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IDENTIFIERS Troubleshooting

ABSTRACT

This curriculum guide, one of 15 volumes written for field test use with educationally disadvantaged industrial education students needing additional instruction in the basic skill areas, deals with helping students develop basic verbal and visual communication skills while studying electronics. Addressed in the individual units of the guide are the following topics: hand tool identification, common electronics hand tools, visual troubleshooting, calibration, technical vocabulary, machine operations, and repair orders. Each unit contains some or all of the following: a discussion of the major concepts of the technique being covered, instructions to the teacher concerning the use of the given technique, suggested related activities, student instructions, a student assignment, supplemental activities, and one or more worksheets. A basic skills checklist and a basic skills verification form are also provided to assist teachers in identifying those students who require additional help with basic skills. (MN)

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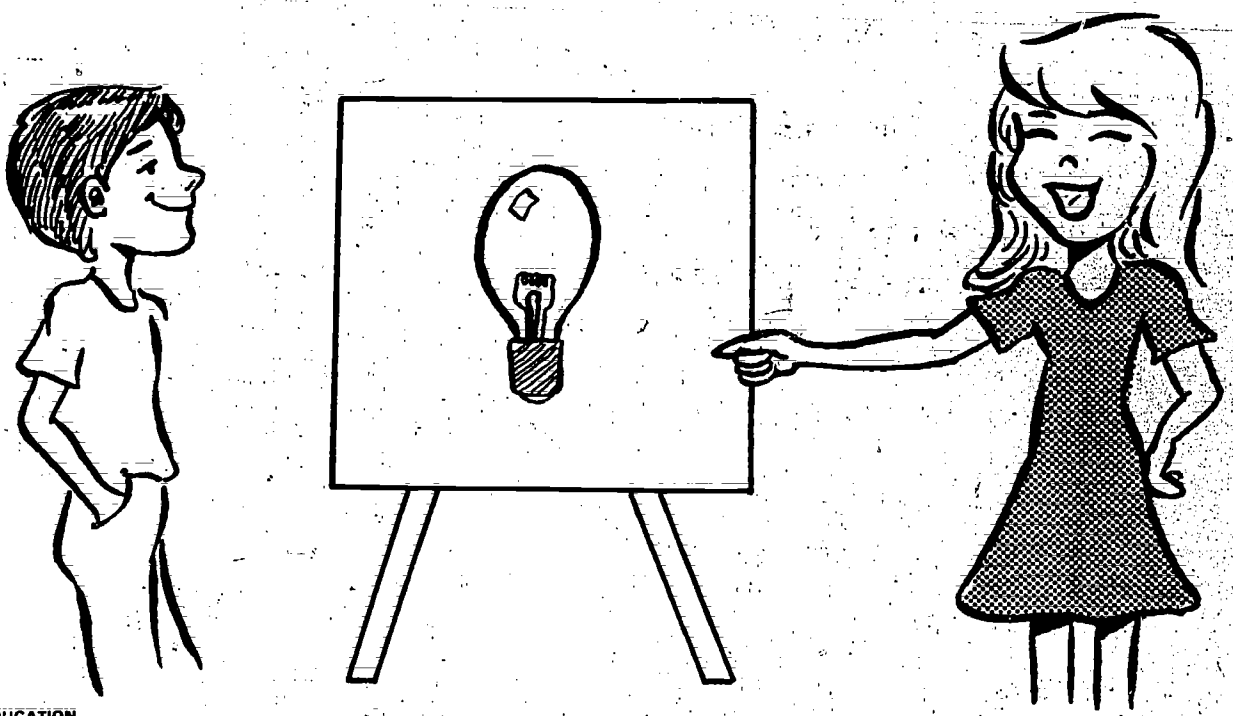
ED244102

"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE ELECTRONICS WAY"



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Field Operations Section
Industrial Education Unit

and

California State University - Los Angeles
Industrial Studies Department

CE038933

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Table of Contents

Instructional Techniques

INTRODUCTION

These instructional techniques were developed for those industrial education students who demonstrate a need for additional instruction in the areas of reading, writing, math, verbal and visual communication. They were written by industrial education teachers with a particular emphasis upon teaching a basic skill while retaining a major focus on the subject areas of auto, woods, metals, electronics, and drafting.

Each of these instructional techniques were written using the same format and with guidance from an expert in the areas of reading, writing, math, verbal and visual communication.

In order to help you identify those students who require additional help with the basic skills, a simple easy-to-use BASIC SKILLS CHECKLIST is provided with each subject area module. This Basic Skills Checklist will enable you as the Industrial Education Teacher to better identify those students in your classes who require additional help in the basic skills.

Additionally, a BASIC SKILLS VERIFICATION FORM is provided which will enable you to ask your school's reading resource teacher, basic skills teacher, math resource teacher, Hart Bill Conferencing teacher, or grade counselors, to verify your identification and provide you with help in the instruction of the basic skills.

You may wish to use these techniques as instruction for your entire class, or as a take-home, parent-involvement assignment. They may also be used in your school's reading or math lab or in conjunction with your school's basic skills instructional programs.

These instructional techniques are successful because your students are able to relate reading, writing, math, verbal and visual communication to their own industrial education classes. When your students succeed, they feel good about themselves, good about their schools, and good about their future.

Name _____

CONFIDENTIAL Grade _____ Class _____

Date _____

BASIC SKILLS CHECKLIST (ELECTRONICS)

The following is a list of the basic skills (reading, writing, math, verbal and visual communication) that the student should demonstrate an ability in for the purpose of employment or advanced training in the electronics trades.

1.0 Verbal Communication: The student needs additional instruction in verbal communication if any of the items below are checked NO:

1.1 Yes ___ The student understands verbal directions or information given by the teacher.

No ___ Example: The teacher informs the student that electrical power must be turned off when making electrical connections. Does the student follow verbal instructions as required? Does the student follow safety rules as required? Does the student turn the power switch to "off"?

1.2 Yes ___ The student asks questions about instructions or information not understood.

No ___ Example: Did the student ask questions about the operation of an oscilloscope if it appears that the verbal instructions were not clearly understood?

1.3 Yes ___ The student is able to apply information and directions heard to work situations.
No ___

1.4 Yes ___ The student is able to verbally communicate with the teacher and other students.

No ___ Example: Is the student able to convey instructions or information on how to etch printed circuit boards?

2.0 Writing: The student needs additional instruction in writing if any of the items below are checked NO:

2.1 Yes ___ The student is able to summarize and write a customer work order.

No ___ Example: A customer complains of "no picture and no sound" on a television receiver; is the student able to convey this problem and suggest corrective procedures in writing on the customer work order?

2.2 Yes ___ The student is able to communicate in writing instructions for a job to be performed.

No ___ Example: Is the student able to write a step-by-step procedure for measuring resistance using a volt-ohmeter?

2.3 Yes ___ The student is able to write a report on the operational function of an electronic component or project.

No ___ Example: Is the student able to describe, in writing, how a fullwave bridge rectifier power supply works?

3.0 Reading: The student needs additional instruction in reading if any of the items below are checked NO:

3.1 Yes ___ The student is able to read and understand job related materials.

No ___ Example: Is the student able to read and understand reference

manuals, safety rules and regulations, specifications, etc?

3.2 Yes ___ The student is able to follow step-by-step procedures on an instruction or job sheet.

No ___ Example: In constructing electronic projects, the student fails to follow the assembly instructions.

3.3 Yes ___ The student is able to read and understand current state of the art developments from periodicals and newspapers.

No ___ Example: The student is requested to read an article from the magazine POPULAR ELECTRONICS. Is the student able to relate both general and specific details from the article?

4.0 Math: The student needs additional instruction in math if any of the items below are checked NO:

4.1 Yes ___ The student is able to perform simple arithmetical operations i.e., addition, subtraction, multiplication and division of whole numbers, decimals and fractions.

No ___ Example: Is the student able to make simple computations that are common to electronics; total voltage drop in a series circuit.

4.2 Yes ___ The student is able to convert exponents to fractional equivalents and metric units.

No ___ Example: Is the student able to understand common conversion units, i.e., 10^{-3}= Milli = 1/1000 ?

4.3 Yes ___ The student is able to compute formulae which requires the use of decimals, squared numbers, multiplication and division.

No ___ Example: Is the student able to apply mathematical concepts to common electronics formulae, i.e., Ohm's Law and Kirchoff's Law.

4.4 Yes ___ The student is able to compute percentages and ratios.

No ___ Example: Is the student able to make simple mathematical computations applied to common electronics concepts? i.e. percentage of tolerance for resistors.

4.5 Yes ___ The student is able to read a ruler and make linear measurements.

No ___ Example: Is the student able to transfer dimensions from a scaled drawing to an actual chassis?

4.6 Yes ___ The student is able to compute hourly rate, multiplied by the number of hours worked to determine the weekly take-home pay.

No ___ Example: A first-year apprentice electrician earns 40% of the journeyman electrician hourly rate of $14.60. The apprentice works a typical 40-hour week, 10% of the pay is withheld for union dues and fringe benefits, 22% is withheld for state and federal income tax. What is the apprentice's net weekly pay?

5.0 Visual Communication: The student needs additional instruction in visual communication if the item below is checked NO:

5.1 Yes ___ The student can communicate to self and others with simple sketches or drawings.

No ___ Example: Is the student able to draw or sketch an item they wish to construct?

Identification Made By: _____ Date _____

BASIC SKILLS VERIFICATION FORM

Student _____ Male____ Female____ Grade Level____

Teacher _____ Class_____ Date_____

The Basic Skills Check List (attached) for the above student indicates a need for instructional assistance in the basic skills (reading, writing, math, verbal or visual communication). The following verification and recommendations are made:

____ Lacks Reading Skills

____ Lacks Writing Skills

____ Lacks Mathematical Skills

____ Lacks Verbal Communication Skills

____ Lacks Visual Communication Skills

METHOD USED FOR VERIFICATION

Recent Test Scores:

Test	Score	Date

Other Verification Methods:

_____

_____

RECOMMENDATIONS

The following instructional assistance is recommended: _____

_____

Verification & Recommendations Made By: _____ Date:_____

Title:_____

_____

_____

FOLLOW UP

Action Taken: _____

Results: ____ Qualified for advanced training

____ Qualified for employment in the trade

____ Other_____

Certified by: _____ Date:_____
Teacher

HAND TOOL IDENTIFICATION

(Visual Communication)

Electronics Verbal/Visual 1

HAND TOOL IDENTIFICATION

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of VISUAL COMMUNICATION.

b. What student learning problem(s) prompted the development of this technique?

The student very often has trouble remembering the names of the various hand tools stored in the tool locker. This problem may be caused by (1) the large number of tools the student is exposed to in a very short period of time and/or, (2) the tool's name is forgotten before the student uses the particular tool.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Label all the tools in the tool locker using a plastic engraver, tape-writer, or some other means.

b. Develop an overhead transparency listing the names of the tools.

c. Develop a student notesheet with the items listing the pertinent information required. Example: Tool name, basic tool information and a sketch of the tool.

d. Display the name of the tool on the overhead. Use one transparency per tool.

e. Show the tool to the class explaining the basic information about the tool which the student will be expected to learn. Taking notes on the presentation will aid their retention.

f. Issue the worksheet "Hand Tool Identification". Allow the students to use their notes from the previous lecture(s) on hand tool identification.

3. Suggested Related Activities:

a. Make flashcards with a picture of the tool on one side and its name on the reverse side.

b. Give a follow-up test after the students have had time to use the tools.

c. Place tools in a big box (minimum: one tool for each student in class). Have students come forward, one at a time, and draw a tool. Identify tool or play "Tool Bingo".

HAND TOOL IDENTIFICATION

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Copy the name of the tool in your class notes from the overhead slide. Check your spelling.

b. Write down the basic information about the tool as explained by the instructor.

c. Sketch a simple outline of the tool to help jog your memory at a later date.

d. Complete the two page worksheet "Hand Tool Identification" Remember to use your notebook as a reference.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

a. Use outdated catalogs to make additional tool identification flashcards.

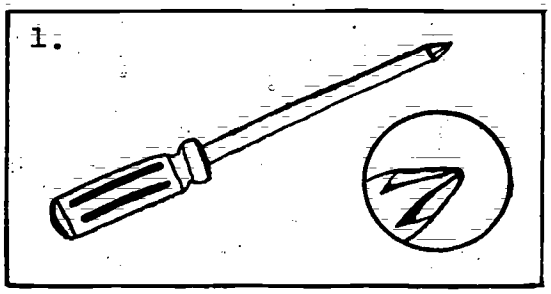
c. Each time you use a tool check its name and spelling on the label in the tool locker.

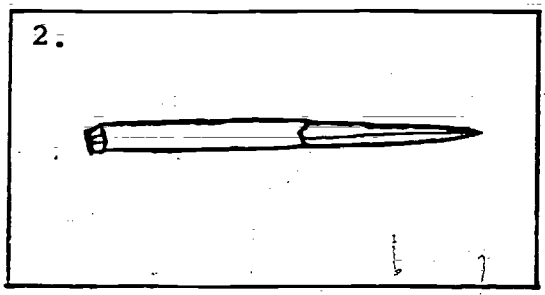
HAND TOOL IDENTIFICATION

WORKSHEET - IDENTIFY THE HAND TOOLS PICTURED BELOW. USE THE COMPLETE NAME. CHECK YOUR SPELLING WHEN COMPLETED.

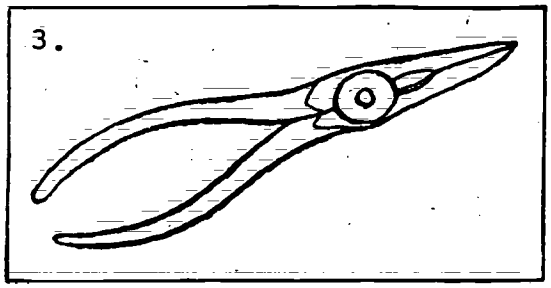
NAME _____

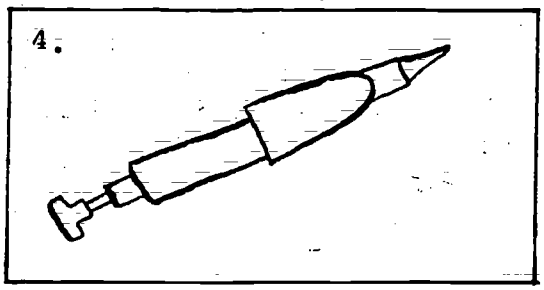
SHOP#_____ DATE_____

1. 

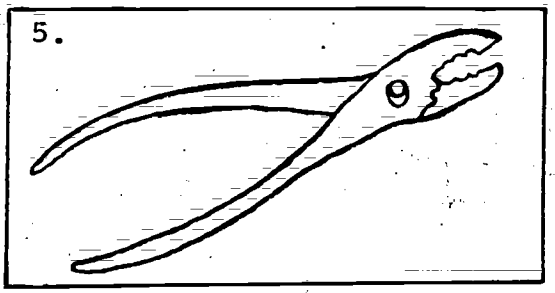
2. 

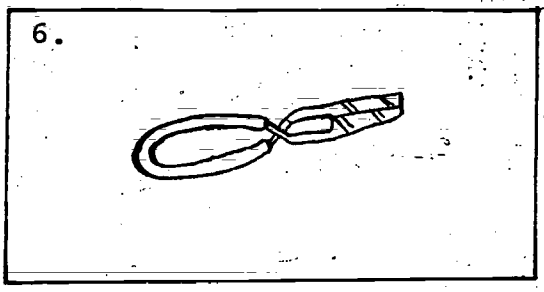
1. _____
2. _____

3. 

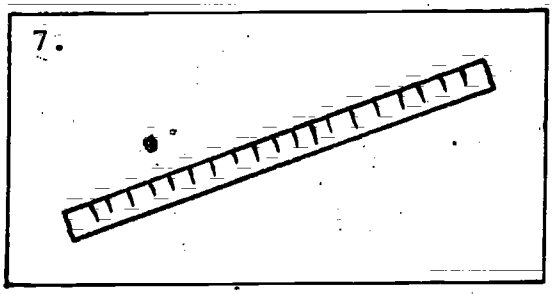
4. 

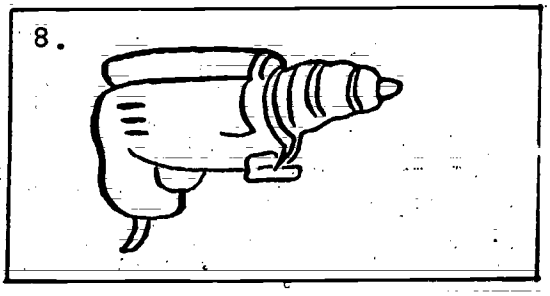
3. _____
4. _____

5. 

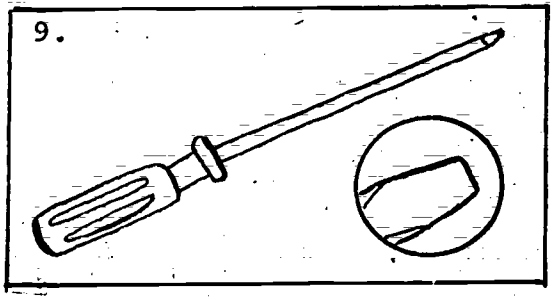
6. 

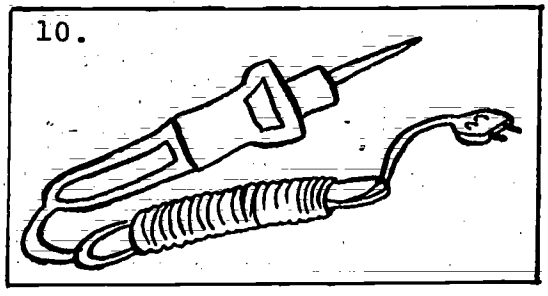
5. _____
6. _____

7. 

8. 

7. _____
8. _____

9. 

10. 

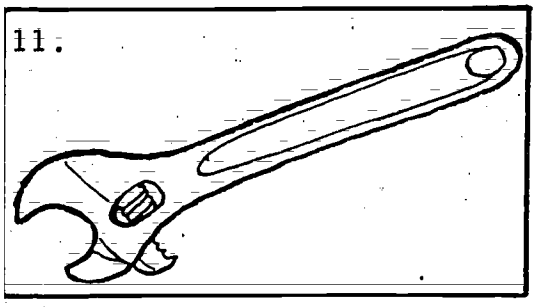
9. _____
10. _____

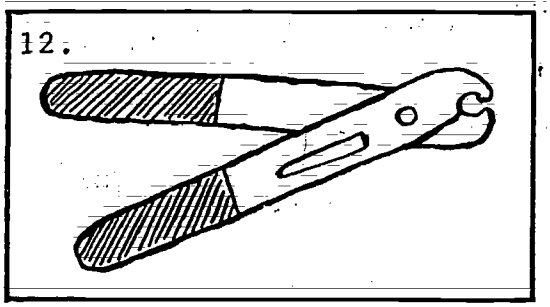
HAND TOOL IDENTIFICATION

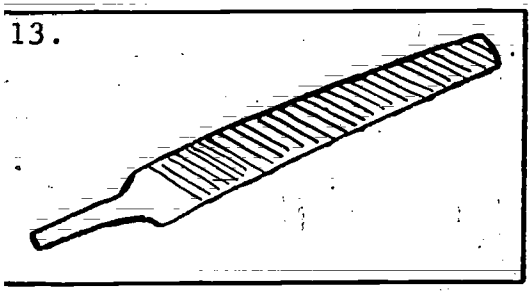
WORKSHEET 2

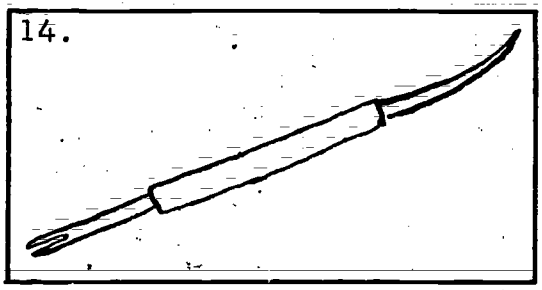
NAME _____

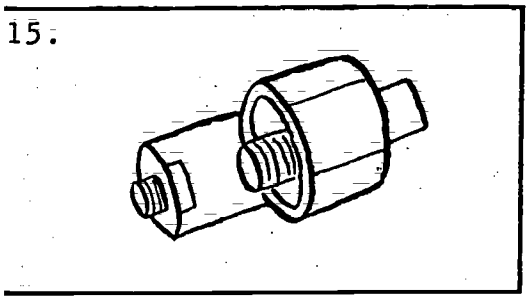
SHOP#_____ DATE_____

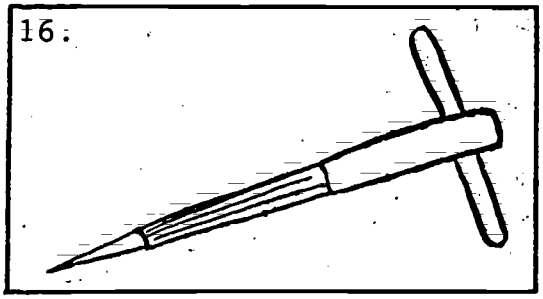
11. 

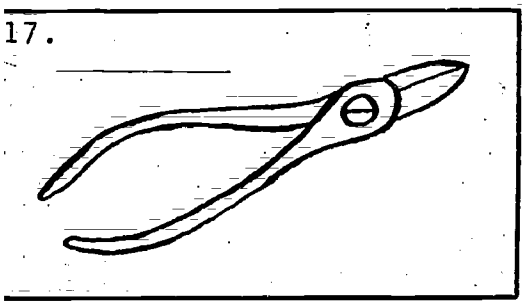
12. 

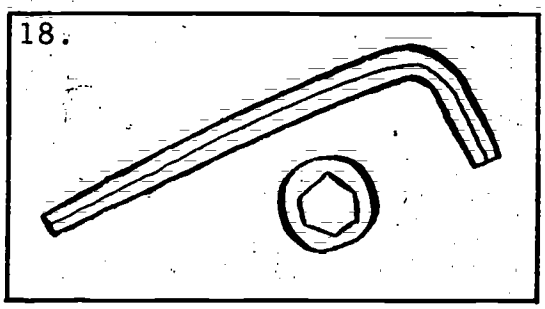
13. 

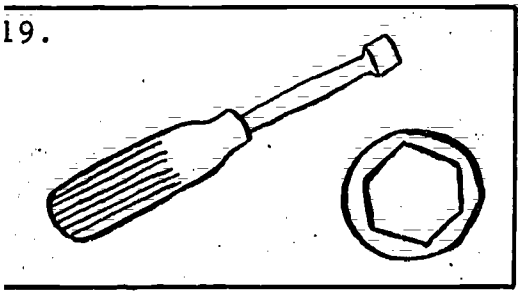
14. 

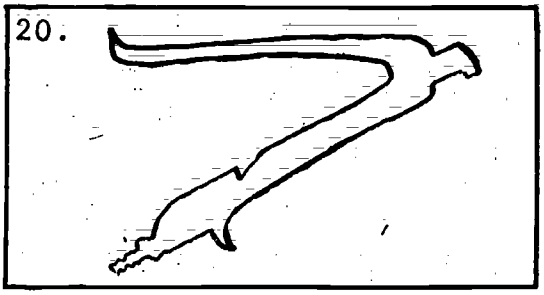
15. 

16. 

17. 

18. 

19. 

20. 

11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____

1.5

Common Electronic Hand Tool Worksheet

(Visual Communication)

Electronics Verbal/Visual 2

COMMON ELECTRONIC HAND TOOL WORKSHEET

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of VISUAL COMMUNICATION.

b. What student learning problem(s) prompted the development of this technique?

The student needs practice in sketching in order to advance to more difficult tasks such as: pictorials, symbols, schematics and layouts required in electronics.

This exercise will also aid the student's clerical skills in note taking.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Place the actual tool on the overhead to allow the student to see its general shape.

b. Explain the need to know these common hand tools and the importance of each in its everyday use.

c. Allow the student time to read about these tools in the text and/or lab manual, if available.

d. Have the students go to the lab, pick up the tool, and work with it at their bench while completing this worksheet.

e. Issue the Common Electronic Hand Tools worksheet. Read the introduction to your students.

3. SUGGESTED RELATED ACTIVITIES:

Encourage the students to do the same with some of the tools stored in the tool locker which are not as common but important in the electronics field.

COMMON ELECTRONIC HAND TOOL WORKSHEET

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Take notes on the "Common Electronic Hand Tool" presentation.

b. Complete the worksheet on "Common Electronic Hand Tools". Take your time and sketch the tool as neatly as possible. Try and list at least 2 examples for each tool in the "Use" and "Safety" columns.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 - 4.

3. EXTRA THINGS THAT YOU CAN DO:

Sketch and identify other tools which may not be used everyday - but are needed in the electronics fabrication field.

COMMON ELECTRONIC HAND TOOLS

WORKSHEET

NAME _____

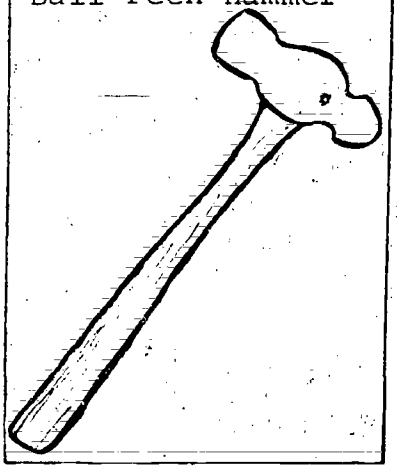
SHOP #_____ DATE _____

During the past few days you have been exposed to many hand tools. Some of these tools may be used in more than one work area. One example is the ball peen hammer. This tool is usually associated with metals. However, the tools listed below were designed mainly for electronics. You will use most of them each and every day when constructing a project.

In this exercise you will draw a sketch of some of the basic hand tools, write a simple statement about the tool's use, and list any safety precautions to observe when using the tool. To help in your work, borrow the tool from the tool locker while you are completing this exercise.

When you have completed this worksheet you may volunteer to describe one of the following seven tools to the class. You will be expected to: (1) explain the tools use; (2) describe any safety precautions.

A. EXAMPLE:

Ball Peen Hammer	Use:	Safety:
	1. Hitting or forming metal 2. Setting rivets	1. Never hit two hammers together. 2. Keep fingers away from the hitting area. 3. Check to see that the handle is on tightly.

1.	Diagonal-Cutting Pliers	Use:	Safety:

COMMON ELECTRONIC HAND TOOLS

WORKSHEET

NAME _____

SHOP# _____ DATE _____

2.	Long-Nose Pliers	Use:	Safety:
3.	Nut Driver	Use:	Safety:
4.	Soldering Aid	Use:	Safety:

COMMON ELECTRONIC HAND TOOLS

WORKSHEET

NAME _____

SHOP#_____ DATE_____

5.	Soldering Pencil	Use:	Safety:
6.	Standard Screw-driver	Use:	Safety:
7.	Wire Strippers	Use:	Safety:

COMMON ELECTRONIC HAND TOOL PRESENTATION

(Verbal Communication)

Electronics Verbal/Visual 3

COMMON ELECTRONIC HAND TOOL PRESENTATION

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of VERBAL COMMUNICATION.

b. What student learning problem(s) prompted the development of this technique?

Many students have difficulty standing before the class and talking. This will be an opportunity to speak in front of their peers.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Have each student show the class a tool and explain how the tool is used and the safety precautions (depending on the references available, the instructor may be the only source for this information).

b. Allow the student to present the tool in the order in which it appears on the worksheet. This takes the guess out of whether they are first, second, etc.

c. Encourage the presentor to ask the class if there are other uses of the tool which he/she did not cover.

d. Encourage the presentor to ask for additional safety precautions not already suggested.

3. SUGGESTED RELATED ACTIVITIES:

Expand this technique to simple test equipment, job opportunities, new products from newspapers and magazines, and don't overlook a project the student has just completed.

COMMON ELECTRONIC HAND TOOL PRESENTATION

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Correct any mistakes you had on the Common Electronic Hand Tool worksheet for the tool you wish to present.

b. Refer to your text and/or lab manual to determine how the tool is used. In some cases you may need to seek the aid of the lab assistant, an advanced student, or the instructor in locating this information.

c. Select the day you wish to present the tool and sign up on the class calendar.

d. Present the tool to the class. Ask the class for additional ideas on its usage and safety precautions.

2. STUDENT ASSIGNMENT:

Present one of the seven common electronic hand tools to the class. Explain how the tool is used and its safety precautions.

3. EXTRA THINGS THAT YOU CAN DO:

Present to the class a project you have just finished, an antique tool belonging to a relative or a new product/idea you have just read about.

VISUAL TROUBLE-SHOOTING

(Visual Communication)

Electronics Verbal/Visual 4

VISUAL TROUBLE-SHOOTING

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of VISUAL COMMUNICATION.

b. What student learning problem (s) prompted the development of this technique?

Many students have difficulty comparing a schematic diagram to a pictorial. This exercise will give them practice doing so.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Select a project frequently built in your lab.

b. Draw a schematic of this project. The schematic should not contain any errors. (See example on STUDENT PAGE 2).

c. Draw a suggested printed circuit board layout of the same project.

d. Now make a few changes on the printed circuit board, such as:

1. Place a polar component in backwards.
2. Exchange two identical components with different values.
3. Indicate an incorrect value on a component.
4. Leave out a connection.
5. ~~Etc. (SEE APPENDIX 2).~~

e. If this is the students first attempt, do not make the exercise too difficult.

f. Distribute ONLY the visual trouble-shooting schematic.

g. Discuss the schematic and answer any questions the students may have before issuing the trouble-shooting pictorial.

h. Issue the trouble-shooting pictorial and allow the students the remainder of the class period to "trouble-shoot" the project.

3. SUGGESTED RELATED ACTIVITIES:

Progress to trouble-shooting live projects. If the student shows an interest and an aptitude, try steering them toward VICA competition.

VISUAL TROUBLE-SHOOTING

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Study the schematic titled VISUAL TROUBLE-SHOOTING. Ask questions concerning the symbols, values, part numbers, etc. which you do not understand.

b. Trouble-shoot the strobe light shown on STUDENT PAGE 3 by locating the errors on the pictorial using the schematic as a reference source.

c. REMEMBER: The schematic is correct. All of the errors are on the printed circuit board which is the pictorial view.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

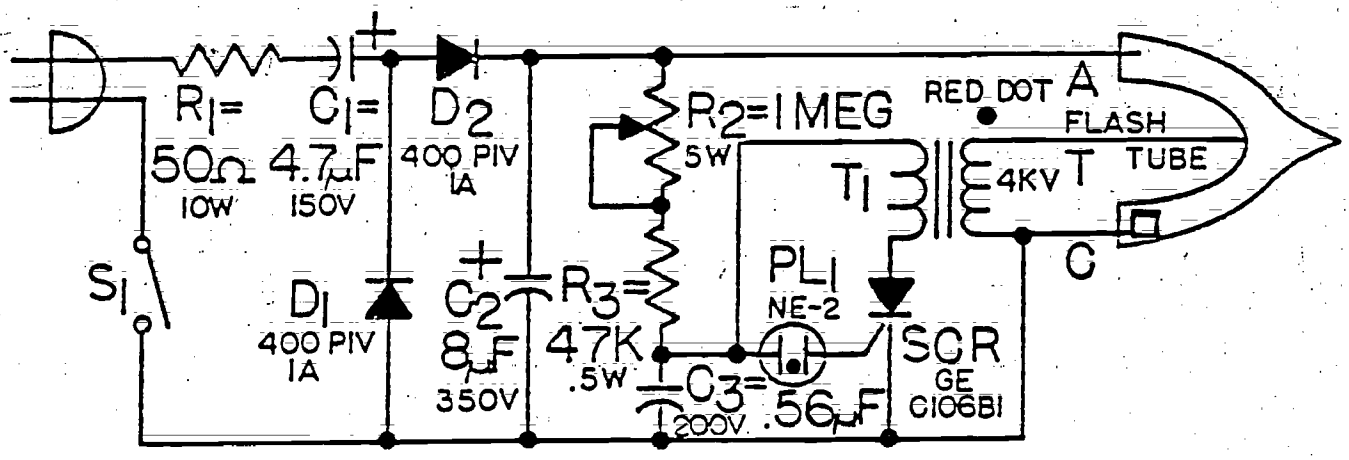
If this type of exercise interests you, see your instructor for a live project to trouble-shoot.

The instructor can also suggest various competitions you may be interested in pursuing.

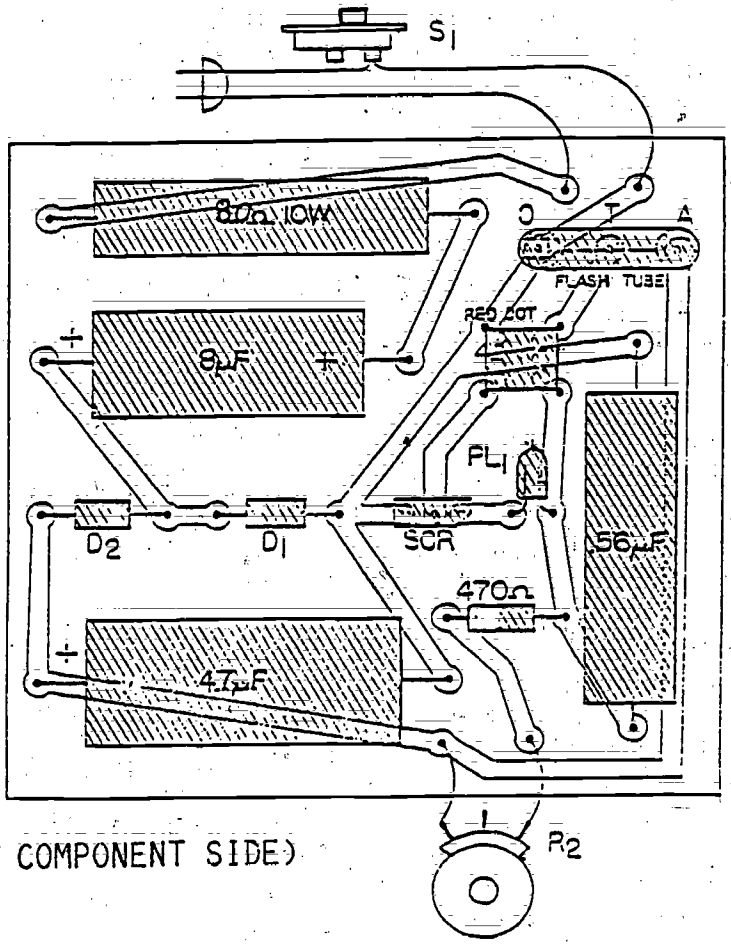
WORKSHEET (SCHEMATIC)

VISUAL TROUBLE-SHOOTING

A classmate has just assembled a strobe light and is concerned that something may be wrong, such as a misplaced component, etc. You are asked to check over the project to see if you can find any errors. Refer to the schematic below as a point of reference.



WORKSHEET (PICTORIAL)
VISUAL TROUBLE-SHOOTING



(TOP VIEW - COMPONENT SIDE)

List below the faults you discover while visually trouble-shooting the circuit assembly pictured above.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

VACUUM TUBE VOLTMETER (VTVM) CALIBRATION

(Visual Communication)

Electronics Verbal/Visual 5

VACUUM TUBE VOLTMETER (VTVM) CALIBRATION

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This skill will teach the technique of VISUAL COMMUNICATION.

b. What student learning problem(s) prompted the development of this technique?

Some students have difficulty visually comparing a drawing with the actual item. In addition, they may have a problem visually following a sequence of steps required to set up test equipment properly.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Develop an overhead transparency of the VTVM's face with the various controls. Allow space for the student to write in the name(s) of the controls. See Appendix 1.

b. Develop an Information Handout Sheet from the same drawing used to produce the transparency. Give this handout sheet to your students.

c. Place the names of the controls and other necessary terminology on the chalkboard in alphabetical order. See Appendix 2.

d. Explain to the class the need for the proper calibration of the meter.

e. Indicate the location of the controls and say their names more than one time to allow the student to locate the term on the chalkboard and then write it on his/her handout sheet.

f. Explain the calibration steps in their proper sequence

g. Repeat the calibration steps. This time actually calibrate the meter as you are repeating the calibration procedure. This allows the student to check his/her notes and actually see the procedure step by step.

h. Allow the students to proceed to the lab and duplicate the calibration demonstration. Have the students work in pairs to help each other this time. Emphasize the use of their notebooks to see if the procedure is written correctly.

3. SUGGESTED RELATED ACTIVITIES:

a. Follow-up with a performance quiz after allowing the students to work with the meters a few days.

b. Encourage your students to enter the VICA Skills Olympics to further enhance their skills.

VACUUM TUBE VOLTMETER (VTVM) CALIBRATION

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS

a. The names of the controls and switches are listed on the chalkboard in alphabetical order. Write the name of the correct term in the blank on the worksheet when explained by the instructor.

b. Your text/lab manual does not contain instructions for calibrating the VTVM, so take accurate notes on the calibrating procedure. Use the key words on the overhead transparency to aid in your notetaking.

c. Using your notes and with the help of your lab partner, calibrate the VTVM.

d. Have your partner change the controls so the meter is not calibrated. Calibrate the meter with only the help of your notes.

2. STUDENT ASSIGNMENT:

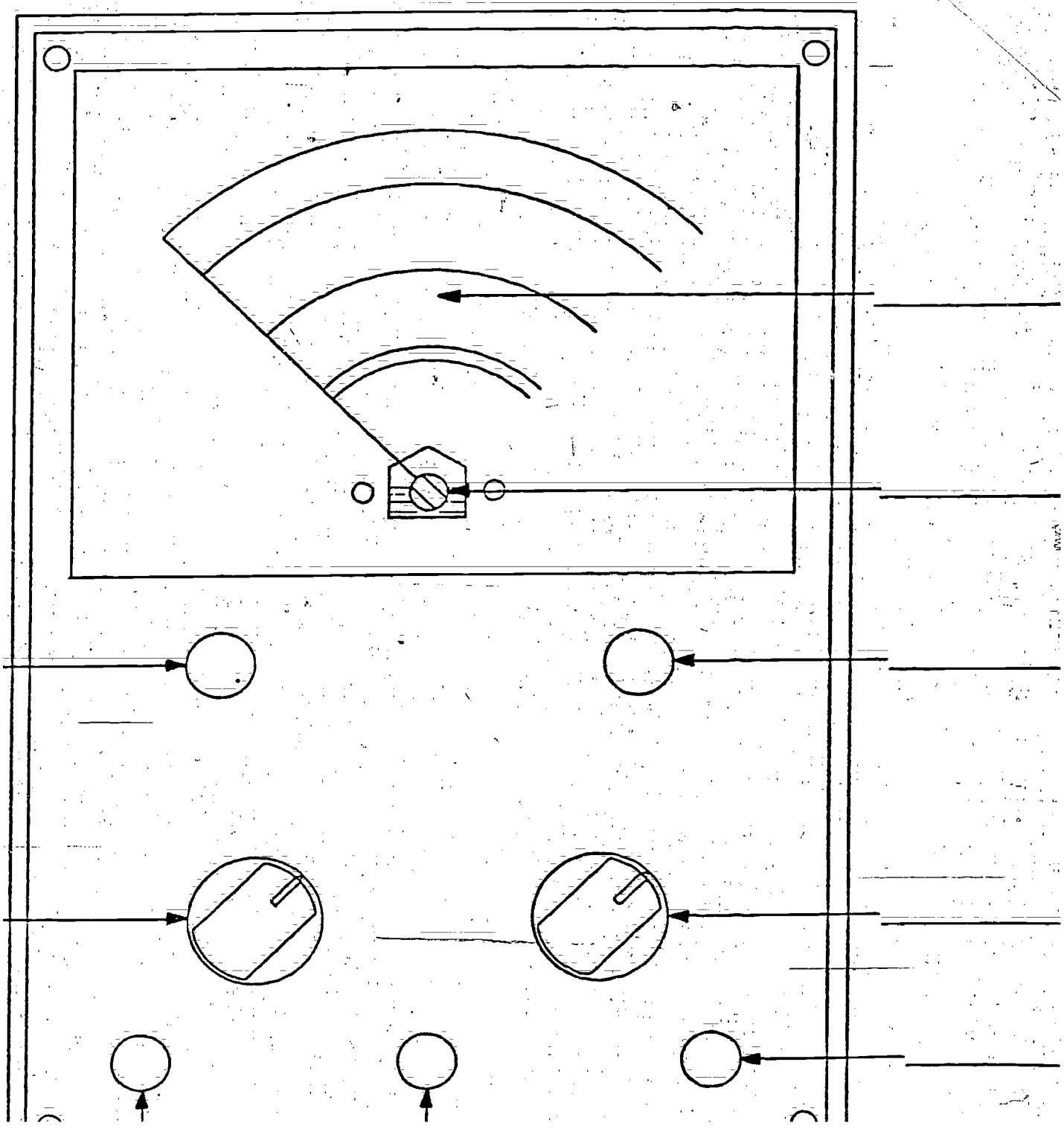
Demonstrate to the instructor your newly acquired skill of calibrating the vacuum tube voltmeter.

3. EXTRA THINGS THAT YOU CAN DO:

Demonstrate your ability to calibrate the VTVM to the entire class.

VACUUM TUBE VOLTMETER CALIBRATION

APPENDIX 1



VACUUM TUBE VOLTMETER CALIBRATION

APPENDIX 2

METER TERMINOLOGY TO BE PLACED ON CHALKBOARD:

RCA MODEL WV77E VACUUM TUBE VOLTMETER (VTVM)
COST - $75.00

ALTERNATING CURRENT-OHMS JACK (AC-OHMS) (BLUE)
DIRECT CURRENT JACK (DC) (RED)
FUNCTION SWITCH
GROUND JACK (GND) (BLACK)
METER FACE
OHMS ADJUST
POINTER SET
RANGE SWITCH
ZERO ADJUST

MASTERY OF THE TECHNICAL GLOSSARY

(Verbal Communication)

Electronics Verbal/Visual 6

MASTERY OF THE TECHNICAL GLOSSARY

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of VERBAL COMMUNICATION.

b. What student learning problem(s) prompted the development of this technique?

The student often has trouble pronouncing and understanding the technical words associated with the area of electronics.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Obtain a language master machine and a supply of the cards used in the machine.

b. Record the following on the card:

a. Pronounce the word
b. Spell the word
c. Pronounce the word again (may not be possible if the word is real long)

c. Write the word on one side of the language master card and the definition of the word on the opposite side. Keep the definition as simple as possible. Cards aren't cheap. If you take the time to make a set of cards, do it once, not over and over.

d. Allow the student ample time to practice. When the student feels he/she has mastered the vocabulary you can test them verbally or have them record their answers on the language master.

e. Keep in mind that not all of the words will need to be practiced on the machine. See Appendix 1 - a suggested list of words from the Technical Glossary covering a unit on METHODS OF GENERATING ELECTRICITY.

TECHNICAL GLOSSARY

MASTERY OF THE TECHNICAL GLOSSARY

ACID:	A strong chemical substance with corrosive properties. Vinegar is an example of a weak acid, other common acids are citric acid and sulfuric acid.
BATTERY:	Two or more cells connected together. A battery is an important source of DC electrical energy because it is self-contained and portable.
CELL:	A single voltaic unit which is made by combining two dissimilar metals and an acid solution or electrolyte.
CHEMICAL ELECTRICITY:	A source of DC electricity, which is produced by chemical reactions. A cell and a battery are examples of chemical electrical devices.
COIL:	A number of turns of insulated wire usually wrapped in circular form. A coil of wire is a necessary part of a generator.
GENERATOR:	A device used to produce electricity by moving a coil of wire through a magnetic field, or by keeping the coil stationary and moving the magnetic field.
PHOTOELECTRICITY:	A source of DC electricity, which is produced by light energy. Photoelectrical devices are of three types: photovoltaic, photoconductive, and photoemissive. Photovoltaic devices produce electricity directly from light.
PIEZOELECTRICITY:	A source of electricity which is produced when pressure is applied to a certain crystal material such as quartz, Rochell salts, or barium titanate.
PRIMARY CELL:	A type of voltaic cell which will produce electricity as soon as the chemicals are combined, and generally cannot be recharged.
SECONDARY CELL:	A cell which requires charging before it will produce electricity, and can be recharged many times.
STATIC ELECTRICITY:	A collection of electrical charges (both positive, and negative) at rest on the surface of an object. Static charges are produced by friction.

MASTERY OF THE TECHNICAL GLOSSARY

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Pronounce the technical word written on the language master card.

b. Read the definition of the word written on the back of the card.

c. Run the language master card through the machine. Listen to the correct pronunciation.

d. Run the card through the machine again. This time check the spelling of the word you hear recorded against the writing on the card.

e. Run the card until you have mastered the word.

f. When you feel confident ask the instructor to check your progress.

g. You may be quizzed orally or you may be asked to record the words as you pronounce them to be checked later by the instructor.

2. STUDENT ASSIGNMENT:

Your assignment is to learn to pronounce and understand the meaning of electronic words by using the language master machine.

3. EXTRA THINGS THAT YOU CAN DO:

Assist other students having vocabulary problems with the language master machine.

DEMONSTRATING MACHINE OPERATIONS TO THE INSTRUCTOR

(Verbal Communication)

Electronics Verbal/Visual 7

DEMONSTRATING MACHINE OPERATIONS TO THE INSTRUCTOR

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

VERBAL COMMUNICATION: This technique will assist the student in learning to verbally communicate with the teacher.

b. What student learning problem(s) prompted the development of this technique?

This technique was developed because of the inability of some students to communicate with the instructor.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Identify students who have difficulty communicating verbally with the instructor.

b. Assign the student to demonstrate to the teacher how to perform a basic operation on a machine (example: operating a drill press).

c. Provide the student with a "MACHINE SAFETY DEMONSTRATION" assignment card and set a date for the demonstration.

d. Review with the student the information needed and questions to be asked by the instructor.

e. Provide the student with the needed resources (reading assignment, information sheet, etc.).

f. The student will complete the assignment by demonstrating and explaining verbally to the teacher how to perform the assigned operation.

3. SUGGESTED RELATED ACTIVITIES:

Students can strengthen their ability to communicate verbally by giving the same demonstration to new students or students not performing the operation correctly.

DEMONSTRATING MACHINE OPERATIONS

TO THE INSTRUCTOR

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. You will demonstrate to the teacher the safe use of the _____(machine).

b. The operation you will perform is_____

_____

c. Use available reading materials in the classroom, from the library or from home. You will need to know vocabulary, safety rules and the operation to be performed.

d. An assignment card will be given to you by the instructor. Fill it out and use it as a reference during your demonstration. The instructor will review the information on the card prior to the demonstration.

2. STUDENT ASSIGNMENT:

a. Prior to giving your demonstration to the teacher, practice with one of your parents at home or one of the other electronics students.

b. The grade you receive will be based on:

1. Your ability to answer these questions:

   a. What is the name of the machine you are using?
   b. What is the name of the operation to be performed?
   c. What are the safety rules for the machine?

2. Your ability to use the machine.

3. Your ability to explain to the teacher what you are doing.

3. EXTRA THINGS THAT YOU CAN DO:

a. You may want to show new students how to use the machine.
b. You may want to assist students in the class who are not using the machine correctly.

SAMPLE ASSIGNMENT CARD

FRONT

MACHINE SAFETY DEMONSTRATION

Student's name _____ Period _____

Date of Demonstration _____

Machine name _____

Operation _____

Notes: _____

BACK

SAFETY RULES:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

REPAIR ORDER

(Verbal Communication)

Electronics Verbal/Visual 8

"REPAIR ORDER"

A. TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

1. LISTENING for details relevant to interpreting a problem

2. SELECTING, ANALYZING AND SYNTHESIZING details to complete a required written report

b. What student learning problem(s) prompted the development of this technique?

1. Students have difficulty listening for details.

2. Students have difficulty expressing themselves precisely.

3. Students have difficulty developing a logical thought necessary for trouble-shooting.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Send a student to the "customer" with the attached form. Have the student listen to the "customer" describe the trouble with the item to be repaired.

b. Have the student fill out as much of the form as possible and return with the form and the item to be repaired.

c. Now have the student write out or explain a trouble-shooting procedure.

d. The student should then repair the item.

e. Upon completion, the item should undergo testing. Then have the student return the item with the bill. Have the finished "Repair Order" returned to you for grading.

3. SUGGESTED RELATED ACTIVITIES:

a. Devise a supplement to the "Repair Order" so the student is forced to pass on information to another student for completion of the job.

b. Use a variety of printed materials necessary to complete the needed repairs.

"REPAIR ORDER"

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Listen to the "customer's" complaint(s) about the item to be repaired.

b. Fill in the "Repair Order" using what information is available to you before repairs.

c. As you progress, fill in information such as the customers complaint, the plan for trouble-shooting, the actual repair, and the date of completion.

d. Complete the Invoice Repair Order.

e. Deliver the repaired item and collect for material costs. Turn in the "Repair Order" for grading.

2. STUDENT ASSIGNMENT:

Your "Repair Order" is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Do research on the repaired item. Use technical manuals, consumer guides and/or catalogues.

REPAIR ORDER

Customer name:_____ Date_____

Customer Complaint_____

Plan for trouble-shooting_____

Actual repair needed_____

Completion date_____

Repaired by _____

Period_____

Grade_____

STUDENT PAGE 2

INVOICE

REPAIR ORDER

QUANTITY	NAME OF PART	COST
	TOTAL	

THE FOLLOWING INDUSTRIAL EDUCATION BASIC SKILL INSTRUCTIONAL TECHNIQUES ARE AVAILABLE FROM:

VOICE (VOCATIONAL OCCUPATIONAL INFORMATION CENTER FOR EDUCATORS)
721 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814

"LEARNING TO READ AND WRITE THE AUTOMOTIVE WAY"
"LEARNING TO DO MATH THE AUTOMOTIVE WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE AUTOMOTIVE WAY"

"LEARNING TO READ AND WRITE THE WOODWORKING WAY"
"LEARNING TO DO MATH THE WOODWORKING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE WOODWORKING WAY"

"LEARNING TO READ AND WRITE THE METALWORKING WAY"
"LEARNING TO DO MATH THE METALWORKING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE METALWORKING WAY"

"LEARNING TO READ AND WRITE THE ELECTRONICS WAY"
"LEARNING TO DO MATH THE ELECTRONICS WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE ELECTRONICS WAY"

"LEARNING TO READ AND WRITE THE DRAFTING WAY"
"LEARNING TO DO MATH THE DRAFTING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE DRAFTING WAY"