ABSTRACT

This vocational instructional module on outlining a basic shape on flat steel is one of eight such modules designed to assist recently arrived Arab students, limited in English proficiency (LEP), in critical instructional areas in a comprehensive high school. Goal stated for this module is for the student enrolled in a machine tool course to construct a basic outline on a piece of flat steel. Each module consists of these parts: title; program goal and performance objectives; a pronunciation key; a language page which offers the pronunciation, definition, and usage of key terms in English and in Arabic; a pretest; bilingual (English and Arabic) language (vocabulary and usage) activities; evaluation; pretest and activity answer sheets; and a list of supplementary materials and their location. For each of the 12 activities in this module the objective, a list of materials needed, procedure, and evaluation are provided in addition to the necessary activity sheets or pages. (YLB)
MACHINE TOOL LAYOUT: OUTLINING a BASIC SHAPE on FLAT STEEL
ABOUT THE PROJECT

The Fordson Arabic Bilingual Demonstration Project is designed to assist recently arrived Arab students, limited in English proficiency (LEP), to adapt to a large and comprehensive high school. The project consists of academic and vocational instructional modules, reading services to teachers and students, bilingual aide and resource services, computer and television modules, staff development activities, and home-community liaison.

ABOUT THE INSTRUCTIONAL MODULES

The modules were designed to assist LEP students in critical instructional areas throughout the school curriculum. These areas of focus were determined by a needs survey of the entire Fordson school community. Each module consists of seven parts: title, objectives, pretest, language (vocabulary and usage) activities, evaluation, and supplementary materials. Modules were translated, duplicated, and field tested.

ABOUT THE AUTHOR

Alan Ochsner did his undergraduate work at Eastern Kentucky University and his graduate training at the University of Michigan. Al has worked in the Industrial Education area at Fordson High School for the past 22 years. The skills developed in this unit were those he and his students defined as critical for a better understanding of machine tool layout.
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MACHINE TOOL LAYOUT

OUTLINING A BASIC SHAPE ON FLAT STEEL

Developed By:

Alan E. Ochsner
This bilingual module has been developed to assist limited English proficiency students in learning to construct a basic outline on a flat piece of steel. This unit is designed for students enrolled in Machine Tool.

GENERAL OBJECTIVE:
The student will be able to construct a basic outline on a piece of flat steel.

SPECIFIC OBJECTIVES:
Given the activities of this module, the student will be able to accomplish the following to the satisfaction of the teacher:

1. Pronounce, spell, and use the vocabulary of basic measurement.

2. Pronounce, spell and use the vocabulary of basic layout tools.

3. Sketch (freehand) the basic outline of a drill gauge.

4. Lay out the outline of a drill gauge using basic layout tools with the accuracy of a Templet.
To the teacher: This test will be checked with Scantron. There are 25 multiple choice questions. The students are to use a number 2 pencil. This test will also be used as part of the post-test evaluation.
To the student:
You will be given the following:
1. Scantron answer sheet
2. Number 2 pencil

General Instructions:
Darken bubble completely with the pencil. Erase completely any changes you might want to make.
Below are 25 multiple choice questions. Read the question carefully and then choose the correct answer.

1. The longest distance is called the:
   a. width
   b. length
   c. thickness
   d. size

2. The name for all measurements:
   a. height
   b. length
   c. total
   d. dimensions

3. The number with a point or dot:
   a. number point
   b. fraction number
   c. decimal number
   d. number

Go on to next page.
4. The number with one number over another number is called a:
   a. fraction
   b. part
   c. numerator
   d. decimal

5. The shortest distance is called:
   a. length
   b. thickness
   c. height
   d. width

6. The distance across is called:
   a. length
   b. height
   c. thickness
   d. width

7. The thin measuring tool with lines marked on it:
   a. compass
   b. scale
   c. ruler
   d. dividers

8. The picture of an object that shows the shape and size of an object and is done without a ruler or straight edge:
   a. objecting
   b. sketch
   c. size
   d. lines

Continue on to next page.
9. Making (drawing) lines on a piece of metal:
   a. lining
   b. viewing
   c. sketch
   d. layout

10. The fluid used for coloring a surface to help in seeing lines:
    a. layout dye
    b. layout oil
    c. layout ink
    d. paint

11. A pointed tool used to scratch lines on steel:
    a. scratcher
    b. pencil
    c. scriber
    d. marker

12. A tool with two pointed legs used for making (scratching) arcs or circles on steel:
    a. divider
    b. scriber
    c. circler
    d. pointer

13. The tool with two pointed legs which fit on a rod and is used to make (scratch) large arcs or circles:
    a. scriber
    b. trammel
    c. divider
    d. templet

Go on to next page.
14. A heavy piece of equipment made of either cast iron or granite and has a flat surface from which accurate measurements may be made.
   a. surface tool
   b. surface gauge
   c. table
   d. surface plate

15. A layout tool made-up of several parts and can be used for doing different measuring operations such as 90° and 45° angles.
   a. divider
   b. combination square
   c. angler
   d. square

16. A tool with a sharp point of 30° - 60° angle that is hit with a ball peen hammer to make marks on a layout line.
   a. pin punch
   b. center punch
   c. prick punch
   d. scribe

17. A rough edge that is not wanted and is to be removed with a file.
   a. sharp
   b. side
   c. Burr
   d. radius
PRETEST (continued)

18. A sheet of material like sand paper which is used to wear away or polish rough surfaces.
   a. cloth
   b. emery cloth
   c. sand
   d. paper

19. The copy of a drawing that has pictures of the object to be made.
   a. drawing
   b. sketch
   c. object
   d. blueprint

20. The layout tool that has hooked leg, pointed leg and scribes (scratches) lines parallel to an edge.
   a. trammel
   b. scribe
   c. dividers
   d. hermaphrodite caliper

21. The tool used as a straight-edge and is marked in degrees.
   a. steel protractor
   b. ruler
   c. angle gauge
   d. edge

Go on to next page.
Instructions: Pick from the following drawing the correct name for each measurement and darken-in either A, B, or C.

22. thickness
23. length
24. width
25. What is the name of the drawing when it is done freehand and not a ruler?
   a. drawing
   b. sketch
   c. view
   d. paper
To the teacher:

You have at least three options in using the following Language Pages:

1. Have the students read, pronounce, spell and use in a sentence (orally and written) each vocabulary item.

2. Read each item to the student and have him say it after you. Discuss at more length any item that would help the student in understanding it.

3. Use these pages only as a reference to be used as needed in the activities whenever the word is found.
Vocabulary - Important new words

1. layout (lā'-out)
2. layout dye (lā'-out di)
3. sketch (sketch)
4. scribe (scri'-ber)
5. divider (di-vi'-der)
6. trammel (tra'-mel)
7. surface plate (sur'-fas plāt)
8. combination square (com-bi-nā'-shun) (skwār)
9. prick punch (prik punch)
10. burrs (berz)
11. abrasive (emery) cloth (ab-rā'-siv) (em'-er-ē) (kloth)
12. blueprint (blū'-print)
13. hermaphrodite caliper (her-mā-frō-dī) (cal'-i'per)
14. steel protractor (stēl prō-trak'ter)
15. templet (tem'plit)
16. dimension (di-men'-shun)
17. decimal (des'-i-māl)
18. fraction (frak'-shun)
19. length (lengkth)
20. width (width)
21. thickness (thik'-nes)
1. **layout (lā'out)**

Making or scratching lines on a blank piece of material. The design used by the machinist.

The layout of the drill gauge was done by the machinist.

2. **layout dye (lā'out dī)**

A liquid material that colors a surface so that lines scratched on the surface may be seen better.

Layout dye comes in different colors; purple is most often used.

3. **sketch (sketch)**

A freehand (done without a straight edge) drawing of something used to help understand the shape and size of a design.

The sketch of the tool helped the student understand the shape of it.

4. **scriber (scrib'er)**

A pointed tool for marking or scratching (scribing) lines.

A scriber looks like a pencil and is very sharp.
5. **divider (di vī′d′er)**

A tool with two pointed legs used for measuring between points, taking a measurement directly from a ruler, and for scribing (scratching) circles and parts of circles (arcs).

Do not confuse the **divider** with the **compass**.

6. **trammel (tram′ el)**

A type of divider used for scribing large circles and arcs. It is also called a beam compass.

A **trammel** can be adjusted to make different sized circles.

7. **surface plate (sur′fus plät)**

An expensive piece of equipment made of either cast iron or granite (rock). It has a very flat surface from which accurate measurements may be made.

A **surface plate** is very heavy.

8. **combination square (kom bi-nā′shun skwär)**

A tool that has several parts that can be used for measuring and scribing angles as well as lines.

A man by the name of L.S. Starrett invented the **combination square**.
9. **prick punch (prik punch)**

A tool that is pointed on one end at an angle of 30°-60° and struck at the opposite end with a machinist's ball peen hammer.

The prick punch is used to make small marks along a layout line to help see the line better.

10. **burr (ber)**

A rough edge which is to be removed by a file.

The burr was so sharp that it cut the student's finger.

11. **abrasive cloth (ab rā'siv kloth)**

A cloth with a coating of sharp grains used to wear down or polish a piece of metal.

Abrasive (emery) cloth can be bought in either sheets or rolls.

12. **blueprint (blū -print)**

The name given to a chemically made copy of a drawing and is used by machinists as a guide to make something. Blueprints are white with blue lines.

The machinist looks at a blueprint very carefully.
13. hermaphrodite caliper (hur-maf'ro'dit kal'-i-per)
A tool with two legs like dividers; one leg is pointed and the other leg is curved in toward the pointed leg. It is used to scribe a line or lines parallel to an edge.

The hermaphrodite caliper has a long name and is sometimes called a "Hermy."

14. steel protractor (stēl prō-trakt' ter)
A tool used for laying out a line at an angle to other lines or surfaces.

The machinist takes very good care of his steel protractor.

15. templet (tem'plit)
A thin rigid plate with a cut pattern used as a guide in making an accurate design.

The machinist used a templet to lay out an accurate outline of a drill gauge.
OBJECTIVES:

When you complete this activity you will:

1. know the vocabulary of basic measurement and be able to pronounce, spell, write and use each word correctly.

2. identify each dimension on a drawing provided.

You will be given the following:

1. a pencil
2. steel ruler

Vocabulary words:

dimension

decimal

toal

We will know you can do this when:

you can pronounce, spell and use each term correctly.

STUDENT ACTIVITY 1

1. التمرين اللازم رقم 1

الطالب

الأهداف:

1 - ستتعرف مفردات القياس الأساسية وسيكون بوسهك لفظ وتهيج لكل كلمة مع كتابتها واستعمالها بشكل صحيح.

2 - ستتعرف على كل بعد على رسم يعطي لك.

سوف عطل ما يلي:

1 - قلم رصاص
2 - مسطرة فولاذية

مفردات:

بعد
عشر
كسر
طول
عرض
سماكة

ستعرف ان بوسهك القيام بهذا الأمر عندما:

تحذر على لفظ، تهيج واستعمال كل عبارة بشكل صحيح.

Eric
DIRECTIONS:
Read the following carefully and look at the pictures.

A. The word dimension (di-men'-shun) means a measurement in a single direction.

B. The word decimal (des'-i-mal) means a number which has a dot or point (decimal point) which is another way of showing a part of a whole number.

C. A fraction (frak'-shun) means part of a complete thing or of a whole number.

D. Length (length) is the longest size (dimension).
STUDENT ACTIVITY 1 (continued)

E. The width (width) is the size of an object measured across from front to back.

1. Say the word decimal (des'-i-mal). How many parts does the word decimal have? Write the missing letters in the word decimal. The word decimal means...

Give an example of a decimal. Say the word decimal again. Write it down.
2. Say the word fraction (frak'-shun). How many parts does the word fraction have? _______ Write the missing letters in the word fraction. f _ _ _ _ i _ _ The word fraction means ... ___________________________ ___________________________ Give an example of a fraction. ______ Say the word fraction again. 

3. Say the word width (width). How many parts does the word width have? _______ Write the missing letters in the word width. _ _ _ _ t _ _ The word width means ... ___________________________ ___________________________ Say the word width again. Write it down. ___________________________
Vocabulary

1. Say the word **length** (length).
   How many parts does the word **length** have?
   Write the missing letters in the word **length**.
   ___ n ___

2. Say the word **dimension** (di-men'shun).
   How many sounds does the word **dimension** have?
   Write the missing letters in the word **dimension**.
   ___ i ___ o ___

3. Say the word **width** (width). How many parts does the word **width** have?

4. Say the word **thickness** (thik'-nes). How many sounds does the word **thickness** have?
STUDENT ACTIVITY 2

OBJECTIVE:
Identify the front, top, side, length, width, thickness of an object for which you have drawn a picture.

DIRECTIONS:
Look at the following drawings carefully, and do the activity described below:

This is a drawing of a shipping box.

Make a drawing of a box showing the following three views and three kinds of dimensions:

A. front
B. top
C. side
D. length
E. width
F. thickness
STUDENT ACTIVITY 3

OBJECTIVE:
Know the name and uses of the prick punch; and be able to pronounce, write, spell, and use the term correctly.

DIRECTIONS:
On this paper do the following:
1. With a pencil, draw lines between numbered dots and look at the finished picture.
2. Pick up a prick punch. Look at it from all sides. Feel the point. Is it sharp? Why is it sharp?
3. Do the activity on the following pages.

This is a picture of a prick punch.
A. Say the word prick (prik). How many parts does the word prick have? ______
Write the missing letters in the word prick. ___ i ___ k
Say the word punch. How many parts does the word punch have? ______
Write the missing letters in the word punch. _p _____ c h

B. The prick punch is used to make small marks in metal when struck (hit) with a ball peen hammer. The small marks are used for:
1. making layout line more visible;
2. marking location of holes;
3. marking place so that divider or trammel point will not slip when scribing circles and arcs.
C. Say the words **prick punch** again.

Write it down. __________

Write what the **prick punch** can be used for?

1. ________________

2. ________________

3. ________________
STUDENT ACTIVITY 4

OBJECTIVE:
Know the name and uses of the steel protractor and be able to pronounce, spell, write and use the term correctly.

DIRECTIONS:
On this page do the following:
1. With a pencil, draw lines between numbered dots and look at the finished picture.
2. Do the activity on the following page.

This is a steel protractor.
A. Say the word steel (stēl). How many parts does the word steel have? ________ Write the missing letters in the word steel.

B. Say the word protractor (pro-trakt'-ter). How many parts does the word protractor have? ________ Write the missing letters in the word protractor.

C. The steel protractor is used as a straight edge for laying out lines at angles to other lines or surfaces. Say the word again, steel protractor. Write it down.

D. What can the steel protractor be used for?
STUDENT ACTIVITY 5

OBJECTIVE:
Know the name and use of the combination square, and be able to pronounce, spell, write, and use the term correctly.

DIRECTIONS:
On this paper do the following:
1. With a pencil, draw lines between the numbered dots and look at the finished picture.
2. Do the activity on the following pages.

This is a combination square.
A. Say the word combination (kom-bi-ni-shun). How many parts does the word combination have? Write the missing letter in the word combination.

   __ o _ _ _ i _ _

B. Say the word square (skwār). How many parts does the word square have? Write the missing letters in the word square.

   __ u __

C. The combination square has several parts, it can be used as a:

1. straight edge for scribing lines at right angles (90°) to and edge or line,

2. straight edge for scribing lines at 45° angles to an edge or line,

3. ruler for measuring distances.
STUDENT ACTIVITY 5 (continued)

D. Say the words combination square again. Write it down.

__________________________

Write what the combination square can be used for?

1. _______________________

2. _______________________

3. _______________________

combination square

د - قال كلمة مرة ثانية. اكتبه.

اكتب استعمالات الزوايا المتعامدة المؤглаة:

1 - _______________________

2 - _______________________

3 - _______________________
STUDENT ACTIVITY 6

OBJECTIVE:
Know the name and use of the surface plate, and be able to pronounce, spell, write, and use the term correctly.

DIRECTIONS:
On this paper do the following:
1. With a pencil, draw lines between the numbered dots and look at the finished picture.
2. Do the activity on the following page.

This is a surface plate.
STUDENT ACTIVITY 6 (continued)

A. Say the word surface (sur'-fis).
   How many parts does the word surface have? _________ Write the missing letters in the word surface.
   ________ e

B. Say the word plate (plāt). How many parts does the word plate have? _________ Write the missing letters in the word plate.
   ________

C. The surface plate is a very expensive tool and is made of either cast iron or granite rock. It is used as a very flat surface from which accurate measuring may be done when laying out work.

Say the words surface plate again. Write it down. ___________________

Write what the surface plate can be used for? ___________________

- 1 -

- 31 -
STUDENT ACTIVITY 7

OBJECTIVE:
Know the name and use of the trammel, and be able to pronounce, spell, write, and use the term accurately.

DIRECTIONS:
On this paper do the following:
1. With a pencil, draw lines between the numbered dots and look at the finished picture.
2. Do the activity on the following page.

This is a trammel.
A. Say the word **trammel** (tram'-el).

How many parts does the word have?

__________ Write the missing letters in the word **trammel**.

__________

The **trammel** can be used for scribbling large circles and arcs (parts of large circles). Say the word **trammel** again. Write it.

__________

\[\text{اقتبس الكلمة: } \text{trammel} \]

\[\text{في هذه الكلمة؟ اكتب الأحرف الناقصة من كلمة } \text{trammel} \]

\[\text{البسكال نو العائقة لخدش دائرة كبيرة واقواس (جزء من الدائرة)، اكتب كلمة } \text{trammel} \]

\[\text{مرة أخرى، اكتبها: } \text{trammel} \]
STUDENT ACTIVITY 8

OBJECTIVE:
Know the name and use of the divider.
and be able to pronounce, spell,
write, and use the term accurately.

DIRECTIONS:
On this paper do the following:
1. With a pencil, draw lines
   between the numbered dots
   and look at the finished picture.

2. Do the activity on the following page.

This is a divider.
A. Say the word **divider** (di-vid'-er).

How many parts does the word **divider** have? ________

Write the missing letters in the word **divider**.

_ _ _ _ _ _ _ _ _

The **divider** can do 3 things:

1. scribe (scratch circles and parts of circles (arcs);

2. take sizes from a piece of material;

3. take sizes from a ruler.

Say the word **divider** again.

Write it down. ________

Write what you use the **divider** for.

1. ________

2. ________

3. ________
STUDENT ACTIVITY 9

OBJECTIVE:
Know the name and use of the hermaphrodite caliper, and be able to pronounce, spell, write, and use the term correctly.

DIRECTIONS:
On this paper do the following:
1. With a pencil, draw lines between the numbered dots and look at the finished picture.
2. Do the activity on the following page.

This is a hermaphrodite caliper.
STUDENT ACTIVITY 9 (continued)

A. Say the word hermaphrodite (her-maf'-rō-dit). Say the word caliper (kal'-i'per). How many parts does the word hermaphrodite have? __________ How many parts does the word caliper have? __________

B. Write the missing letters in the word hermaphrodite.

_ _ _ _ _ _ _ _ _ _ _ _ _ e

Write the missing letters in the word caliper. _ _ _ _ _ _ _

C. The hermaphrodite caliper is used to scribe a line or lines parallel to an edge.

Say the words hermaphrodite caliper again.

Write it down. _____________________

The hermaphrodite caliper can:

______________________________

______________________________
STUDENT ACTIVITY 10

OBJECTIVE:
Know the name and use of the scriber, and be able to pronounce, spell, write, and use the term correctly.

DIRECTIONS:
On this paper do the following:
1. With a pencil, draw lines between the numbered dots and look at the finished picture.
2. Do the activity on the following page.

This is a scriber.

---

This is a scriber.
STUDENT ACTIVITY 10 (continued)

A. Say the word scriber (skrib'-er). How many parts does the word scriber have? ________ Write the missing letters in the word scriber. ______ i ______

B. The scriber can scratch marks on metal and is used like a pencil. It should have a very sharp point. Say the word scriber (skrib'-er) again. Write it down. __________

Write what the scriber can be used for. ________________


SECTION II

OBJECTIVES:

You are going to learn:

to lay out a basic shape on a piece of flat steel.

You have been given:

1. the vocabulary of basic measurement,
2. the vocabulary and use of basic layout tools.

You will be given the following:

1. a blueprint of a drill gauge,
2. a piece of flat steel and,
3. basic layout tools.

You will be doing the following:

1. sketching (drawing) freehand the outline of a drill gauge;
2. coating a piece of steel with layout dye and scratching lines on it;
3. using the tools studied to lay out lines on a piece of flat steel that has been coated (painted) with layout dye.

We will know you can do this when:

you complete the layout tool activity pages with 100% accuracy.
STUDENT ACTIVITY 11

On the following page:

1. sketch (draw) freehand the outside lines of a drill gauge, inside the dark lined box on the next sheet.

   a. draw lightly first.
   b. complete with dark lines.

You will use:

A. the drawing beside the box as a guide;
B. a pencil.

We will know you can do this when:

A. you have a dark outline;
B. the shape in the box looks the same as the picture beside the box, but is smaller.
SKETCH OF A DRILL GAUGE
STUDENT ACTIVITY 12

OBJECTIVES:

When you complete this activity, you will be able to:

1. coat (paint) with layout dye a piece of flat steel;
2. scribe (scratch) lines on the piece of flat steel using the basic layout tools so that the lines are visible;
3. lay out, accurately, the outline of a drill gauge so that the lines line up with the master templet.

You will be given:

1. scribe
2. combination square
3. divider
4. trammels
5. surface plate
6. prick punch
7. steel rule
8. layout dye
9. abrasive (emery) cloth
10. steel protractor
11. ball peen hammer
12. file
13. blueprint of a drill gauge
14. flat piece of steel
DIRECTIONS:

STEP 1:

Scratch (scribe) lines on a piece of flat steel without layout dye.

STEP 2:

A. Polish (shine) flat surface of the piece of steel with an emery cloth.

B. Remove burrs (rough places) on edges of steel with a file.

C. Coat (paint) flat polished surface with layout dye.

D. Scribe some lines on the dyed surface with the following tools:
   1. scribe
   2. combination square
   3. steel rule
   4. divider
   5. trammel
   6. steel protractor
   7. hermaphrodite caliper
   8. prick punch
   9. ball peen hammer
STEP 3:

A. Coat the same surface with another layer of layout dye.

B. By using the blueprint of the drill gauge, lay out the drill gauge outline on the piece of flat steel.
EVALUATION

There are three parts to the post-test evaluation.

Part 1 - Pretest (scantron)
Part 2 - Sketch evaluation
Part 3 - Layout evaluation
   (In order to complete Part 3, a master templet must be provided.)

The layout of the drill gauge on a piece of flat steel must meet the following criteria:
A. Layout lines must be visible and neat.
B. Layout lines must line up with the master templet.
Use Pretest for post-test evaluation.
We will know you can do this when:

1. you can sketch (draw) the outline of a basic shape to the following conditions:
   a. lines are dark and neat;
   b. similar in shape to the checking templet.
EVALUATION (continued)

PART 3

We will know you can do this when:

1. The outline that you made of the drill gauge is the same size and shape as a templet of the drill gauge.
PRETEST
1. b. length
2. d. dimensions
3. c. decimal number
4. a. fraction
5. b. thickness
6. d. width
7. c. ruler
8. b. sketch
9. d. layout
10. a. layout dye
11. c. scriber
12. a. divider
13. b. trammel
14. d. surface plate
15. b. combination square
16. c. prick punch
17. c. burr
18. b. emery cloth
19. d. blueprint
20. d. hermaphrodite caliper
21. a. steel protractor
22. B
23. A
24. C
25. b. sketch
### Supplementary Materials

#### What Did You Use

<table>
<thead>
<tr>
<th>What Did You Use</th>
<th>Where It Can Be Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Webster's New Collegiate Dictionary</td>
<td>Machine Tool Office</td>
</tr>
<tr>
<td>General Industrial Machine Shop</td>
<td>Machine Tool Office</td>
</tr>
</tbody>
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