

# Chapter 1 Employability Skills for Drafting and Design Technicians

## Goal

The goal of this chapter is to teach students how to develop the employability skills needed to secure good jobs in their field and succeed in those jobs.

## Discussion Topics

1. Discuss the definition of employability skills.
2. Ask students for examples where ‘soft’ skills have helped them accomplish a goal.
3. Ask the students, in groups or individually, to select one entry from the “Categories of Employability Skills” (Figure 1-4) on page 22 that they feel is most important. Have an open discussion and weigh the answers as a class.
4. Discuss the job seeking skills needed by drafting and design technicians and how they may be acquired and maintained.
5. Discuss how required employability skills have changed over the years, and how they may continue to change in the future.

## Chapter Objectives

Upon completion of this chapter, students should be able to do the following:

- Define the term *employability skills*.
- Explain the importance of employability skills to drafting and design technicians.
- List the most important employability skills for drafting and design technicians.
- Demonstrate the skills necessary to secure employment in drafting and design.

## Teaching Hints

As future CAD operators, students should understand the basic components and functions of a computer system. Explain to students that they will need this information when upgrading, installing software, replacing peripheral devices, and troubleshooting problems. This will become even more essential as computers become more complicated and integrated. Students may access excellent internet web sites to learn about computer systems, but should also be taught how to evaluate resources before adopting them. Books, magazine articles, and videos will also enhance this chapter.

Begin by explaining the outward components of a computer system. Explain how these devices are connected to the central processing unit and a network if applicable. Using an old or damaged computer system, remove the cover from the CPU and identify the internal components for the class. Set up this computer so students can examine it in pairs or trios. Consider designing a worksheet for the groups to complete as they identify and explain the computer parts. Give students a computer magazine to list components that would fit into the computer system, because they should understand the cost of the computer components. If possible, allow students to view older magazines to compare how prices have changed over the past few years.

The best way to teach students about the internet is to have them actually use it. The computer on campus should be able to set up internet and email accounts for the students. Have the students send email messages to each other. You could use email to simulate two CAD operators working on the same drawing, but in different locations. When using the internet, provide students with a directed task. They should have step-by-step instructions to follow that allow them to visit a variety of computer and CAD sites.

## **Chapter 2 Drafting Tools: Conventional, CAD, and Solid Modeling**

### **Goal**

The goal of this chapter is to teach students how to: 1) use the most common conventional drafting tools; 2) explain the concepts of CAD and solid modeling.

### **Discussion Topics**

1. Discuss the most frequently used conventional drafting tools and the methods/tools that replaced them.
2. Discuss the concept of computer-aided drafting (CAD).
3. Discuss the most important features of CAD Software and compare opinions.
4. Discuss the concept and history of solid modeling.
5. Discuss the impact of consumer-based 3D printing on the direction of the industry.

### **Chapter Objectives**

After studying this chapter you should be able to:

1. Recognize the most frequently used conventional drafting tools.
2. Demonstrate the proper use of the most frequently used conventional drafting tools.
3. Explain the concept of computer-aided drafting (CAD).
4. Explain the most important features of CAD software.
5. Explain the concept of solid modeling.

### **Teaching Hints**

The field of drafting and design has come a long way since the advent of personal computers with the power to run sophisticated CAD software and with advances in the concept of solid modeling and 3D printing. Although students are going to learn drafting and design using CAD and solid modeling, there is still value in them learning to use selected conventional drafting and design tools. It is helpful to require things be done manually and use that competency as ‘license’ to use the far easier technology-based tools. Some of the concepts that are fundamental to drafting and design and engineering communication can still be taught more effectively using these conventional instruments.

Begin the lesson by discussing how some conventional drafting equipment is still important and may be used in conjunction with CAD and how many of the CAD commands are based on the operation of certain items of conventional drafting equipment. For instance, in CAD, circles can be drawn from a given center point, the same way a compass and circle templates operate. During the lesson, discuss with the students how a drafting tool corresponds to similar CAD commands.

Another option for students to learn how the tools operate is to give each of them two or three tools for practice use. As you monitor their progress they should write a brief description of the tool, how it operates, and its purpose. The students can then teach the rest of the class about their particular tool. Finally, as students work on drawings with drafting tools, ask them individually about the tool they are using and why they chose it. This will reinforce what they have learned and give you an opportunity to check their understanding. Once students have a grasp of how these selected conventional tools are used, move on to CAD and teach them how the conventional tools evolved into CAD and solid modeling.

## **Chapter 3 Sketching and Lettering for Engineering Communication**

### **Goal**

The goal of this chapter is to teach students how to develop skills in lettering and sketching.

### **Discussion Topics**

1. Explain the concept of talking sketching.
2. Discuss the various styles of freehand lettering and good lettering characteristics.
3. Discuss the various types of lines used on technical drawings.
4. Discuss the four styles of sketches. Which is best, when?
5. Discuss the materials needed to make sketches.
6. Discuss the most commonly used sketching techniques.

### **Chapter Objectives**

After studying this chapter you should be able to:

1. Explain the concept of talking sketching including the two kinds.
2. List the various styles of freehand lettering and the characteristics of good lettering.
3. Explain the techniques one must know in order to do freehand lettering.
4. Illustrate the various types of lines used on technical drawings.
5. Illustrate the four types of sketches.
6. Explain what materials are needed in order to make sketches.
7. Demonstrate the most commonly used sketching techniques.

### **Teaching Hints**

Begin this chapter by discussing the advantages and disadvantages of sketching. Students should see that sketching is a part of the design process and essential for those who want to communicate ideas quickly. Pass out a napkin, a scrap piece of paper, or a piece of notebook paper to each student. Put the students into pairs and give them the name of a fictitious product that they are to design by sketching on the provided medium. Because they are in pairs, students should discuss the elements of the product and how it should function and look.

When discussing lettering, students should understand why proper lettering is essential to quality sketches. Although precise and neat lettering can be done using a CAD system, the skill of lettering is still important since much of the communication between engineers and drafting and design technicians involves sketching and lettering. Distinguish between lettering and writing. The PowerPoint slide presentation illustrates the differences between the font and style of letters. Finally, discuss with the class the five characteristics of good lettering technique: neatness, uniformity, stability, proper spacing, and speed. These are described in the PowerPoint slide presentation.

The final section of the chapter covers sketching in more detail. Students primarily learn how to draw various types of projections using graph paper. Demonstrate this skill by showing small groups of students at a time. The proper sketching technique cannot be seen as well on the chalkboard in front of the entire class. When demonstrating the aspects of sketching, explain the principles of proportion and the differences between the types of projections.

## Chapter 4 Geometric Construction

### Goal

The goal of this chapter is to teach students how to develop technical drawings using geometric construction.

### Discussion Topics

1. Quiz students on geometric nomenclature and terms.
2. Recite the steps required to perform basic constructions.
3. Recite the steps required to perform polygon constructions.
4. Describe the six types of polygons.

### Chapter Objectives

After studying this chapter you should be able to:

1. Define the most frequently used terms in geometric nomenclature.
2. Properly apply the elemental principles of geometric construction.
3. Demonstrate the proper procedures for polygon construction.
4. Demonstrate the proper procedures for circular construction.
5. Demonstrate the proper procedures for supplementary construction including the following: spiral; helix; involute of a line, triangle, square, and circle; and cycloidal curve.

### Teaching Hints

Students need to develop a working definition of the terms in the chapter to fully understand and implement geometric construction. A working definition includes a written and a drawn example, plus it describes the subject item's use in everyday life. The terms and a written definition have been provided in the PowerPoint slide presentation. As you proceed through each term, be sure to draw an example of each on the board. Students then should be able to identify where they have seen the shapes being used in everyday life.

If students understand the basic concepts of constructing geometric shapes using drafting tools, then they will make an easier transition to the fundamentals of CAD. It may not be necessary to work through every shape detailed in the chapter as a class. Many of the directions have been summarized in the PowerPoint slide presentation. These can be projected onto a screen and drawn at the same time. Some of the problems should be given to the student to follow the directions and solve individually. Have the students check their work by writing an explanation of why they did each particular step. Although they may find this exercise tedious, when they need to reference their work later it will be easier to remember the procedures.

Finally, demonstrate to the student how to draw some of the common shapes (circle, square, ellipse, octagon, tangent arcs and lines, triangles, and lines) detailed in the chapter using CAD. To improve their CAD skills, you could also have the students follow the directions given in the chapter to draw the shapes using CAD as if it were a drafting tool. In other words, when they are to draw a tangent arc between two lines, students should draw the arcs parallel to each line, attach tangential lines, and then draw the resulting arc from the line intersection. This will show them that the same techniques are possible with CAD, and sometimes absolutely necessary.