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| **Unit 2 Technical Sketching and Drawing** |

**Preface**

It is often said that a picture is worth a thousand words. This proverb is very true when communicating ideas to solve problems. To properly communicate technical information about objects that must be manufactured, fluency in the universal language of technical drawing is required. One of the first steps to learning this language is developing the ability to sketch.

Visualizing, communicating, exploring, and documenting ideas occur throughout the process of design. The process begins when a client and an engineer meet for the first time to define a problem; when research requires field measurements to be taken so that a scenario can be replicated; when an idea occurs during lunch and must be quickly recorded on a napkin before it is lost; when teams of people feed off each other’s ideas and brainstorm possible solutions; when an engineer works out the details of a design solution so that it can be prototyped and tested; and when a solution has been proven to work and must be documented for reproduction.

As they advance in their experiences and skills through the course, students will learn basic rules of technical sketching in this lesson and will learn the drawing standards that apply. The understanding of technical sketching is critical for designers when effectively conveying their ideas about a product. Sketching is the beginning stage of product development. Students will learn how to sketch isometric, oblique, perspective, and multi-view sketches of various objects.

**Unit 2 – Concepts & Objectives**

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| **Concepts** | **Objectives** |
| Brainstorming may take many forms and is used to generate a large number of innovative, creative ideas in a short time. |          Generate and document multiple ideas or solution paths to a problem through brainstorming. |
| Two- and three-dimensional objects share visual relationships which allow interpretation of one perspective from the other. |          Identify flat patterns (nets) that fold into geometric solid forms. |
| Geometric shapes and forms are described and differentiated by their characteristic features. |          Explain the concept of proportion and how it relates to freehand sketching. |
| The style of the engineering graphics and the type of drawing views used to detail an object vary depending upon the intended use of the graphic. |          Identify and define technical drawing representations including isometric, orthographic projection, oblique, perspective, auxiliary, and section views.          Identify the proper use of each technical drawing representation including isometric, orthographic projection, oblique, perspective, auxiliary, and section views. |
| Technical drawings convey information according to an established set of drawing practices which allow for detailed and universal interpretation of the drawing. |          Identify line types (including construction lines, object lines, hidden lines, cutting plane lines, section lines, and center lines) used on a technical drawing per ANSI Line Conventions and Lettering Y14.2M-2008 and explain the purpose of each line.         Determine the minimum number and types of views necessary to fully detail a part.         Choose and justify the choice for the best orthographic projection of an object to use as a front view on technical drawings.         Apply tonal shading to enhance the appearance of a pictorial sketch and create a more realistic appearance of a sketched object. |
| Hand sketching of multiple representations to fully and accurately detail simple objects or parts of objects is a technique used to convey visual and technical information about an object. |          Hand sketch 1-point and 2-point perspective pictorial views of a simple object or part given the object, a detailed verbal description or the object, a pictorial view of the object, and/or a set of orthographic projections.         Hand sketch isometric views of a simple object or part at a given scale using the actual object, a detailed verbal description of the object, a pictorial view of the object, or a set of orthographic projections.         Hand sketch orthographic projections at a given scale and in the correct orientation to fully detail an object or part using the actual object, a detailed verbal description of the object, or a pictorial an isometric view of the object. |
| Sketches, drawings, and images are used to record and convey specific types of information depending upon the audience and the purpose of the communication. |          Create drawings or diagrams as representations of objects, ideas, events, or systems. |

**Essential Questions (Unit-Specific)**

1.    How can we clearly convey the intent of a design to someone unfamiliar with the original problem or the solution?

2.    How is technical drawing similar to and different from artistic drawing?

3.    What can cause a technical drawing to be inadequate or misinterpreted?

**Essential Questions (Course-Wide)**

1.    How does the design process promote the development of good solutions to technical problems?

2.    How can an engineer or technical professional effectively communicate ideas and solutions in a global community?

3.    How do inventors and innovators impact and shape society?

**Day-by-Day Plans**

*Time: 6 days*

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| **Day 1-2** | * **Essential Question: How can we clearly convey the intent of a design to someone unfamiliar with the original problem or the solution ?**
* The teacher will present **Objectives**, **Concepts**, **Key Terms**, and **Essential Questions**, and provide a unit overview.
* The teacher will present **Line Convention.ppt**.
* Students will take notes using **Line Conventions Handout** graphics .
* The teacher will present **Isometrics and Oblique Pictorials.ppt**.
* Students will take notes.
* The teacher will distribute **Activity 2.1 Isometric Sketching** and provide **Isometric Grid Paper**.
* Students will work on Activity 2.1 Isometric Sketches.
* Students will complete #1 - 3 in Activity 2.1 for homework.
* Students will complete #4 – 7 in Activity 2.1 Isometric Sketches for homework.
* The teacher will present Sketching an Isometric Circle. ppt.
* Students will take notes.
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| **Day 3** | * The teacher will present **Perspective Sketching.ppt****.**
* Students will take notes.
* The teacher will distribute **Activity 2.2 Perspective Sketching****.**
* Students will work on Activity 2.2 Perspective Sketching.
* Students will complete #1 - 2 in Activity 2.2 for homework.
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| **Day 4-5** |          **CFU: What are the advantages/disadvantages of each pictorial representation?*** The teacher will present **Multi-view Sketching.ppt****.**
* Students will take notes.
* The teacher will distribute **Activity 2.3 Glass Box** and print of a transparency print of **Glass Box Pattern**.
* Students will work on Activity 2.3 Glass Box.
* The teacher will distribute **Activity 2.4 Multi-view Sketching**.
* Students will work on Activity 2.4 Multi-view Sketching.
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| **Day 6** |          **CFU:  What can cause a technical drawing to be inadequate or misinterpreted?*** **Essential Question: How is technical drawing similar to and different from artistic drawing?**
* The teacher will distribute **Activity 2.5 Sketching Practice**.
* Students will work on Activity 2.5 Sketching Practice.
* The teacher will informally assess student work during class and provide assistance as students complete Activity 2.5.
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**Standards and PLTW Concept and Objective Overviews**

***National Science Education Standards addressed in unit.***

**Unifying Concepts and Processes:**  As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes.

         **Systems, order, and organization**

         **Evidence, models, and explanation**

         **Change, constancy, and measurement**

         **Form and function**

**Science and Technology Standard E:** As a result of activities in grades 9-12, all students should develop

         **Abilities of technological design**

***Standards for English Language Arts addressed in unit.***

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| **Standard 4** | Students adjust their use of spoken, written, and visual language (e.g. conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. |
| **Standard 5** | Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences and for a variety of purposes. |

***Standards for Technological Literacy addressed in unit.***

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| **Standard 12:  Students will develop the abilities to use and maintain technological products and systems.**  |
| **BM L:** | Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.  |
| **BM P:** | Use computers and calculators to access, retrieve, organize and process, maintain, interpret, and evaluate data and information in order to communicate. |
| **Standard 17:  Students will develop an understanding of and be able to select and use information and communication technologies.**  |
| **BM L:** | Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information. |
| **BM M:** | Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.  |
| **BM N:** | Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.  |
| **BM P:** | There are many ways to communicate information, such as graphic and electronic means. |
| **BM Q:** | Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. |