Computer Aided Drafting & Design Unit 1: Introduction to 3D Modeling

Unit Focus

This unit introduces the student to concepts and tools for producing solid models that can be efficiently manufactured in an engineering shop. Students will learn and apply the major processes (Sketching, dimensioning, Extrude, Shell, Revolve, Sweep & Loft) within a 3D modeling software (SolidWorks) in creating solutions (models) to a variety problems. Student will learn these skills/processes in a collaborative fashion with their classmates through conceiving, designing, modeling and creating working prototypes for testing by using 3D printing technologies. The PBA will have students design and 3D print a cell phone stand/audio enhancer.

Stage 1: Desired Results - Key Understandings

Standard(s)

Connecticut Goals and Standards

Computer Aided Drafting and Design: 12

- Apply conventional Computer Aided Drafting and Design processes and procedures accurately, appropriately, and safely. *CADD.02.01*
- Describe physical objects as geometric entities.* *CADD.02.02*
- Express a design of an object as a 3D model.*(A5) *CADD.02.07*
- Identify basic geometric elements (e.g., line, circle, rectangle, sphere, and cube).*(A9) *CADD.02.11*
- View file names of a storage device.*(C14) *CADD.04.04*
- Store, copy, move, and retrieve information to/from various drives.*(C15) *CADD.04.05*
- Rename and backup files*C16) *CADD.04.06*
- Understand the commands and concepts necessary for producing drawings through traditional or computer-aided means. *CADD.05.01*
- Use the concepts of geometric construction in the development of design drawings. *CADD.05.04*
- Explain the Cartesian Coordinate System.*(E20) *CADD.05.07*
- Describe the process for setting and editing drawing elements.*(E21) *CADD.05.08*
- Create and edit line types, colors and layers/levels.*(E22) *CADD.05.09*
- Create and edit basic geometry.*(E23) *CADD.05.10*
- Place and edit text and fonts.*(E24) *CADD.05.11*

Transfer

Students will be able to independently use their learning to...

T1 Explore and hone techniques, skills, methods, and processes to create and innovate

T2 Develop a product/solution that adheres to key parameters (e.g., cost, timeline, restrictions, available resources and audience).

Meaning

Understanding(s)

Students will understand that...

U1 Design thinking allows people to trust the process even if it feels nonlinear, to help them improve anything, with anyone, in the world around them.

U2 Standardized procedures for creating drawings within a 3D Modeling software package is essential to communicate with various tradesmen in a common language.

U3 Fabricating an object requires many steps including planning, drawing and revisions before the object can be manufactured.

U4 Modeling, prototyping, and simulation are used in the design and testing of solutions.

Essential Question(s)

Students will keep considering...

Q1 What are the fundamental skills required for the construction of computer based 3D objects?

Q2 How do people effectively use the Design Thinking tools in larger teams to identify and solve problems within a community?

Q3 How can I communicate my design ideas clearly and efficiently?

Q4 Why would you create a prototype of a product before the actual production takes place?

Acquisition of Knowledge and Skill

Knowledge

Students will know...

K1 Vocabulary: Features, Base, boss, extrusion, axis, fillet, chamfer, extrude, sketch, constraints, faces, edges, points, planes, axis, degrees of freedom and assemblies.

Skill(s)

Students will be skilled at...

S1 Manipulate relations to create more efficient geometry when sketching.

S2 Create a part using a variety of features.

Stage 1: Desired Results - Key Understandings

- Generate a pictorial drawing.*(E28) *CADD.05.15*
- Scale and print hard copy of an output device.*(E29) *CADD.05.16*
- Create and edit construction planes through reference geometry.*(G35) *CADD.06.03*
- Generate/modify geometric components on construction planes.* *CADD.06.04*
- Create a 3-D model from a 2-D drawing.*(G35) *CADD.06.06*
- Create an assembly in 3-D geometry.*(F31) *CADD.07.01*
- Create an exploded view of a 3-D assembly.*(F32) *CADD.07.02*

ITEEA - Standards for Technological Literacy
Technological Literacy: K-12
- Students will develop an understanding of the characteristics and scope of technology. (1)
- Students will develop an understanding of the attributes of design. (8)
- Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (10)
- Students will develop the abilities to use and maintain technological products and systems. (12)

Madison Public Schools Profile of a Graduate
- Idea Generation: Studying a problem, need or model (mentor text, political piece, documents, art work, etc.) to consider limitations and imagine new solutions/transformations. (POG.2.1)
- Product Creation: Effectively use a medium to communicate important information. (POG.3.2)

K2 The major features are: Extrude, Shell, Patterns, Revolve, Sweep, Loft & Mate.
K3 3D Modeling has three types of files: part, assembly and drawing.
K4 Parametric versus dimensional constraints (relations)
K5 Differentiate between Cartesian Coordinate System and the Global Coordinate System.
K6 Trimming tools such as Power Trim,Corner, Trim Away Inside, Trim Away Outside and Trim to Closest.
K7 Addative prototyping versus subtractive prototyping
K8 Part files created in a solid modeling software can be used in a variety of applications/processes ranging from 3D printing, CNC Milling and CNC routing.

S3 Utilize a 3D printer in creating prototypes in solving problems.
S4 Manipulate the criteria within a slicing software to yield to best print results when 3D printing.
S5 Combine and apply features to new situations.
S6 Assemble several pieces together using the Mate Feature.