PLANNED INSTRUCTION

A PLANNED COURSE FOR:

7th Grade Technology Education
Design and Modeling

Curriculum writing committee:

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Grade Level: 7th Grade

Date of Board Approval: ____July 14, 2022_____

Course Weighting: 7th Grade Technology Education (Design and Modeling)

Participation	**10%**
Classwork	**40%**
Projects	**50%**
Total	**100%**

Curriculum Map

Overview: This is the first formal exposure that students at Delaware Valley will experience in Technology Education. With that in mind the focus at the middle school level is to introduce students to the nature of technology and its role and impact on society. The activities are intended to challenge and engage students while establishing a clear interrelationship between Technology and other disciplines including Science, Math, History, Language Arts, and Art. Students will experience design and problem-solving models as they work on hands-on activities representing the designed world. Specific projects/activities include learning how the design process is used to solve problems, practice using historical and current techniques for measuring in both metric and customary systems, create thumbnail, perspective, isometric, and orthographic sketches and to dimension them correctly, and using Autodesk® Inventor® to learn how to create 3D models.

Units of study include:

Introduction to Design, Solid Modeling, Design Challenge

Time/Credit for the Course: 45 days (1 quarter) and .25 credits

Goals:

- Students will participate in an instant design challenge to create an optimal solution to a given problem and apply what they learn to understand the importance of using the design process.
- Students will learn thumbnail, perspective, isometric, and multi-view sketching as methods for communicating design ideas effectively without the use of technology.
- Students will calculate conversions between two measurement systems.
- Students will apply measurement skills while dimensioning sketches.
- Students will apply the design process to create a puzzle cube.
- Students will apply a mathematical model to study a situation.
- Students will design shapes in a coordinate system.

- Students will transfer a two-dimensional representation to a three-dimensional solid model using technology.
- Students will create a solid model using Autodesk Inventor software.
- Students will fabricate and test their design solution.
- Students will apply the design process and create all the necessary documentation in each of the steps of the design process.
- Students will create sketches for your design ideas.
- Students will create a 3D design using Autodesk Inventor.
- Students will assess your solution and analyze the test data using a data analysis application.

Big Ideas:

- Recall that the goal of any engineering design process is to create solutions and opportunities for people and society.
- Construct a prototype based on design documentation.
- Recognize perspective, thumbnail, isometric, and multi-view sketches.
- Summarize the reasoning for using sketching as a communication tool.
- Differentiate between two-dimensional and three-dimensional models.
- Interpret multi-view drawings, specifications, dimensions and annotations.
- Compare and contrast the various types of models used when designing a solution.
- Apply geometric and dimensional constraints to solid model designs.
- Identify the proper tool to use to measure and dimension with accuracy and precision.

Textbook and Supplemental Resources:

Project Lead the Way
https://my.pltw.org/

Curriculum Plan

Time/Days **18 days**

Unit 1-Introduction to Design

- **Standards (by number):** 3.4.7.A1, 3.4.7.A2, 3.4.7.B3, 3.4.7.B4, 3.4.7.C1, 3.4.7.C2, 3.4.7.C3, 3.4.8.C1, 3.4.8.C3, 3.4.7.D1, 3.4.7.D2, 3.4.7.D3, 3.4.7.E1

- **Anchors:** S7.A.1, S7.A.2, S7.A.3, S8.A.2

- **Eligible Content:**
  - How is a design process used to effectively develop a design solution that solves a problem or addresses a design opportunity?
  - Why is communication of design ideas with teams and with stakeholders important throughout the design process?
  - What role do team norms play in making a collaborative team more successful?

Objectives:

- Students will participate in an instant design challenge to create an optimal solution to a given problem and apply what they learn to understand the importance of using the design process. (DOK 4)
- Students will learn thumbnail, perspective, isometric, and multi-view sketching as methods for communicating design ideas effectively without the use of technology. (DOK 2)
- Students will calculate conversions between two measurement systems. (DOK 1)
- Students will apply measurement skills while dimensioning sketches. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Ankle Foot Orthosis Design
   a. Lecture: Teacher will discuss project requirements.
   b. Demonstration: PLTW instructional video.
   c. Hands-on: Create foot orthosis prototype.
2. Thumbnail, Isometric, and Multi-view Sketching
   a. Lecture: Teacher will discuss the different types of sketches.
   b. Hands-on: Practice sketching techniques by drawing given objects.
3. Measurement
   a. Lecture: Teacher will discuss the different types of measurement.
   b. Hands-on: Practice measuring objects.

4. Skimmer Project
    a. Lecture: Teacher will discuss the project requirements with the class.
    b. Demonstration: Teacher will show students how to properly read a dimensioned sketch and create a scaled drawing.
    c. Hands-on: Students will create their own skimmer drawing using the metric system. They will then cut out and construct the skimmer.

Assessments:

Diagnostic:

1. Oral response to determine student comprehension

Formative:

1. Teacher review of engineering notebook
2. Sketching activities
3. Measurement activities

Summative:

1. Ankle Foot Orthosis Challenge
2. Skimmer Project

Curriculum Plan

Time/Days **18 days**

Unit 2- Solid Modeling

- **Standards (by number):** 3.4.7.A1, 3.4.7.A2, 3.4.7.B4, 3.4.7.C1, 3.4.7.C2, 3.4.7.C3, 3.4.8.C1, 3.4.8.C3, 3.4.7.D1, 3.4.7.D2, 3.4.7.D3

- **Anchors:** S7.A.1, S7.A.2, S7.A.3, S8.A.2

- **Eligible Content:**
  - Why is it important for an engineer to be aware of the criteria and constraints when designing a project?
  - How do coordinate systems help engineers with their modeling?
  - How has the evolution of rapid prototyping tools impacted design fabrication?

Objectives:

- Students will apply the design process to create a puzzle cube. (DOK 4)
- Students will design shapes in a coordinate system. (DOK 4)
- Students will transfer a two-dimensional representation to a three-dimensional solid model using technology. (DOK 3)
- Students will create a solid model using Autodesk Inventor software. (DOK 4)
- Students will fabricate and test their design solution. (DOK 4)
- Students will apply measurement skills while dimensioning sketches. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Building Blocks Challenge
   a. Lecture: Teacher will discuss project requirements.
   b. Demonstration: Teacher will build an example project.
   c. Hands-on: Create a building blocks puzzle cube.
2. Autodesk Inventor 3D Modeling
   a. Demonstrate: Show how to properly use the 3D modeling software.
   b. Hands-on: Complete various Inventor projects.
3. Dimensioning
   a. Lecture: Teacher will discuss the proper dimensioning techniques
   b. Demonstrate: Show how to properly dimension an orthographic sketch.

c. Hands-on: Draw and dimension various orthographic sketches.

Assessments:

Diagnostic:

1. Oral response to determine student comprehension

Formative:

1. Teacher review of engineering notebook
2. Dimensioning Activity

Summative:

1. Building Blocks Challenge
2. Autodesk Inventor Projects

Curriculum Plan

Time/Days **9 days**

Unit 3- Design Challenge

- **Standards (by number):** 3.4.7.A1, 3.4.7.A2, 3.4.7.B3, 3.4.7.B4, 3.4.7.C1, 3.4.7.C2, 3.4.7.C3, 3.4.8.C1, 3.4.8.C3, 3.4.7.D1, 3.4.7.D2, 3.4.7.D3, 3.4.7.E1

- **Anchors:** S7.A.1, S7.A.2, S7.A.3, S8.A.2

- **Eligible Content:**
    - Why are brainstorming, research, and testing important when creating, modifying, or improving a design solution?

Objectives:

- Students will apply the design process to reverse engineer a linking cube or similar item. (DOK 4)
- Students will create sketches for their design ideas. (DOK 4)
- Students will transfer a two-dimensional representation to a three-dimensional solid model using technology. (DOK 3)
- Students will create a solid model using Autodesk Inventor software. (DOK 4)
- Students will fabricate and test their design solution. (DOK 4)
- Students will apply measurement skills while dimensioning sketches. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Dial Caliper Activity
    a. Lecture: Teacher will discuss project requirements.
    b. Demonstration: Teacher will show how to use and read a dial caliper.
    c. Hands-on: Measure various items throughout the room using a dial caliper.
2. Reverse Engineering Challenge
    a. Lecture: Teacher will discuss project requirements.
    b. Hands-on: Complete sketches of their object, create a 3D model using Inventor, 3D print item to check for accuracy.

Assessments:

Diagnostic:

1. Oral response to determine student comprehension

Formative:

1. Teacher review of engineering notebook
2. Dial Caliper Activity

Summative:

1. Reverse Engineering Challenge