DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Advanced CADD Applications

Curriculum writing committee:

Tom Moran

Grade Level: 11 & 12

Date of Board Approval: 2024

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

Curriculum Map

Overview: This course will be a culmination of the previous three mechanical drawing courses. The purpose of Advanced CADD Applications is to allow students to develop a mastery level of skills learned in those courses and experience how they are applied in the 21st century workplace. Students will work on more in-depth projects, using the software learned in Mechanical Drawing levels I and II. They will do several projects in each unit to achieve a mastery level the unit goals. They will further their experience with our 3D printer by creating detailed prototypes of their projects. They will be able to use a laser scanner to collect geometric data to create 3 dimensional models. Students will be progressing their design techniques, use of Adobe Illustrator and use of the vinyl cutter/printer through more involved graphics designs. They will be applying the skills they have learned through real-world problem-solving projects brought to the students by DVSD employees and/or local industry.

Goals:

- Students will know how to analyze interference between moving parts when they simulate the virtual movement of their assemblies.
- Students will be able to create a properly functioning prototype using a 3D scanner and 3D printer.
- Students will further their knowledge and efficient use of Adobe Illustrator.
- Students will know how to safely use the Roland Printer/Cutter.
- Students will use all their skills and knowledge of mechanical drawing software and hardware to solve everyday real world technological problems.
- Students will learn how to use the Artec 3D laser scanner and the Artec Studio software to collect and manipulate digital data that will be used to reproduce exact, or innovated 3D printed models.

Big Ideas:

Big Idea # 1: Technology is created, used, and modified by humans.

Big Idea #2: Technological design is a creative process that anyone can do which may result in new inventions and innovations.

Big Idea #3: Technological literacy is the ability to use, assess and manage technology around us.

Big Idea #4: Successful STEM professionals exhibit specific personal and professional characteristics that lend themselves to the creative, collaborative, and solution-driven nature of their profession.

Big Idea #5: STEM professionals use professional skills and knowledge to pursue opportunities and create sustainable solutions to improve and enhance the quality of life of individuals and society.

Textbook and Supplemental Resources:

No textbooks used or print resources.

Curriculum Plan

UNIT 1: Advanced 3-Dimensional CAD Processes

Time Range in Days: 15 days

Standards (by number):

- 3.5.9-12.K (ETS), 3.5.9-12.N, 3.5.9-12.O, 3.5.9-12.Q, 3.5.9-12.PP

Anchor(s):

- NA

Eligible Content:

- Students will know how to analyze interference between moving parts using the collision detection feature when they simulate the virtual movement of their assemblies.

Objectives:

1. Students will be able to drive their assembly's constraints to simulate motion. (DOK 2)
2. Students use collision detection and analyze interference to diagnose. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Introduce and demonstrate the necessary tools and functions to drive constraints.
    a. Demonstration: software tools
    b. Hands-on: practice use of tools on examples
2. Simulate the movement of the mechanism.
    a. Hands-on: software and functions to drive and simulate mechanism

Assessments:

Diagnostic:

Oral responses during discussion

Formative:

Progress and understanding of advanced software tools

Summative:

Proper simulation of the virtual mechanism on the computer

UNIT 2: Precision Prototyping **Time Range in Days:** 15 days

Standards (by number):

- 3.5.9-12.K (ETS), 3.5.9-12.N, 3.5.9-12.O, 3.5.9-12.Q, 3.5.9-12.PP

Anchor(s):

- NA

Eligible Content:

- Students will be able to create a properly functioning precise prototype using the Inventor software, and the 3D printer.

Objectives:

1. Students will know how to set up the 3D printer to receive the STL file so it can be built and run build. (DOK 1)
2. Students will understand how to clean the support material off their parts using hand tools and the parts cleaner. (DOK 1)
3. Students will assemble their parts to test for form, fit, and function. (DOK 2)
4. If parts do not assemble correctly, they will learn how to analyze problems. (DOK 4)
5. Students will be able to assess the failing parts and reengineer them in Inventor so they can be rebuilt. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Set up 3D printer and build parts.
    a. Demonstrate: 3D printer set-up
    b. Hands-on: students will set-up and build part in 3D printer
2. Clean off support material.
    a. Demonstrate: cleaning process
    b. Hands-on: students clean their parts
3. Students will assemble their parts.
    a. Hands-on: project assembly
4. Students will reengineer and rebuild any parts that are improperly engineered.
    a. Demonstrate: editing process and tools in Inventor
    b. Hands-on: edit, rebuild and reassemble parts (repeat until form, fit and function is correct)

Assessments:

Diagnostic:

Oral response during discussion

Formative:

Understanding of the 3D printer, software, and hardware

Summative:

Test functionality of student protypes

UNIT 3: Vinyl Printer/Cutter

Time Range in Days: 15 days

Standards (by number):

- 3.5.9-12.K (ETS), 3.5.9-12.N, 3.5.9-12.O, 3.5.9-12.Q, 3.5.9-12.PP

Anchor(s):

- NA

Eligible Content:

- Students will know how to create a design (graphic) of their choice, use Roland Printer/Vinyl Cutter driver software to program the printer/cutter then print and cut their design.

Objectives:

1. Students will know how to use AutoCAD or other design-based software (Adobe Illustrator) to create a graphic design to drive the Roland Printer/Cutter. (DOK 4)
2. Students will be able to program the Roland Printer/Cutter using the Versaworks driver software. (DOK 4)
3. Students will acquire the skills and experience necessary to create a product properly and safely with the Roland Printer/Cutter. (DOK 4)

Core Activities and Corresponding Instructional Methods:

1. Use design-based software or AutoCAD software to create multiple designs to be printed.
    a. Demonstrate: drawing tools in design software
        i. Students will already have sufficient experience with AutoCAD from Mechanical Drawing I.
            1. No demo of AutoCAD is needed.
    b. Hands-on: use of techniques learned during demonstrations on creating designs
2. Program the Roland Printer/Cutter using Versaworks.
    a. Demonstrate: programming process using the Versaworks software
    b. Hands-on: program the printer/cutter
3. Safely print and cut their design.
    a. Demonstrate: safe set-up and operation of the Roland printer/cutter
    b. Hands-on: use of the Roland Printer/Cutter to make their graphics

Assessments:

Diagnostic:

Oral response during demonstrations

Formative:

Progress and understanding of design and driver software

Summative:

Safe and proper use of the tool's software and hardware and the quality of the student's design

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UNIT 4: Advanced Problem **Solving Time Range in Days:** 30 days

Standards (by number):

- 3.5.9-12.K (ETS), 3.5.9-12.N, 3.5.9-12.O, 3.5.9-12.Q, 3.5.9-12.PP

Anchor(s):

- NA

Eligible Content:

- Students will use problem solving techniques to analyze strengths and weaknesses of failed parts provided by Delaware Valley School District employees and local industries. Students will produce innovated parts for the provider which will help them master and progress skills learned in Mechanical Drawing levels I & II. These problems may be mechanical or architectural in nature.

Objectives:

1. Allow students to critically think, problem solve, and create an advanced problem-solving project posed by local industry or a DVSD employee by using skills, software and machinery learned in all mechanical drawing classes to this point. (DOK 4)
2. This project will be used to reinforce what students have learned in all aspects of the mechanical drawing curriculum. (DOK 1)
3. Students will also be able to independently research and learn any advanced procedures they may not have already learned. (DOK 3)

Core Activities and Corresponding Instructional Methods:

1. Create electronic drawings using Revit software, of any architectural projects brought to the students.
    a. Hands-on: create and print drawings
2. Deliver drawings and model, review with project managers for potential edits.
    a. Hands-on: edit drawings, and model and deliver final drawings
3. Use existing technologies to build/draw problem solving projects for other local industry or DVSD staff member.
    a. Hands-on: complete project

Assessments:

Diagnostic:

Oral response during demonstrations

Formative:

Progress and understanding of design and driver software

Summative:

Proper use of the tools, software and hardware and the quality of the student's design

UNIT 5: 3D Scanning

Time Range in Days: 15 days

Standards (by number):

- 3.5.9-12.K (ETS), 3.5.9-12.N, 3.5.9-12.O, 3.5.9-12.Q, 3.5.9-12.PP

Anchor(s):

- NA

Eligible Content:

- Use of the 3D scanner and its rendering software to create accurate replicas of components. The 3D scanner can 3 dimensionally collect geometry of objects that can be edited, and 3D printed. This tool eliminates having to use the Inventor software and the reverse engineering process to replicate parts.

Objectives:

1. Students will learn how to use the 3D scanner and printer software to import, scale, orient, set-up and process their STL files which will drive the 3D printer and make their mechanism. (DOK 1)

Core Activities and Corresponding Instructional Methods:

1. Use the 3D Scanner and Printer software to prepare STL file for build.
    a. Demonstrate: software
    b. Hands-on: program part into software
2. Master 3D printer use.
    a. Demonstrate: 3D printer set-up
    b. Hands-on: students will set-up and build part in 3D printer
3. Students will reengineer and rebuild any parts that are improperly engineered using the 3D scanner.
    a. Demonstrate: editing process and tools in Inventor
    b. Hands-on: edit, rebuild, and reassemble parts (repeat until form, fit and function is correct)

Assessments:

Diagnostic:

Oral response during discussion

Formative:

Understanding of the 3D scanner, 3D printer, software and hardware

Summative:

Test functionality of student protypes