GEORGIA MIDDLE SCHOOL Instructional Resources

CAREER, TECHNICAL, & AGRICULTURAL EDUCATION

ENGINEERING & TECHNOLOGY

COURSE: Invention and Innovation

UNIT 1: 3D Solid Modeling

INTRODUCTION

Annotation:

This unit will provide students with an opportunity to design objects in 3D. Students will be able to take 2D sketches and create 3D solid objects.

Grade(s):

	6th
X	7th
	8th

Time:

Seven to eight 50 minute class periods

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Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided appropriately. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation. Many students (both with and without disabilities) who struggle with reading may benefit from the use of text reading software or other technological aids to provide access to printed materials. Many of these are available at little or no cost on the internet.

FOCUS STANDARDS

GPS Focus Standards:

ENGR-II-2- Students will examine the core concepts of engineering and technology.

d) Reverse engineer a consumer product

ENGR-II-4- Students will invent or innovate a technological product.

b) Design a simple invention or innovation

g) Evaluate the invention or innovation

ENGR-II-6- Students will develop leadership skills and work ethics.

a) Demonstrate work ethics within the classroom and lab environment

GPS Academic Standards:

M7G4- Students will further develop their understanding of three-dimensional figures.

a. Describe three-dimensional figures formed by translations and rotations of plane figures throughout space.

M7A3- Students will understand relationships between two variables.

a. Plot points on a coordinate plane.

UNDERSTANDING & GOALS

Enduring Understandings:

Students will understand the use of 3D models in product invention, design and development.

Essential Questions:

- What is the difference is 2D and 3D design?
- What is an extrusion?
- What are dimensions?

Knowledge from this Unit:

Students will be able to:

- Explain 2-dimensional and 3-dimensional drawings.
- Describe the use of extruding material in product development.

Skills from this Unit:

Students will be able to:

- Create 3D solid model of various objects.
- Read technical illustrations.
- Read dimensions.
- Create technical drawing with dimensions.

ASSESSMENTS

Assessment Method Type:

_____ Pre-test
_____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ Unit test
x Group project
_____ Individual project
_____ Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
__ Self-check rubrics
__ Self-check during writing/planning process
__ Journal reflections on concepts, personal experiences and impact on one's life
__ Reflect on evaluations of work from teachers, business partners, and competition judges
__ Academic prompts
__ Practice quizzes/tests
x Subjective assessment/Informal observations
__ Essay tests
x __ Observe students working with partners
__ Observe students role playing
_____ Peer-assessment
__ Peer editing and commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
x Dialogue and Discussion
__ Student/teacher conferences
x __ Partner and small group discussions
__ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners
_____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
__ Application of skills to real-life situations/scenarios
x Post-test

Assessment(s) Title:

Google SketchUp Object Reproduction 1 – L Block with 2 holes
Google SketchUp Object Reproduction 2 - Wheel
Google SketchUp Object Reproduction 3 – Stairs with recessed area
Google SketchUp Object Reproduction 4 – Table
Google SketchUp Object Creation – Chair Design
3D Solid Modeling Test

Assessment(s) Description/Directions:

Google SketchUp Object Reproductions 1 - 4: Students will accurately reproduce the L block with holes. The design should be accurately drawing and include dimensions. Reproducing the3se objects will teach the students the basics of how to use Google SketchUp. From these basics they will then be able to create their own designs.

Google SketchUp Object Creation – Chair Design: Students will design a chair using Google SketchUp. The chair should be appropriately sized for an adult. They will need access to measuring devices: rulers, tape measures, or yard sticks to find out the correct sizes for a chair.

3D Solid Modeling Test: Used to evaluate the knowledge gained through this activity. This test is designed to be administered using a PowerPoint and CPS system. It can also be used as a written test.

Attachments for Assessment(s):

Google SketchUp Instructions (Includes the 4 reproductions and the Chair assignment)
3D Solid Modeling Test

LESSON PLANS

- **INTRODUCTION**

1. Identify the Standards. Standards should be posted in the classroom for each lesson.

ENGR-II-2. Students will examine the core concepts of engineering and technology.
d) Reverse engineer a consumer product

ENGR-II-4. Students will invent or innovate a technological product.
b) Design a simple invention or innovation
g) Evaluate the invention or innovation

ENGR-II-6. Students will develop leadership skills and work ethics.
a) Demonstrate work ethics within the classroom and lab environment

2. Review Essential Questions.

- What is the difference is 2D and 3D design?
- What is an extrusion?
- What are dimensions?

3. Identify and review the unit vocabulary.

2 Dimensional	3 Dimensional	Extrusion
Template	Inferring	Axis
Dimension	Arc	Component

Offset	Face	

• LESSON 1: GETTING STARTED WITH GOOGLE SKETCHUP (1 DAY)

1. Watch the following YouTube videos
   Google SketchUp - New Users 1: Concepts
   http://www.youtube.com/watch?v=xqcL-xPC-Ys&feature=channel

   Google SketchUp New Users 2: Drawing Shapes
   http://www.youtube.com/watch?v=0MXharjbIdY&feature=channel

   Google SketchUp New Users 3: Push/ Pull
   http://www.youtube.com/watch?v=fCqrvCVOxdE&feature=channel

   • Use the videos to demonstrate the basics of Google SketchUp.

• LESSON 2: OBJECT REPRODUCTION USING GOOGLE SKETCHUP (4 DAYS)

1. Assignment – **Google SketchUp Instructions**
2. Students should work in teams of 2 unless you have enough computers for everyone.
3. Students will recreate the 4 objects on the assignment. The objects should be correctly drawn and accurately dimensioned.
4. The instructor should check each reproduction before the students move on to the next object.

• LESSON 3: CREATING A FUNCTIONAL CHAIR DESIGN USING GOOGLE SKETCHUP (2 DAYS)

1. Watch the Video

   Google SketchUp New Users 4: Create a Chair
   http://www.youtube.com/watch?v=RCqr3ZJ8Igc&feature=channel

2. Create a Functional Chair for an adult. Follow the **Google SketchUp Instructions** document for creating the chair.

• LESSON 4: 3D SOLID MODELING TEST (1 DAYS)

1. Administer the **3D Solid Modeling Test** using PowerPoint and a CPS System, using the PowerPoint and an answer sheet, or convert this to a written test.

• ATTACHMENTS FOR LESSON PLANS

Google SketchUp Instructions

3D Solid Modeling Test
3D Solid Modeling Test Answer Key
3D Solid Modeling Study Guide
3D Solid Modeling Study Guide Answer Key

- **NOTES & REFLECTION:**

Google SketchUp7 is free. You can download this onto as many computers as you would like. The instructional videos are excellent. You may need to download them due to filters at your school.

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title:

Designing a Functional Chair

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Use the attached instructions.

Attachments for Culminating Performance Task:

Google SketchUp Instructions

UNIT RESOURCES

Web Resources:

http://sketchup.google.com/

Google SketchUp - New Users 1: Concepts
http://www.youtube.com/watch?v=xqcL-xPC-Ys&feature=channel

Google SketchUp New Users 2: Drawing Shapes
http://www.youtube.com/watch?v=0MXharjbIdY&feature=channel

Google SketchUp New Users 3: Push/ Pull
http://www.youtube.com/watch?v=fCqrvCVOxdE&feature=channel

Google SketchUp New Users 4: Create a Chair
http://www.youtube.com/watch?v=RCqr3ZJ8Igc&feature=channel

Materials & Equipment:

- Computers
- Measuring devices

- Projector

What 21st Century Technology was used in this unit?

x	Slide Show Software		Graphing Software		Audio File(s)
	Interactive Whiteboard		Calculator		Graphic Organizer
x	Student Response System		Desktop Publishing		Image File(s)
	Web Design Software		Blog	x	Video
	Animation Software		Wiki		Electronic Game or Puzzle Maker
	Email	x	Website		