GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING & TECHNOLOGY

PATHWAY: Engineering

COURSE: Foundations of Engineering and Technology

UNIT: STEM Mini-Golf Course

INTRODUCTION

Annotation: Briefly describe the unit topics, tasks, methods, etc.

More than just problem solving! Integration of Science, Technology, Engineering and Math to develop a mini-golf course that incorporates all six simple machines and a Rube Goldberg device into each hole of the course. Students learn how to calculate the mechanical advantage of each simple machine and how energy is transferred to keep the ball moving in the Rube Goldberg device.

Grade(s):

X	9th
X	10th
	11th
	12th

Time:

20 Hours

Author:

Susan Millican (Dade County High School)

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. 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.

FOCUS STANDARDS

GPS Focus Standards: Please list the standard and elements covered.

- ENGR-FET-4 – Students will apply mathematics and science to the solution of a technological problem.
  ENGR-FET-5 – Students will describe the essential systems and processes involved with invention, innovation, and entrepreneurship.
- ENGR-STEM-1 – Students will recognize the systems, components, and processes of a technological system.
- ENGR-STEM-3 – Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.
- ENGR-STEM-4 – Students will apply principles of science, technology, engineering, mathematics, interpersonal communication, and teamwork to the solution of technological problems.
- ENGR-STEM-5 – Students will select and demonstrate techniques, skills, tools, and understanding related to energy and power, bio-related, communication, transportation, manufacturing, and construction technologies.

GPS Academic Standards:

- MA1G1. Students will investigate properties of geometric figures in the coordinate plane.
- MA1P1. Students will solve problems (using appropriate technology).
- MA1P3. Students will communicate mathematically.
- MA1P4. Students will make connections among mathematical ideas and to other disciplines.
- MC2P2. Students will reason and evaluate mathematical arguments.
- MM3P3. Students will communicate mathematically.
- MM3P4. Students will make connections among mathematical ideas and to other disciplines.
- MM3P5. Students will represent mathematics in multiple ways.
- SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.
- SCSh3. Students will identify and investigate problems scientifically.
- SP3. Students will evaluate the forms and transformations of energy.
- SPS8. Students will determine relationships among force, mass, and motion.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings:

Students will gain an understanding of problem solving, engineering design techniques, 6 simple machines, mechanical advantage, and work ethics.

Essential Questions:

- How are simple machines used to transfer energy?

Knowledge from this Unit: Factual information.

Skills from this Unit: Performance.

ASSESSMENT(S)

Assessment Method Type: Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

____ Pre-test
____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ Unit test
X Group project
X 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
____ Subjective assessment/Informal observations
__ Essay tests
__ Observe students working with partners
__ Observe students role playing
____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
____ Dialogue and Discussion
__ Student/teacher conferences
__ 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
____ Post-test

Assessment(s) Title:

- Rube Goldberg Mini Golf
- Rube Goldberg Simple Machine Assessment
- Rube Goldberg Reading Assessment
- Mechanical Advantage Assessment

Assessment(s) Description/Directions:

See attached rubric and design brief.

Attachments for Assessment(s): Please list.

- Rube Goldberg Mini Golf Rubric – Design brief and rubric for Rube Goldberg Mini Golf
- Rube Goldberg Simple Machine Assessment
- Rube Goldberg Reading Assessment
- Mechanical Advantage Assessment
- Simple Machines PowerPoint
- Rube Goldberg Mini Golf Sequence
- NAEP Simple Machines Learning Module
- NAEP Simple Machines Teacher Guide
- NAEP Simple Machines Worksheet
- NAEP Simple Machines Newsletter

LEARNING EXPERIENCES

Sequence of Instruction

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

- ENGR-FET-4 – Students will apply mathematics and science to the solution of a technological problem.
  ENGR-FET-5 – Students will describe the essential systems and processes involved with invention, innovation, and entrepreneurship.
- ENGR-STEM-1 – Students will recognize the systems, components, and processes of a technological system.
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- MA1P1. Students will solve problems (using appropriate technology).
- MA1P3. Students will communicate mathematically.
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- SP3. Students will evaluate the forms and transformations of energy.
- SPS8. Students will determine relationships among force, mass, and motion.

2. Review Essential Questions.

- How are simple machines used to transfer energy?

3. Identify and review the unit vocabulary.

4. Assessment Activity.

- FLUBBER 1
- RUBE GOLDBURG READING – FACTS AND LIES .5
- SIMPLE MACHINES 1
- WEB SITES – IDENTIFY SIMPLE MACHINES IN RUBE GOLDBURG AND COMPLETE RUBE GOLDBURG "GAME" 1
- RUBE GOLDBURG MINI GOLF 5-7
- CALCULATE MACANICAL ADVANTAGE OF COURSE 1
- REPORT ON RUBE GOLDBURG DEVICES (HOMEWORK) 1

Attachments for Learning Experiences: Please list.

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Notes & Reflections: May include notes to the teacher, pre-requisite knowledge & skills, suggestions, etc.

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title:

Rube Goldberg Mini Golf Course

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Build one par three hole of a mini golf course that includes all six simple machines and a Rube Goldberg device.

Attachments for Culminating Performance Task: Please list.

Rube Goldberg Mini Golf Sequence

UNIT RESOURCES

Web Resources:

- Rube Goldberg Videos and Game:
  - Game: http://pbskids.org/zoom/games/goldburgertogo/game.html
  - Honda cog: http://www.ebaumsworld.com/2006/06/honda-ad.html
  - Dorm room alarm clock: http://www.break.com/index/rubegold6.html
  - Rube Goldberg web site: http://www.rgmc.com/
  - http://www.mousetrapcontraptions.com/links-10.html
  - High school videos: http://eoh.ec.uiuc.edu/corporate/movies.php
  - Rube Goldberg hints: http://www.pen.k12.va.us/Pav/Science/Physics/Contests/RUBE%20CONTEST/rube.html
  - Tea cup: http://video.google.com/videoplay?docid=-2367646121273499414
  - 4 videos: http://www.minezone.org/blog/2006/04/10/four-great-rube-goldberg-videos/
  - High school videos: http://www.anl.gov/Careers/Education/rube/rubevideos.htm
  - http://www.donpixel.com/play/en/060302124616/

Attachment(s): Supplemental files not listed in assessment, learning experiences, and performance task.

What 21st Century Technology was used in this unit:

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