GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING & TECHNOLOGY

COURSE: Engineering Applications (ET-EA)

UNIT: 3. Economic, Social, Ethical, & Environmental Impacts

INTRODUCTION

Annotation:

In this unit, students will describe how external issues constrain the engineering design process and explain strategies for balancing external issues with the design outcomes.

Grade(s):

X	9th
X	10th
X	11th
X	12th

Time:

10 hours

Author:

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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. 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-EA-2 – Students will develop and follow a detailed plan for the solution of a design problem.
- ENGR-EA-5 – Students will identify the impacts of social, economic, and environmental issues on the engineering design process.
- ENGR-STEM-1 – Students will recognize the systems, components, and processes of a technological system.
- ENGR-STEM-2 – Students will identify the impact of engineering and technology within global, economic, environmental, and societal contexts.
- 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-6 – Students will enhance reading by developing vocabulary and comprehension skills associated with text materials, problem descriptions, and laboratory activities associated with engineering and technology education.
- CTAE-FS-3 – Communications: Learners use various communication skills in expressing and interpreting information.
- CTAE-FS-6 – Systems: Learners understand a variety of organizational structures and functions.
- CTAE-FS-8 – Leadership and Teamwork: Learners apply leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.
- CTAE-FS-9 – Ethics and Legal Responsibilities: Learners commit to work ethics, behavior, and legal responsibilities in the workplace.

GPS Academic Standards:

- SCSh6. Students will communicate scientific investigations and information clearly.
- SCSh7. Students analyze how scientific knowledge is developed.
- MM3P4. Students will make connections among mathematical ideas and to other disciplines.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings:

Students will identify the impacts of social, economic, and environmental issues on the engineering design process.

Essential Questions:

- How do external issues constrain the engineering design process?
- What strategies are used for balancing external issues with design outcomes?
- How are appropriate accommodations integrated into designed solutions?

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
_X_ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
_X_ Unit test
____ 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:

Top Engineering Impacts

Assessment(s) Description/Directions:

The National Academy of Engineering produced a list of the top 20 engineering impacts of the 20th century. Have students research these advancements & create a presentation of the impacts (+ & -) these had on our society. Also have them include how society would change if these had not been invented or if they had been introduced at a different point in time.

Attachments for Assessment(s): Please list.

Top Engineering Impacts

LEARNING EXPERIENCES

Instructional planning: Include lessons, activities and other learning experiences in this section with a brief description of the activities to ensure student acquisition of the knowledge and skills addressed in the standards. Complete the sequence of instruction for each lesson/task in the unit.

Sequence of Instruction

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

- ENGR-EA-2 – Students will develop and follow a detailed plan for the solution of a design problem.
- ENGR-EA-5 – Students will identify the impacts of social, economic, and environmental issues on the engineering design process.
- ENGR-STEM-1 – Students will recognize the systems, components, and processes of a technological system.
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- CTAE-FS-8 – Leadership and Teamwork: Learners apply leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.
- CTAE-FS-9 – Ethics and Legal Responsibilities: Learners commit to work ethics, behavior, and legal responsibilities in the workplace.

- SCSh6. Students will communicate scientific investigations and information clearly.
- SCSh7. Students analyze how scientific knowledge is developed.
- MM3P4. Students will make connections among mathematical ideas and to other disciplines.

2. Review Essential Questions.

- How do external issues constrain the engineering design process?
- What strategies are used for balancing external issues with design outcomes?
- How are appropriate accommodations integrated into designed solutions?

3. Identify and review the unit vocabulary.

4. Assessment Activity.

Day 1

Have students brainstorm ideas of impacts brought about by engineering advancements and facilitate a class discussion on positive & negative impacts of engineering.

- What are ethics?
- How are engineers responsible for maintaining high standards of ethics in their profession?
- How can non-ethical concerns including personal preference, social or political values etc. have an impact on an engineer's ethics?

Some general ethics may include honesty, dealing fairly with other people, obeying the relevant laws, etc. Some principles are specific to engineering. Introduce the Code of Ethics *(see handout)*.

Day 2

Show Ethics in Engineering slideshow. Facilitate a class discussion on the engineer's obligation to society, specific to economic, social, ethical & environmental impacts. Divide into groups & assign scenarios to each group. Have them use the code of ethics to answer the scenario questions.

Day 3

Complete scenarios & present information to class

Day 4 – What Does It Mean To Build Green?

Most of us know a little about this concept, but do you understand the ramifications completely? Begin investigating the issue by visiting several of these websites. Form your own opinions and then report to the class how this could have an impact on the environment.

1) Building Green http://www.buildinggreen.com/index.cfm
2) GreenBuilder http://www.greenbuilder.com/
3) Green Building Basics http://www.energybuilder.com/greenhome-basics.htm
4) Green Building Resource Guide http://www.greenguide.com/
5) Green Home Building http://www.greenhomebuilding.com/
6) Natural Building Colloquium
http://www.networkearth.org/naturalbuilding/colloquium.html
7) Natural Building, Environmental, and Related Web Pages
http://www.deatech.com/natural/
8) Natural Building Materials http://www.naturalbuilder.com/materials.html
9) U.S. Green Building Council http://www.usgbc.org/
10) Your Home Planet http://www.yourhomeplanet.com/
11) Siting A Natural Building by M.G. Smith
http://oikos.com/library/naturalbuilding/building_site.html

Day 5

Discussion of Top Engineering Impacts of the 20th Century *(see handout)*. Assign students (individual or groups of 2) an innovation to research. You may set criteria for slideshow presentation.

Day 6-7

Students research & work on presentations

Day 8

Students complete presentations

Day 9-10

Presentations

Attachments for Learning Experiences: Please list.

- ASCE Code of Ethics
- ASTM Standards for Site Assessment

- ASTM Transaction Screening Guide
- Bhopal Case Study Assessment
- Bhopal Toxic Disaster
- CATT Environmental Lesson and Activities
- Engineering Code of Ethics PowerPoint
- Environmental Site Assessment Quality Assurance Review
- Ethics Case Study 1-4
- KWL Chart Assessment
- KWL Chart
- NAEP Environment Newsletter PDF
- NAEP Environment Teacher Guide PDF
- NAEP Environment Worksheet PDF
- NAEP Environmental Engineering Learning Module
- Photographs of Commercial Buildings
- Prompt
- Top Engineering Impacts

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

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title:

Code of Ethics Scenarios

Culminating Unit Performance Task Description/Directions/Differentiated

Begin with a discussion of ethics in general. Introduce (review) the American Society of Civil Engineering Code of Ethics & show Ethics in Engineering PowerPoint. Divide students into groups to evaluate the different scenarios.

Attachments for Culminating Performance Task

- Engineering Code of Ethics
- ASCE Code of Ethics
- Ethics Case Study One

- Ethics Case Study Two
- Ethics Case Study Three
- Ethics Case Study Four

UNIT RESOURCES

Web Resources:

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

Materials & Equipment:

What 21st Century Technology was used in this unit:

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