GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING &

COURSE: Engineering Applications (ET-EA)

UNIT: 2. Project Management

INTRODUCTION

Annotation:

In this unit students will develop and follow a detailed plan for the solution of a design problem. They will produce flow charts and timelines. They will apply calculations to complete a predictive analysis and they will assess the effectiveness of their design plans. The focus should be on collaborative groups and teamwork.

Grade(s):

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

Time:

17 hours

Author:

Jennifer Gillespie

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-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.
- 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:

- SCSh3. Students will identify and investigate problems scientifically.
- SCSh4. Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.
- SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and develop reasonable scientific explanations.
- SCSh6. Students will communicate scientific investigations and information clearly.
- MM3P1. Students will solve problems (using appropriate technology).
- MM3P2. Students will reason and evaluate mathematical arguments.
- MM3P4. Students will make connections among mathematical ideas and to other disciplines.
- MM4P5. Students will represent mathematics in multiple ways.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings: Enduring understandings are statements summarizing important ideas and have lasting value beyond the classroom. They synthesize what students should understand – not just know.

Students will develop and follow a detailed plan for the solution of a design problem.

Essential Questions: Essential questions probe for deeper meaning and understanding while fostering the development of critical thinking and problem-solving skills. Example: Why is life-long learning important in the modern workplace?

- How are flow charts, timelines, and other scheduling tools used?
- Why are mathematical models and calculations necessary to complete predictive analysis?
- How are design plans modified to accommodate unforeseen constraints?
- How is the effectiveness of a design plan assessed?

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:

Engineering Notebook

Assessment(s) Description/Directions:

Students will provide an engineering notebook documenting every step of their design problem.

Special emphasis should be placed on their Project Management charts and timelines.

Attachments for Assessment(s): Please list.

- Engineering Design Notebook PowerPoint for review
- Project Management PowerPoint

- Basic Criteria Analysis
- CATT Team Sheet

LEARNING EXPERIENCES

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-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.
- 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.
- SCSh3. Students will identify and investigate problems scientifically.
- SCSh4. Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.
- SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and develop reasonable scientific explanations.
- SCSh6. Students will communicate scientific investigations and information clearly.
- MM3P1. Students will solve problems (using appropriate technology).
- MM3P2. Students will reason and evaluate mathematical arguments.
- MM3P4. Students will make connections among mathematical ideas and to other disciplines.
- MM4P5. Students will represent mathematics in multiple ways.

2. Review Essential Questions.

- How are flow charts, timelines, and other scheduling tools used?
- Why are mathematical models and calculations necessary to complete predictive analysis?
- How are design plans modified to accommodate unforeseen constraints?
- How is the effectiveness of a design plan assessed?

3. Identify and review the unit vocabulary.

4. Assessment Activity.

- **Day 1 & 2**
  - Begin this lesson with the PowerPoint on Project Management (PM). Stop before the teamwork roles. Choose a teamwork activity from the following site. http://wilderdom.com/games/InitiativeGames.html Once complete, have students reflect on the different roles that were needed within the group to achieve success. Continue the PM PowerPoint on teams & decision-making.
- **Day 3-5**
  - Complete the PM PowerPoint by discussing timelines & flowcharts. There is a link in the PPT to an Excel tutorial on how to produce a Gantt chart. If your school blocks YouTube, there is a link at the beginning of this unit to the same video on a different site. Have students practice with Excel producing charts & the basic predictive analysis chart. You may want to provide sample numbers for them to plug in.
- **Day 6-7**
  - The timeline may differ depending on what design problem you will give to your students. One suggesting is Tetrahedral Kites. There is a simple project at the following site. Materials are CHEAP! http://teachengineering.org/view_activity.php?url=http://www.teachengineering.com/collection/wpi_/activities/wpi_building_tetrahedral_kites/tetrahedral_kites.xml
  - You could have each students build a kite using the directions given at the above link. Once done, have them evaluate the steps & how these (or something similar) could be mass produced. Students could research different types of kites & materials, create a production timeline & produce these as a class fundraiser. Groups would plan all of the steps, but they would have access to the entire class as their "workforce."
  - Another idea is a Rube Goldberg Device. There are ideas every year in the TSA Competitive Events guide. Each group could have the same criteria & must produce an Engineering Notebook on their design.

- If it is a broad idea project (think “green” golf course development) students would only be creating the project management layout after researching materials and projected timelines. The planning would be in theory only.

- **Day 8**
  - Groups would present preliminary plan to instructor (or entire class). Depending on project and availability of resources, classes could vote on one solution to mass-produce.
- **Day 9-17**
  - Groups are working on design problem solution. There should be working drawings, flow charts, timelines, etc. in their engineering notebooks.
- **Day 18**
  - Project Design must be complete.
- **Day 19-20**
  - Students would present their final solution, cost analysis, and marketing plan for their product.

Attachments for Learning Experiences: Please list.

- CATT Team Sheet PDF
- Basic Criteria Analysis Excel Spreadsheet
- Engineering Design Notebook PowerPoint
- Project Management PowerPoint

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

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title:

Develop a detailed plan for the solution of a design problem

Culminating Unit Performance Task Description/Directions/Differentiated

Students will create a design plan for a specific problem. It is up to the instructor whether the student teams are working towards the same solution or on different design problems.

Attachments for Culminating Performance Task

UNIT RESOURCES

Web Resources:

- Kites http://teachengineering.org/view_activity.php?url=http://www.teachengineering.com/collection/wpi_/activities/wpi_building_tetrahedral_kites/tetrahedral_kites.xml
- www.ganttchart.com (what is the history of the Gantt chart?)
- http://www.guidesandtutorials.com/excel-2003-making-a-gantt-chart.html (Making a Gantt Chart in Excel video tutorial)
- Microsoft Office Online has project management templates available for free download
- Read the publication "PMBOK: Project Management Body of Knowledge: at www.pmi.org, the website of the Project Management Institute
- Teamwork Activities http://wilderdom.com/games/InitiativeGames.html

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		