GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

FOUNDATION SKILLS

PATHWAY: All Pathways

COURSE: All CTAE Courses

UNIT 4.5: Science Fair Projects

INTRODUCTION

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

In this unit students will learn the steps to the scientific method and how to develop a science fair project specific to their career pathway.

Grade(s):

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

Time: Five 50 minute periods.

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Additional Author(s):

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.

CTAE-FS-4 Problem Solving and Critical Thinking: Learners define and solve problems, and use problem-solving and improvement methods and tools.

National / Local Standards / Industry / ISTE:

ESS01.04: Demonstrate science knowledge and skills required to pursue the full range of post-secondary and career education opportunities.

ESS03 Problem-Solving and Critical Thinking: Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.

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 learn the steps to the scientific method and why it's important to use when solving a scientific 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?

- Why is the use of the scientific method important?
- What is important to include in research writing?
- What is the difference between good and bad research projects?

Knowledge from this Unit: Factual information.

- Students will list the steps of the scientific method.
- Students will explain what is included in research paper.
- Students will list possible experiments for a chosen career pathway

Skills from this Unit: Performance.

Students will use the scientific method to perform a laboratory experiment.

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
_____ 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
_____ 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
_X___ Dialogue and Discussion
_X_ Student/teacher conferences
__ Partner and small group discussions
_X_ 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: Choosing a Science Fair Project Topic

Assessment(s) Description/Directions:

Picking a science fair project that is interesting for the student and relevant in their career pathway can be a challenge. Ask the students to brainstorm possible science fair topics. List the topics on the writing surface for discussion.

Here are some ideas to help the students get started.

- Which gears give the most mechanical advantage?
- Does house color effect energy usage?

- How is root grow affected by the direction of gravity changes?
- The affect of light color on growth rate of plants.
- Can pulse rate measure emotion?
- Comparing the speed of human reaction time.
- Does gender affect color preference?
- Which car design has the least amount of drag?
- Does the amount of water in concrete affect its strength?
- The effects of antibiotics on bacterial growth.
- How do pesticides affect cockroaches?

Allow students to use Internet search engines to further develop their topics.

Attachments for Assessment(s): Please list.

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.

CTAE-FS-4 Problem Solving and Critical Thinking: Learners define and solve problems, and use problem-solving and improvement methods and tools.

2. Review Essential Questions.

- Why is the use of the scientific method important?
- What is important to include in research writing?
- What is the difference between good and bad research projects?

3. Identify and review the unit vocabulary.

Hypothesis

Experiment

Control group

Independent variable

Dependent variable

Treatment group

Abstract

Logbook

4. Lesson

One way to explore the many opportunities in science is to develop a science fair project. Here are detailed steps in how to develop a science fair project for your career pathway.

- Select a topic— the first step in developing an science fair project is to select a topic. The student should choose a topic of personal interest that would be useful and meaningful in the field of study.
- Conduct a literature review—the next step is to do a literature review to determine what is known on the subject. Information can be found in magazine articles and research journals or on reliable Internet sites. Information can also be from someone in the community who specializes in the subject.
- Design the experiment—designing the experiment is the next step in developing an science fair project. Supplies and equipment needed for the project should be listed. A problem can be broken down into

several parts and may be researched over a period of years. So it is possible for the experiment to have many phases.

- Form a hypothesis—a *hypothesis* is an educated guess about the outcome of the experiment. The hypothesis does not have to be correct or accepted in the science fair project. The main purpose is to show that the procedures of the scientific method were followed and that the experiment was conducted in a scientific manner.
- Conduct the experiment—once a hypothesis is formed, the student is ready to conduct the experiment. An *experiment* is a planned procedure to test the hypothesis. The procedure must include a control group, an independent variable, a dependent variable, and a treatment group.
  1. The *control group* is a group of animals, plants, etc., that do not receive the treatment under study.
  2. The *independent variable* is the manipulated treatment, such as temperature, light, or time.
  3. The *dependent variable*s are the changes observed from the response to the independent variable.
  4. The *treatment group* is the group experimented with.
- Record all data—the next step is to collect data from the experiment. The data need to be analyzed so conclusions can be formed.
- Prepare written report and display—The final step is to prepare the report and the display. The report should include the introduction, abstract, results, materials, and methods. An *abstract* is a summary or condensed version of what was done for the experiment and highlights the major points covered. One of the most important parts of an science project report is the logbook. The *logbook* contains all the details of the experiment from start to end, with dates and details. The logbook should be started with the first activity of the project and maintained throughout the project. Alert the student that judges will be able to tell if the logbook was done in full right before the science fair.
- The display needs to include photographs, charts/graphs, and the results/conclusions from the experiment. The display needs to draw people in and show all main points. It should get attention and be creative to tell a quick story of the experiment.

A logbook can be handwritten, but it should be neat and legible.

5. Assessment Activity

6. Performance Task

Attachments for Learning Experiences: Please list.

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

This is a generic lesson on science fair projects. Search for any additional information on ideas for science fair projects on the internet that may pertain to the specific career pathway.

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title: Planning an Science Fair Project

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Purpose:
To plan a science fair project by identifying a problem and outlining an experimental procedure to solve the problem.

Procedure

1. Select a topic You may identify problems in your community, in your home, or in your career pathway that needs investigation. You can get good ideas by reviewing what others have done in previous science fair projects.	Title:
2. Conduct a literature review. Make sure all literature you cite comes from reputable sources. Include title, author, page number, publisher, copyright date, and/or a Web address.	References:
3. Describe the problem. Briefly describe a problem you have identified and are interested in solving.	Problem:

4. List the supplies and equipment needed for your experiment.	Supplies and equipment:
5. State the hypothesis. Remember that a hypothesis is an educated guess about the outcome of an experiment.	Hypothesis:
6. List the procedures you will use to test your hypothesis.	Procedures:

7. Briefly describe any special procedures, problems, etc., that you have identified or that you think you might encounter. List any special circumstances.	Notes:

Attachments for Culminating Performance Task: Please list.

Rubric

Grading Criteria	Superior 5	Excellent 4	Good 3	Fair 2	Poor 1
Hypothesis					
Quality of Information					
Grammar & Spelling					
Interest Level					
Procedures					
References					

Superior – Meets all requirements; exhaustive coverage; completely understands problem and ability to apply solution; shows originality; few grammatical errors.

Excellent – Meets all requirements of task; well defined and documented; excellent understanding and ability to apply solution; shows evidence of creativity; few errors.

Good – Meets requirements; fairly well planned and documented; shows an understanding and ability to apply data to the solution of new problems; could show more evidence of creativity and more details; few grammatical/mechanical errors.

Fair – Uneven work; meets some requirements; poor coverage; little understanding and ability to apply data to problem solving; needs to improve in significant areas; many grammatical/mechanical errors.

Poor – Meets few if any requirements; little understanding and little application of solution; grammatical/mechanical errors significant.

UNIT RESOURCES

Web Resources:

Search engines

Attachment(s):

Materials & Equipment:

What 21st Century Technology was used in this unit:

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