



*Drexel-SDP GK-12 ACTIVITY*

## Science Fair Activity

**Subject Area(s)** Science and Technology  
**Associated Unit** Science Fair Project  
**Associated Lesson** "Lesson: Scientific Method"  
**Activity Title** Science Fair Activity

**Header**

**Grade Level** 6 (5-7)

**Grade Level** 6 (5-7)

**Activity Dependency** None

**Time Required** 45 min per week for 5 weeks

**Group Size** 3

**Expendable Cost per Group** \$0 - \$2



### Image 1

**ADA Description:** Picture shows a Pasco handheld data collection device

**Caption:** Pasco handheld data collection device

**Image file name:** xplorer.jpg

**Source/Rights:** Copyright ©<http://probesight.concord.org>

## Summary

In this ongoing activity, students will be introduced to the scientific (inquiry) process and assigned a project group as well as a scientific question to ask and investigate. This activity requires some extra curricular supervision, as the students are taken out of the classroom in their small project groups to get some personalized teaching time on topics relevant to their project, and extra supervision when conducting their experiment. Some of the activity, such as explaining the scientific process, can be conducted in lecture format to the entire class.

## Engineering Connection

Engineers and scientists perform very complementary work. Engineers often design the tools that enable scientists to do their job faster, and with more accuracy. Scientists explore the fundamental building blocks of our world in order to give engineers the understanding they need to apply these findings to make life easier and more efficient for people. Very often engineers follow a “test-and-revise” process to design tools that is very similar to the scientific process that scientists apply to understand the world around us.

## Keywords

Experiment, hypothesis, inquiry, presentation, scientific process, science project

## Educational Standards

- Science: Inquiry and Design 3.2: Process Knowledge (3.2.B) and Scientific Method (3.2.C)
- Math: Measurement and Estimation 2.3, Statistics and Data Analysis 2.6

## Pre-Requisite Knowledge

Averages and interpreting numerical data. Some prior experience in note-taking is preferred.

## Learning Objectives

After this activity, students should be able to:

- **Ask a scientific question**
- **Formulate an hypothesis**
- **Acquire scientific vocabulary relevant to a topic**
- **Use a portable electronic device to collect data (the Pasco Xplorer)**

## Materials List

Each group needs:

- Time-share of the Pasco Xplorer data collector and any attachable sensors pertaining to their topic
- Any materials necessary for the completion of the experiment

## Introduction / Motivation

This activity is intended to have you apply the scientific inquiry method and to practice asking a question that you intend to answer yourself through experimentation. It may be that neither the teacher nor any other adult knows the answer to the research question, so that you will have the experience of teaching others.

(In addition gaining familiarity with the scientific research process, there is an additional objective to have the students develop patience with their studies. Very often, students are given short assignments that take an hour or less to complete. With a science fair project, the timeline is stretched over weeks or even months. In addition, students will become familiar with keeping a scientific notebook to record and analyze experimental data.)

(A Pasco Xplorer hand-held digital data collection device is used in conjunction with an array of sensors for the purpose of gathering and recording data. The Xplorer allows the students to become familiar with the types of equipment engineers design for scientists to use in their investigative work. In addition, the Xplorer allows children to practice using portable technology to collect, graph and analyze experimental data.)

(Lastly, learning to prepare and deliver an oral presentation is an important component of this activity. The students will be expected to give a short talk that discusses how their group followed the scientific process in relation to their particular topic. Students should prepare visual aids, such as posted board and graphs, and discuss what they learned in investigating their topic. Students should also follow the conventions of introducing themselves, their group members, and inviting questions from their audience.)

## Vocabulary / Definitions

Word	Definition
Scientific Inquiry	The process by which scientists ask questions, develop and carry out investigations, make predictions, gather evidence, and propose explanations.
Research Question	The main question a scientific investigation aims to answer
Hypothesis	An educated guess for the outcome of the research question
Experiment	A procedure designed to test the hypothesis
Analysis	Evaluating and drawing conclusions based upon data collected
Quantitative Data	Numeric information that is measured.
Pasco Xplorer	Electronic handheld data collection device.

## Procedure

### Background

It is recommended that the instructor first prepare a list of topics from which the children can choose. The list of topics may tie in to other lecture-based coursework being carried out simultaneously with the science fair projects as a way to augment the course material for those subjects. For example, if studying a typical 6<sup>th</sup> grade curriculum of landforms, sample science fair topics may include testing water sample for pH levels, studying erosion patterns with and

without plant matter, etc. The list of topics is also recommended to ease the transition into self-guided studies to students who might otherwise need some help deciding on a suitable topic. The list of topics should require little to no extra materials to be purchased, and each topic should utilize the Pasco Xplorer in some way.

Groups of three students per science fair project also work well. Three people can compensate when one member is absent, and more than three people often leads to inactive group members. It is recommended the instructor assign the groupings so that children learn to work in groups, and cooperate with members not of their choosing. Assigned groups generally reduce the amount of off-topic conversation among the members.

### **Before the Activity**

Define the vocabulary words, then ask the students to copy the steps for the scientific inquiry process in their notebook as the instructor discusses each step. Ask the students to maintain a dedicated 'science fair notebook' that will contain all their lecture notes and the data related to their particular topic.

Schedule time to work with individual groups on their topic. If this is not possible, then schedule group time as a class, and have the teacher and possibly one assistant on hand to answer questions as the groups work.

Inform the students of all the assessment points for the project. For example, an instructor may evaluate students on the comprehensiveness of their notes, the quality of a written research report, the ability to work within an assigned group, the completion of the experiment, and the clarity of their oral presentation. Discuss with the students how many points or what percent of the grade will be assigned to each item.

Prior to assigning the topics, or having the groups choose, present the notes below on the scientific inquiry process, and give a demonstration of how to use the Pasco Xplorer data collection equipment. Take time to become familiar with the Pasco Xplorer and its capabilities. With basic computer proficiency and knowledge of scientific units, it should not take very long to become familiar with the device.

Next, prepare the list of topics and assign the groupings. A sample list of topics that use the Xplorer can be found here: <http://www.pasco.com/labdownload>. Generate a list of vocabulary words relevant to each group's topic to get the students started on the practice of conducting research. Students who are not as proficient with conducting research will at least have a list of definitions for scientific terms related to their topic.

### **With the Students**

First, give an overview of the project and overarching objectives (practice asking a research question, perform the steps of the scientific inquiry process, learn to work in assigned groups, learn to keep a research notebook, learn to use electronic data collection equipment, and practice making an oral presentation).

Next present the steps to the scientific inquiry process. Cite each step along with an example from a science fair experiment. For example, use the Pasco Xplorer and the heart-rate sensor to test “Who has the faster heart rate in the 6<sup>th</sup> grade? Boys or girls?” Go through each step in the process below as it relates to the sample topic:

1. Define the problem. (We wish to study the human heart rate.)
2. Formulate a research question. (Who has the faster heart rate: boys or girls?)
3. State the hypothesis (We think girls have the faster heart rate because....)
4. Design an experiment. (We will use the Xplorer to measure the heart rates of three boys and three girls in the classroom and average the heart rate of each group to compare them.)
5. Collect data. (Make a table of the resting heart rates for the three girls and three boys and record the data on the blackboard)
6. Analyze data and draw conclusions (Review how to compute an average, then take the averages for the boys’ and girls’ heart rates. Conclude which is faster, and offer possible explanations why, such as, the boys were more/less excited to participate in the demonstration, or two of the girls had just ingested some sugar, etc.).
7. Present the results (Demonstrate how to give a quick presentation of the results).

Next, assign the topic and the vocabulary words to the students. Discuss that the vocabulary words are necessary to “talk like a scientist.” Consider giving a writing assignment where students are instructed to use the vocabulary words in context to practice using them. Require that the students record the vocabulary definitions in their notebook, and that each student in the group has a copy of the definitions.

Over the course of a few weeks, depending upon the complexity of the project and the amount of classroom assistance from volunteers and student teachers, work with the groups individually to ensure that all are working toward the goal of completing the experiment. The data analysis can take place as a classroom, particularly if several projects require averages, plotting, etc.

Lastly, discuss with the students as a group the basic process to prepare and give an oral presentation. Here is an example:

- 1) Introduce the group members
- 2) In one sentence, discuss the topic that the group studied
- 3) Discuss the scientific inquiry process as it relates to the group project, e.g. what was the research question, what was the hypothesis? Use each step in the scientific process as a “talking point.”
- 4) Include graphs, pictures and data tables
- 5) Draw conclusions and give possible explanations for the findings
- 6) Ask for questions

### **Safety Issues**

- Be aware of cables and cords to the equipment at all times.
- If working with chemicals, be aware of safe-handling procedures and review with the students. Work in a well-ventilated room

- If working with electronics, be sure the students are adequately supervised by a trained professional
- If working with human subjects, be sure to get consent forms from participants or their guardians

### **Troubleshooting Tips**

If the Xplorer does not power on, check the batteries (take AA).

### **Investigating Questions**

What kinds of toys and entertainment do computer programmers have a role in? What would our life be like without computer programming and computer scientists? For how many years has the computer been available for everyday household use? What did the first computers look like?

### **Assessment**

#### **Pre-Activity Assessment**

None

#### **Activity Embedded Assessment**

Ask to see the students' notebooks for completeness and require a short status report as an oral presentation.

#### **Post-Activity Assessment**

Evaluate the students on your own grading scale for the following:

- Notebook completeness (vocabulary, experimental data, other notes as necessary)
- Completion of experiment
- Teamwork
- Quality of written report
- Clarity of oral presentation

### **Activity Extensions**

Challenge accelerated students with a project extension that also utilizes the Pasco Xplorer for data collection. Give the students a topic and ask them to generate a list of scientific inquiry questions related to that topic. Ask the students to prepare their presentation using PowerPoint or other similar presentation software.

### **URL**

Website for the Pasco Xplorer:  
<http://www.pasco.com/labdownload>

### **Owner**

Drexel University GK-12 Program

### **Contributors**

Dara Kusic

**Copyright**

Copyright 2007 Drexel University GK12 Program. Reproduction permission is granted for non-profit educational use

**Version: Mar 2007**