THE INQUIRY WHEEL

AT A GLANCE

What is the relationship between independent and dependent variables? The Inquiry Wheel helps students clarify these two terms.

OBJECTIVES

Students will:

- Distinguish independent and dependent variables
- List possible independent and dependent variables for an investigation
- Formulate scientific questions for investigation
- Learn how to complete an investigation using scientific inquiry

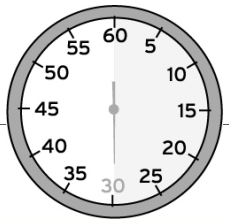
KEY VOCABULARY
Independent variable, dependent variable

SUGGESTED GRADE LEVELS: 4—8

ILLINOIS STATE LEARNING GOALS

Late Elementary
10: A, B; 11:A
Middle/Junior High
10: A, B; 11:A

PACE YOURSELF
30 MINUTES



ADVANCE PREPARATION

1. Photocopy the Inquiry Wheel handouts.
2. Select a simple lesson with many testable variables.

MATERIALS

Per Class:
One experiment or scientific phenomenon

Per Group:

One sheet of blank or lined paper
One pair of scissors

Per Student:

One copy of the Inquiry Wheel handout
One brass fastener

WHAT YOU NEED TO KNOW

1. According to the National Science Education Standards, all children should have the ability to do scientific inquiry by fourth grade. The Exploratorium Institute for Inquiry defines inquiry as an "approach to learning that involves a process of exploring the natural or material world that leads to asking questions and making discoveries in the search for new understandings." Teachers hesitate to use inquiry for fear that their students' questions will not be related to required curriculum. The Wheel of Inquiry is a tool that guides the development of student driven questions, organizing **independent** and **dependent variables**. Independent variables are the factors we can change and dependent variables are the factors we can count, measure or observe that are affected by the independent variables.

WARM UP

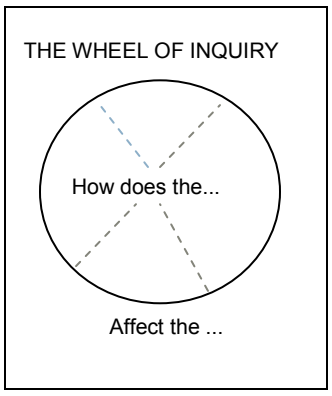
Explore the concepts of dependent and independent variables. Tell a story about a student named Joe who had been doing poorly in math, and decided to improve his grade. Joe started studying more, doing all his homework on time, and paying attention in class. Joe also changed his home routine: he ate healthier food, got 8 hours of sleep a night, and began exercising. Joe got an A in his next math test, and was so excited! Now ask students: what did Joe do to improve his math grade? What variable was most important in his success? Was it his extra studying or his increased exercise?

Guide students to the idea that there is no way of knowing which factors affected the outcome most, because they were all happening at the same time. In order to determine exactly which factor was most influential, each variable (the studying, the sleep, the exercise, etc.) would have to be tested by itself.

ACTIVITY

The Inquiry Wheel is divided into sections allowing students to develop questions to be investigated and responses to test or observe. You may divide the wheel as needed depending on the number of variables and students' abilities.

1. Review the experiment you chose to make sure there are enough measurable questions (independent variables) to record on the Inquiry Wheel. Make a note of your ideas for questions for a class discussion to help students having trouble with brainstorming.
2. Demonstrate the experiment. Ask students to describe what is happening by asking open ended questions such as, "What do you notice?," "Tell me what is happening?," and "What do you see?" Encourage a variety of answers.
3. Review definitions of independent and dependent variables. As a class, brainstorm these variables on the board, making two lists - the factors we can change (independent variables) and the factors we can count, measure or observe (dependent variables).
4. Direct students to fill in their Inquiry Wheel using the list on the board as a guide. The independent variables are written inside the circle "How does the _____ affect …" The dependent variables are written around the circle "Affect the... _____?" Point out to that by turning the Inquiry Wheel, you can create multiple combinations of variables to investigate.
5. Instruct students to write their names on the back of their Inquiry Wheel to save for future reference.



CHECK IN

Have students write their own definitions of independent and dependant variables on the back of their Inquiry Wheel.

DIFFERENTIATED INSTRUCTION

Have students create tables and graphic organizers to help them separate dependent variables from independent variables. Have students write sentences that link independent variables, like "the amount of sunlight a plant receives (independent) affects how much a plant grows (dependent.)"

EXTENSIONS

LANGUAGE ARTS

Think about the word inquiry, and related words like inquire and inquisition. What do those words make you think of? Do they remind you of anything? Research the etymology (the study of what words mean) of the word inquiry, and write a short essay explaining its meaning.

MATH

Select an experiment and create a flow chart organizing independent variables and the possible dependent variables that may be affected.