

Read in conjunction with *Conducting a fair test investigation*.

## Introduction

Scientific inquiry and investigation are focused on and driven by questions. Some questions lend themselves to scientific investigation, while others do not. Students often experience difficulty in developing questions for investigation.

This document explains the structure of questions and how they are related to variables in a scientific investigation. It describes an approach to developing questions for a fair test investigation and provides a guide for constructing investigable questions with your students.

Developing their own questions for investigation is an important skill in becoming a scientifically literate person, and gives students ownership of their investigation.

## The structure of questions for investigation

The way that a question is posed in a scientific investigation affects the type of investigation that is carried out and the way information is collected. Examples of different types of questions for investigation include:

- How does/do ...?
- What effect does ...?
- Which type of ...?
- What happens to ...?

Many science investigations involve variables. Variables are things that can be changed (independent variables), measured (dependent variables) or kept the same (controlled variables) in an investigation.

- The *independent* variable is the thing that is changed during the investigation.
- The *dependent* variable is the thing that is affected by the independent variable, and is measured or observed.
- *Controlled* variables are all the other things in an investigation that could change but are kept the same to make it a fair test.

An example of the way students can structure questions for investigation is:

What happens to \_\_\_\_\_ when we change \_\_\_\_\_?  
*dependent variable (M)* *independent variable (C)*

For example, if students were exploring electricity, they might investigate the things (variables) that affect the brightness of a bulb might consider the number of bulbs and the length of the wires. The question for investigation could be:

## **Q1: What happens to the brightness of a bulb when we change the number of bulbs in a circuit?**

In this question, the brightness of a bulb depends on the number of bulbs. The number of bulbs is the thing that is changed (independent variable) and the brightness of the bulb is the thing that is measured or observed (dependent variable).

## **Q2: What happens to the brightness of a bulb in a circuit when we change the number of wires?**

In this question, the brightness of a bulb depends on the number of wires. The number of wires is the thing that is changed (independent variable) and the brightness of a bulb is the thing that is measured or observed (dependent variable).

## **Developing questions for investigation**

The process of developing questions for investigation is to:

- Provide a context and reason for investigating.
- Pose a general focus question in the form of:  
'What things might affect \_\_\_\_\_ (dependent variable)?'

For example, 'What things might affect an electrical circuit?'

- Use questioning to elicit the things (independent variables) students think might affect the dependent variable, for example, the brightness of a bulb.

By using questions, elicit the things that students can investigate, such as the number of batteries, the length of the wires, the number of wires. These are the things that could be changed (independent variables), which students predict will affect the thing that is measured or observed (dependent variable). List variables in a scaffold such as a Variables Grid (image below), agree on a variable to be changed (independent variable), and have students commit to keeping all other variables the same.

- Each of the independent variables can be developed into a question for investigation. Use the question scaffold 'What happens to \_\_\_\_\_ when we change \_\_\_\_\_?' to help students develop specific questions for their investigation.

For example, 'What happens to the brightness of a bulb when we change the number of bulbs?' or 'What happens to the amount of energy generated by a fruit battery when we change the type of plant material used?'

- Ask students to review their question for investigation after they have conducted their investigation and collected and analysed their information.

Encouraging students to review their question will help them to understand the relationship between what was changed and what was measured in their investigation. It also helps students to see how data and information they collected relates to their prediction.

