

## **Knowledge-based Learning Outcomes**

Upon completion of *Understanding Experimental Design*, students should be able to:

1. Describe why systematic variation (varying only a single variable between treatments) is important for inferring causality.
2. Explain why replication is important for reducing uncertainty and increasing the scope of inference.

Given an experiment, students should be able to:

3. Identify the independent and dependent variable(s).
4. Identify the control and experimental treatments.
5. Identify potentially confounding variables that are, or should be, held constant.
6. Identify replicates and experimental units.

## **Skills-based Learning Outcomes**

Given a scenario and hypothesis, students should be able to:

1. Select appropriate independent and dependent variable(s).
2. Choose appropriate systematic variation, with appropriate independent variable(s) and control and experimental groups, while holding constant potentially confounding variables.
3. Choose appropriate replication.

In the design and execution of an experiment, students should be able to:

4. Record data with an appropriate dependent variable.
5. Create systematic variation, with appropriate independent variable(s) and control and experimental groups, while holding constant potentially confounding variables.
6. Create replicates of both control and experimental treatments.
7. Infer if data support or reject a hypothesis.
8. Relate the conclusion back to the relevant real-world issue.