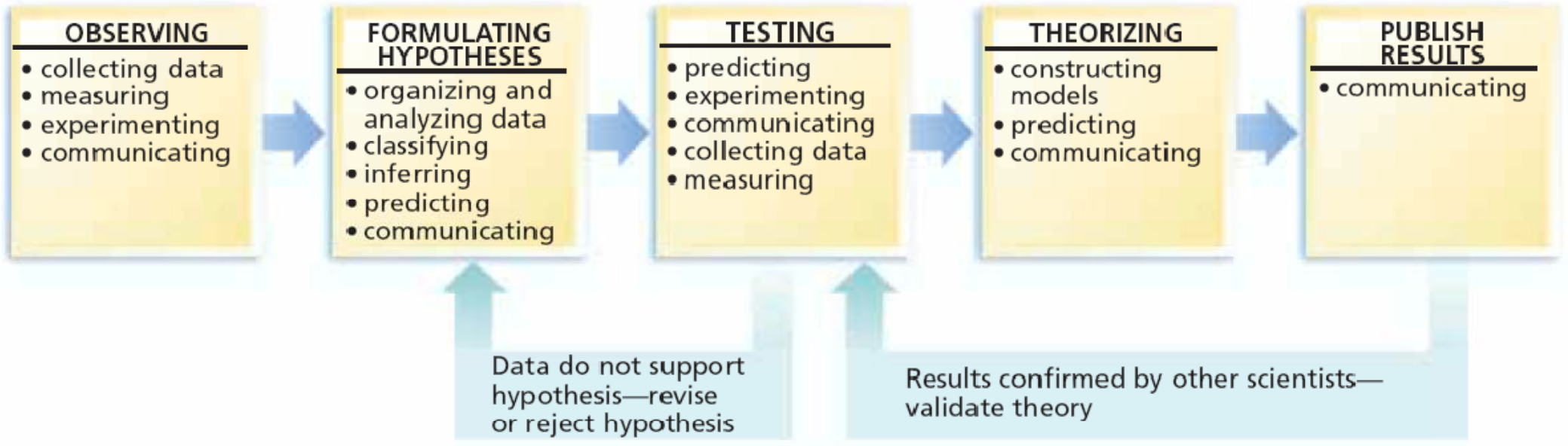
Stages in the Scientific Method



Scientific Method

Types of Data

Qualitative– Descriptive of the situation (think quality)

ex. The color of the sky is blue

Quantitative– Numerical information (think quantity)

ex. The room is 30 feet wide

System – Matter and region where the experiment takes place

This could be a beaker, a classroom, a country, etc.

Experiments use a <u>controlled</u> system

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Using the Scientific Method

Four Common Steps to the Scientific Method

1. Observing / Collecting Data / Define the Problem
2. Form Hypothesis
3. Testing Hypothesis
4. Theorizing

Observing / Collecting Data

Information needs to be collected for a problem or situation. The observer tries to find patterns.

Freddy noticed he scored higher on tests when he studied the night before

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Scientific Method Steps

Form a Hypothesis

Hypothesis – a testable "if-then" statement, developed from data that displays patterns or relationships

If Freddy studies the night before a test – then he will score higher.

Testing a Hypothesis

Involves creating experiments that prove or disprove the statement

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Testing the Hypothesis with an Experiment

Independent Variable – The variable being tested (Cause $\rightarrow$ "If" part of hypothesis)

Freddy varied his study habits

Dependent Variable – The variable being affected (Effect $\rightarrow$ "Then" part of hypothesis)

Freddy recorded the scores of his tests

Control Group – The group or study that is tested at the normal condition.

Freddy scored a 62 without studying

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Testing the Hypothesis with an Experiment

Experimental Group – The group or study that is tested with the experimental variable or condition

Freddy scored a 93 when he studied the night before

- A hypothesis that is not supported by data is revised or rejected
- When a hypothesis is supported by data, a model should be developed

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Results of Hypothesis Testing

Model – explains or predicts how the data and conditions are related.

A model can be used to help develop a theory

Freddy scored 50% higher when he studied.

Other examples of models:

- Solar system model
- DNA model
- Equations to predict values
- Atomic Model

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Theorizing

Theory - a generalization that explains facts or phenomenon that has been proven through repeated observations.

Studying improves your grades

Although theories are supported by evidence there may be opposing theories.

Sometimes a theory can be developed into a scientific law.

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Theorizing

Law - a statement of repeated observations about nature. A law is has more support than a theory and will not have opposing theories.

Laws tend to be general concepts and are not highly detailed.

The law of gravity causes objects to fall to the Earth.

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