

## Designing a research project

## Scientific Research

- Four goals of science (ordered progressively)
  - Description
  - Prediction (modeling)
  - Explanation – why it exists
  - Control – prevention

## Scientific research

- Empirically and systematically test theories and hypotheses
  - What is a theory?
    - A possible explanation about how something works, operates, or occurs
  - What is a hypothesis?
    - A tentative statement about how something works, operate, or occurs

## Order of statements in science

- Hypotheses – educated guess based on observations
  - Personal
- Theories – explanation about a set of observations
  - Plate Tectonics theory
- Laws – accepted to be true by scientific community
  - Law of gravity
  - Law of supposition

## Nature of scientific research

- Identify a topic
- Look at the issues/problems/debates surrounding the topic
- Identify a research problem, objective, question, statement, or hypothesis
  - Should be free of bias, inflammatory language, outside influence
  - Be logical

## The research project

- Must have a research problem, objective, statement, question, or hypothesis
- Located within the first 2-3 pages of a report
  - Gives the reason for the research
  - Certain fields of study or positions will favor a hypothesis or question over another form of stating the research issue.

## Research Objective

- States the purpose of the research
- Usually described in a paragraph or a very long (English) sentence:
  - The objective of this research was to discern the traffic patterns entering and leaving the stadium following the football game. Variables that were considered in the research were the number of cars, distribution of parking lots around the stadium, and the number of feeder roads into the stadium...

## Research objective

- Objectives are more descriptive than a research question
- Does not preclude the use of research questions or hypotheses
- To be given without bias towards a particular result
  - NO: We set out to prove that people have been the cause of degrading the environment at the state park.
  - YES: The cause of environment degradation at the state park was investigated. Of the variables considered, the general public was hypothesized to be the main culprit.

## Research problem

- Specifically states the issue: “The lack of parking spaces at the stadium is the current problem being researched by Facilities”.
- Problem may also be a paragraph long or several sentences
- A problem statement can be used in conjunction with research questions
  - “Can the number of parking spaces be increased?”

## Research Problem

- Should be compelling
- Clear and “stand on its own”
- Be researchable: can we investigate the issue?
- Must state why it is a actual problem
  - YES: “Parking is a problem at the stadium because the number of parking spaces can hold 25% of the vehicles that are brought to the stadium on game day.”
  - NO: “Parking is a problem because some visitors are parking on side streets.”

## Research questions

- A question or series of questions that seek to answer a problem about something
- In general, each question addresses a single issue
- As a whole, several questions may be asked in a research project.
- Questions are not biased or leading.
  - How can the species population, endangered because of man’s actions, be increased?

## Research questions

- Provides focus and specific direction to your research project
- Will probably have research questions even if they are not identified in a report
- Must be researchable
  - “How were people’s careers irrevocably harmed by the recession?”

## Research questions

- Need questions that have specific variables that are identified and can be tested
- Questions should not be broad
  - “Which is a better company: Target or Wal-mart?”
    - What is meant by “better”?
    - In what respect are they to be judged?
      - Needs variables for testing
  - “In terms of health care benefits for their full-time employees, which company offers more: Target or Wal-mart?”

## Research questions

- Questions for a project or report cannot be too narrow:
  - Narrow: “Do students like the path located between the University Library and the Life Sciences Building?”
  - Better: “What campus paths are preferred by students?”

## Research questions: practice

- “How can the parking problem be fixed?”
- Problems with question:
  - Is it broken?
  - What is meant by fixed?
  - What is the problem?
  - Whose problem? Everybody? Students? Faculty?
- Reword:

## Research hypotheses

- Hypothesis: singular
- Hypotheses: plural
- A tentative statement proposing an explanation about something
- More refined than a research problem
- Statistical hypotheses have a null and an alternative hypothesis
- Research hypotheses are statements.

## Research hypotheses

- Proposing a *relationship* between variables
  - The clarity of the water in the river is negatively related to the amount of water released by the dam operators.
- Variables are specific
  - NO: people on campus
  - YES: undergraduate students or students

## Research hypotheses

- Cause and effect hypotheses:
  - If x increases, then y increases.
  - The increase in student enrollments resulted in an increase in the size of classes on campus.
  - The decrease in the number of earthquakes that occurred in the area resulted in a relaxation in the building codes.

## Research hypotheses

- Must be testable/researchable
  - The decrease in the number of earthquakes that occurred in the area resulted in a relaxation in the building codes.
    - Is the above statement testable?
    - What are the variables?

## To do for next week:

- Complete Exercise 2: Formulate hypotheses, questions, problems, objectives
  - Use examples to guide you
- Read chapter 2: How to Conduct a Literature Search
- Look at the library's website: peruse the databases.