Introduction to Medical Education Research

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Research paradigms & process
Research questions
Research designs
Threats to internal & external validity
Defining variables
IRB approval -- is it needed?
Paradigms

- **Deductive**
  The investigator begins with a theory and collects data to test it.

- **Inductive**
  The investigator begins with observations and attempts to explain what has been observed by generalizing.
The Deductive Research Process

1. Define Research Question
2. Conduct Literature Review
   - No hole in the literature
   - Hole in literature
3. Refine Question
4. Design Study
   - Collect & Analyze Data
   - Obtain IRB Approval
Recognizing and Choosing Among Research Opportunities

- What situations or problems tend to puzzle, fascinate, challenge, or interest you?
- Consider which are:
  - Most interesting
  - Feasible
  - Fundable
  - Best overall
The Research Question

• Based on literature/theory
• Includes sample description (e.g., 4th-year medical students)
• Includes study design (e.g., relationship, difference between groups, etc.)
• Includes the independent & dependent variables
• Measurable
• State as a question or hypothesis
A FINER Research Question

- Feasible
- Interesting
- Novel
- Ethical
- Relevant
Definitions

- Independent Variable (IV)
  - A variable that is manipulated, measured, or selected to observe the relationship to some other observed variable, i.e., it is expected to influence some other variable.

- Dependent Variable (DV)
  - Observed and measured in response to an independent variable, i.e., it is expected to increase, decrease, or vary systematically as the IV changes.
More Definitions

- **Control variable**
  - any variable held constant by observing only one of its levels

- **Intervening variable**
  - hypothetical variable not observed directly but is inferred from the relationship
Example Research Question

Do first-year medical students who complete a student-run anatomy review course score higher on the anatomy final exam than students who do not complete the review course?

☐ What is the independent variable?
☐ What is the dependent variable?
☐ What are possible control variables?
☐ What is the sample?
☐ What are you testing?
Selecting an Appropriate Study Design

- Confirmatory
  - Experimental
  - Quasi-experimental
  - Correlational (non-experimental)

- Exploratory
  - Qualitative
Creating a Study Design

Population → R → Sample

Treatment

Control

Measurement

Analysis

R = randomize

OR

Measurement

Analysis
Inductive Research

What is the phenomenon? What is the context?

Use When

- Focus on meaning and context
- In-depth recording and triangulation
- Inductively derived interpretation

Methods

- Interview
- Observation
- Think aloud, stimulated recall
- Chart review
- Surveys
**Correlational Research**

How are the variables associated?

**Use When**
- Data on target variables is available
- Predictors can’t be randomized
- Subjects &/or treatments not controllable
- Control groups not available

**Methods**
- Surveys
- Chart review
- Archived data

All data is confidential
Experimental and Quasi-Experimental Research

Does the predictor **cause** the relationship?

**Use When**
- Temporal relationship
- Feasible explanatory mechanism
- No alternative explanation
- Subjects and treatments controlled

**Methods**
- Control over treatment and measurement
- Randomization
- Control Groups
Non-Experimental Designs

- Case Control
- Cross-sectional
- Time Series -- serial surveys
- Cohort (Panel)
  - Prospective
  - Retrospective
Threats to Internal Validity

- History
- Maturation
- Repeated measurement
- Statistical regression
- Selection
- Loss of Subjects/mortality
- Investigator bias
External Validity

- Is the sample representative of the population? Can the study be generalized to the population?
- Are the conditions the same? For example, laboratory setting versus natural setting.
- Did the subjects act differently because they were subjects in the study (Hawthorne Effect)?
Designing Your Study

- Determine Study Design
- Determine Major Variables
  - Independent variable(s)
  - Antecedent control variables
  - Intervening control variables
  - Dependent variable(s)
- Determine Threats to Internal Validity
Research Designs
Quasi Experimental

- One shot case study
  X ------ O

- One group Pretest-Posttest
  O------X------O

- Static Group
  X------O
  ------O
Research Designs Experimental

- Post-test only control group (Randomized)
  \[X---------O\]
  \[---------O\]

- Pre-test/Post-test Control Group (Randomized)
  \[O---------X-------O\]
  \[O-------------------O\]

- Solomon Four Group Design (Randomized)
  \[(1) O------X------O \quad (3) -----X------O\]
  \[(2) O--------------O \quad (4) --------------O\]

(O=Observation  X=Treatment)
Randomized Double Blind Cross-over Design

Washout Period

\[ O_1 \rightarrow X_T \rightarrow O_2 \rightarrow X_P \rightarrow O_3 \]

\[ O_1 \rightarrow X_P \rightarrow O_2 \rightarrow X_T \rightarrow O_3 \]

O = Observation  \quad X_T = Treatment  \quad X_P = Placebo
Do I Need IRB Approval?

- Data normally collected in your course?
- Data collected specifically for your study?
- Will the data be anonymous?
- Will you use an any identifier? Is it linked?
- Do you need an informed consent?
- Exempt Status (most educational studies)
- Expedited
- Full review
Is Your Study Research?

- Research means a systematic investigation including research, development, testing, and evaluation to develop or contribute to generalizable knowledge.
- If you might publish the results, it’s research.
References

The End

• Proceed to the Post Test
• Download the Post Test
• Complete the Post Test
• Return the Post Test to Dr. Sandra Oliver
  407I TAMU II
Post Test Question One

1. Which of the following describes an inductive reasoning:
   A. The investigator develops specific predictions from general principles
   B. The investigator begins with specific observations and moves to more general conceptualizations
You are studying the impact of clinical simulation on general surgeons’ clinical competence. The dependent variable is

A. Clinical simulation
B. Clinical competence
C. Type of surgeon
Post test question Three

3. You are using a pre test - post test design to study change in knowledge of residents who attend grand rounds versus those who do not attend grand rounds. Threats to internal validity include:

A. Selection
B. Repeated measurement
C. History
D. All of the above
Post test question Four

4. You are conducting a study of resident quality of life. You are utilizing an anonymous survey with no identifiers. Do you need a signed informed consent?
A. Yes
B. No