EDFI 642
Research in Education
Course Packet
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**Class #1**

**Seeking Answers to Questions**

Familiar sources of information:
- **Tradition**—relying on past behaviors
- **Authority**—seek out opinions of experts
- **Common sense**—logical human reasoning

Familiar sources often prove to be unsuccessful...why?

Less familiar sources of information:
- **Science**—study and theoretical explanation
- **Scientific method**—systematic discovery of facts and relationships
- **Research**—systematic investigation

Research is the: “systematic investigation of a subject aimed at uncovering new information (discovering data) and/or interpreting relations among the subject’s parts (theorizing)” (Vogt, 1993, p. 196).

**The Scientific Method**

Definition—strategy used to determine facts and relationships; then used to answer questions and resolve problems
- **Facts**—agreements made by people knowledgeable in the field
- **Relationships**—cause-and-effect associations among facts
- **Common sense**—logical human reasoning

Scientific method is a procedure for thinking and making decisions objectively

Steps involved in the process:
1. Identify a problem
2. State the main question inherent in the problem
3. State a hypothesis
4. Collect information related to the question
5. Analyze and interpret information
6. Form conclusions derived from analysis/interpretation
7. Use conclusions to verify/reject hypothesis

Steps may not be followed in precise order; dependent on specific type of research being used

**All research begins with a question!**

Good research questions are:
- **feasible**: time, money, resources
- **clear**: constructive and operational definitions
- **significant**: provides valuable information
- **ethical**: not harm anyone or thing through research

**Research questions must include:**
- variables being studied (concept: noun; represents variation of “something”)
- target population (to whom the results may be generalized)
- relationship in question (causal or mutual)
Ways of classifying variables:

- **Quantitative (continuous)**-- can range from low to high
  ex: height, IQ, test score
- **Categorical (discrete)**-- fall in one category or another
  ex: gender, ethnicity, eye color

- **Independent variable** (many)-- treatment, possible “cause”
- **Dependent variables** (1-2) - outcome, effect
- **Extraneous** variables other independent variables that may influence the outcome (dependent var.)
  - Want to control!

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<tr>
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<th>Causal</th>
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<td>Effect</td>
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<td></td>
<td>Difference</td>
<td>Associate</td>
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**Constitutive definition**—how you the researcher defines the term/variable

**Operational definition**—how you plan on measuring the variable

Research categorized by **RESEARCH QUESTION**:

**Question->Explore Causation**

**Experimental**—examines effect of a cause (IV is categorical and is manipulation) on an effect (DV is quantitative). Utilizes random selection and assignment for sampling.
  - Example—Does cultural sensitivity training improve attitude toward diversity among Elmwood students? Treatment and control groups are created through random sampling selection and assignment to groups.

**Quasi-Experimental**—examines effect of a cause (IV is categorical and is manipulation) on an effect (DV is quantitative). Typically utilizes existing groups.
  - Example— Does cultural sensitivity training improve attitude toward diversity among Elmwood students? Existing groups are used.

**Causal-Comparative**—examines influence of pre-existing condition (IV) on an outcome variable (DV); nonexperimental; quantitative
  - Example—What is the effect of bilingualism on school achievement among Elmwood students?

**Question->Explore Mutual Relationship**

**Correlational**—explores degree of relationship between two or more variables; nonexperimental; quantitative
  - Example—What is the relationship between English vocabulary proficiency and school achievement among EHS students?

**Question->Describe**

**Ethnographic (qualitative)**—explains social behavior; nonexperimental; qualitative
  - Example—What is a typical week like in the lives of five selected students attending Elmwood HS?

**Historical**—explores conditions, events of the past; nonexperimental; qualitative/quantitative/both
  - Example—What cultural, ethnic, and linguistic groups made up Elmwood schools' student population in 1955, and how successful were those groups academically?

**Survey/Questionnaire**—describes current status; nonexperimental; qualitative/quantitative/both
  - Example—What are the current attitudes toward diversity among Elmwood students?
**Question→Evaluate situation/program**

**Action**—to improve conditions in a particular setting without generalizing; experimental/nonexperimental; qualitative/quantitative/both

- Example—Can a school-wide disciplinary system be designed to improve the overall behavior of students in Elmwood ES?

**Evaluation**—conducted to make judgments about programs, etc.; experimental/nonexperimental; qualitative/quantitative/both

- Example—How effective is Elmwood’s bilingual education program in promoting scholastic achievement?

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**Variable Practice**

1. Does web-enhanced courses increase course grades in EDFI 642?
2. Does socio-economic status (low, middle, high) effect SAT scores among high school seniors?
3. What is the relationship between hours spent studying and semester GPA among college freshmen?
4. Do GRE scores predict first semester GPA among graduate students?
5. Does whole-language (treatment vs control) increase reading ability among 3rd grade students?

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**Terminology Related to Research Topics**

- **Problem**—a refined topic/issue that needs to be improved
- **Problem statement**—sentence stating the purpose of an investigation
- **Research question**—fundamental question inherent in the topic/problem
- **Subquestions**—questions of secondary importance to the research question; compliment main question
- **Hypothesis**—brief statement predicting the outcome of a study
  - **Alternative hypothesis**—states the actual prediction one has regarding the outcome of the study
    - Ex: IQ is related to ACT scores.
  - **Null hypothesis**—states that no difference exists, no relationship exists, no effect will occur...
    - Ex: IQ is NOT related to ACT scores.
  - **Directional hypothesis**—statement of expectations with direction of results specified
    - Ex: IQ is positively related to ACT scores.
  - **Non-directional hypothesis**—statement of expectations with no direction for results specified
    - Ex: IQ is related to ACT scores.
- **Theory**—overall explanation of why things exist as they do; usually the result of many studies
The province of Quebec has one of the highest school dropout rates in the world (for an industrialized country): almost 40% of adolescents drop out before completing high school. Such a problem could be attributed in great part to a lack of motivation toward school. The purpose of this study was to investigate gender differences in motivational styles among adolescents, from grade 6 to junior college.

Subjects were 538 elementary-school students (278 female and 260 male), 1519 high school students (810 female and 709 male) and 2434 junior college students (1463 female and 971 male) from the Montreal area. Elementary subjects had a mean age of 10 years; high school subjects had a mean age of 14; junior college subjects had a mean age of 18 years.

The Adolescents Academic Motivation Scale (AAMS) was administered to the subjects eight weeks after the beginning of the school and was used to measure adolescents' extrinsic and intrinsic motivation toward academic activities (primarily 'doing homework' and 'going to school'). The AAMS is composed of 28 items that are rated on a 1-7 Likert scale with 7 representing maximum appropriateness. Items address five subscales: amotivation, three types of extrinsic motivation (external, introjected, and identified regulation), and intrinsic motivation. These subscales are defined as: intrinsic motivation-being in an activity for itself and the pleasure and satisfaction derived from participation; external regulation-being in an activity because it is regulated through external means such as rewards and constraints; introjected regulation-internalizing the reasons for one's actions; identified regulation-valuing an action and perceiving that it is chosen by oneself; amotivation-not perceiving a link between outcomes and one's actions/being non-motivated. Utilizing Cronbach alpha, the reliability of subscales ranged from .89 to .94.

The findings revealed significant gender differences in motivational styles among the studied adolescents. Primarily, females reported to be more self-determined (intrinsically and extrinsically motivated) and less externally regulated and amotivated to academic activities. These results are consistent through all levels of school, from grade 6 to junior college.

1. Identify the independent variable in the bold-face sentence. Is it categorical or quantitative? Justify your answer. How is this variable measured?

2. Identify the dependent variable in the bold-face sentence. Is it categorical or quantitative? Justify your answer. How is this variable measured?

3. Restate the sentence typed in italics as an alternative hypothesis and a null hypotheses.

4. Suggest one assumption and one limitation for this study.

5. Suggest two extraneous variables that could affect the results of this study.

A perplexing issue that continues to plague American schools is the inevitable failure of children from economically poor families to acquire literacy skills at levels comparable to their middle-class counterparts. This study compared the literacy knowledge that 4-year-olds from low- and middle- socioeconomic status homes bring to preschool.

Study participants were 64 children, who were randomly selected from preliminary class lists of English speaking students enrolled at six different preschools in a mid-sized, Midwestern city. The preschools were selected because of the particular populations they served. Three Head Start preschools were identified that serve families with household incomes below the current poverty level; three tuition-based preschools were selected that serve children from middle-income homes.

During the first four weeks of school, nine informal tasks were administered to assess preschoolers’ knowledge of literacy on nine variables—recognizing environmental print, identifying literacy objects, describing the functions of literacy objects, recognizing readable print, letter names, letter sounds, blending word parts into syllables, blending word parts into phonemes, and writing dictated words. In addition, a questionnaire was administered to the parents of the 64 preschoolers. The questionnaire consisted of 65 questions and investigated the frequency and quality of the literacy experiences which parents are likely to interact with their preschoolers.

The results revealed that children from middle-class homes outperformed their counterparts on eight of the nine variables. In addition, preschoolers from low-income homes had fewer and less enriching literacy experiences in the home than children from middle-class homes.

1. Identify the independent variable in the bold-face sentence. Is it categorical or quantitative? Justify your answer. How is this variable measured?

2. Identify the dependent variable in the bold-face sentence. Is it categorical or quantitative? Justify your answer. How is this variable measured?

3. Restate the sentence typed in *italics* as an alternative hypothesis and a null hypotheses.

4. Suggest one assumption and one limitation for this study.

5. Suggest two extraneous variables that could affect the results of this study.
Class #2

Ethics and Research

Basic ethical question involving educational research:

“Will any physical or psychological harm come to anyone as a result of my research?”

- Harm
- Confidentiality
- Deception

Recommendations to Researchers for Conducting an Ethical Study

1. Receive written permission from all appropriate authorities before you begin collecting data
   - superintendent and principal from participating schools
   - parents of minors
   - participants
   - human subjects committee (if conducting research through a university)

2. Plan a study that will:
   - not withhold proper services from students
   - not cause emotional or physical distress to participants

3. Ensure confidentiality of research data
   - have written agreements with participants (individuals and institutions) as to how you will handle the identification of names and the presentation of the study

4. Be honest with participants
   - Avoid deception, unless your honesty will influence participants’ responses

5. Anticipate problems you may encounter in the research process

Developing a Research Study

Sources for Research Topics

- Existing literature: Journals in your field --“Recommendations for further research…”
- Professional interest/experiences
- Personal experiences *

Considerations in Selecting Topics

- Personal interest
- Importance
- Newness
- Time requirements
- Estimation of difficulty level
- Monetary costs
- Ethical issues
YOUR Research Proposal

Section I—The Problem
- Introduction (& rationale) to Problem—1 pg minimum
- Purpose of Study—1/2 pg minimum
- Significance of Study—1/2 pg minimum
- Research Questions or Alternative Hypotheses—list
- Variables defined—list

Section II—Review of Related Literature
- Introduction—1/2 pg minimum
- Body with Subheadings—4 pg minimum
- Summary—1/2 pg minimum

Section III—Methods and Procedures
- Participants—1/2 pg minimum
- Instrumentation—1/2 pg minimum
- Design—1/2 pg minimum
- Procedures—1/2 pg minimum
- Proposed Data Analysis—1/2 pg minimum
- Null Hypotheses (if appropriate)—list
- Assumptions and Limitations—1/2 pg minimum

References

Why Explore Existing Literature?
To see what has already been done
- To profit from the experiences of others
- Findings
- Cautions
- Suggestions
- Recommendations

Secondary Sources Of Information In The Library
- Not firsthand accounts (primary sources): analyses, compilations, interpretations, summaries of primary information
- Begin a literature search by examining secondary sources
- Specific secondary sources:
  - The Encyclopedia of Educational Research
  - The NSSE Yearbooks
  - The Handbooks of Research
  - Review of Research in Education
  - Review of Educational Research
  - Educational Leadership
  - Scholarly books
  - Magazines and newspaper articles
- Locating secondary sources
  - Library’s main on-line catalog
  - Reference section
  - Newspaper Abstracts
  - Periodical Abstracts
Primary Sources Of Information In The Library

- Original research and other information
- Abstracts can be found in publications such as:
  - Psychological Abstracts
  - ERIC's Current Index to Journals in Education (CIJE)
  - Specific directories of primary sources:
    - Educational Resources Information Center (ERIC) -- 16 clearinghouses that abstract and index research articles and other papers
      - Thesaurus of ERIC Descriptors
      - Current Index to Journals in Education (CIJE)
      - Resources in Education (RIE)
  - Abstracts publications:
    - Psychological Abstracts
    - Dissertations Abstracts International (DAI)..also known as Digital Dissertations
    - Social Science Citation Index
    - Digest of Educational Statistics

Locating Primary Sources

- Manual searching of ERIC's CIJE and RIE -- L
- Computer searching -- J
- Using it is a learning experience -- "trial-and-error"
- Many databases are available via the Web
  - ERIC:
    - AskERIC--(http://www.askeric.org)
    - Access ERIC--(http://www.accesseric.org)
- ProQuest Digital Dissertations
- ProQuest Periodical Abstracts

Reading Research Reports

- Skim to quickly examine nature of study and conclusions
- Begin with abstracts, summaries
- Title and introductions
- Scan Findings, Conclusions, and Discussion
- Summarize the report; include the following:
  - Topic
  - Subjects
  - Basic methods
  - Results/conclusions
  - Complete bibliographic citation
Interpreting Statistical Information

- Three types of research questions/findings:
  - Status—describes people, places, etc. as they currently exist
  - Comparison—examines differences between two or more groups
  - Covarying relationships—examination of relationships that will permit predictions

- Descriptive reports (descriptive, qualitative research):
  - Often make use of raw data
  - Utilize statistics that indicate:
    - Typicality (mean, median, mode)
    - Spread or diversity (range, standard deviation)
    - Conversion or transformation (z-scores, percentile ranks, grade equivalents, etc.)

- Comparison (causal) reports (evaluation, causal-comparative, experimental research):
  - Utilize statistics including:
    - Chi-square ($\chi^2$)—when data are counts or categories; used to determine if difference exists between two groups
    - t-Test ($t$)—when measures are scores; used to determine whether difference exists between two groups based on means
    - Analysis of variance or ANOVA ($F$)—when measures are scores; used to determine whether differences exist between three or more groups based on variability of scores about the means

- Correlational reports (correlational research):
  - Utilize statistics including:
    - Pearson correlation coefficient ($r$)—when measures are scores; used to determine degree of relationship between variables, ranging from -1.00 to +1.00
    - Many other additional measures of correlation exist

The Concept of (Statistical) Significance

**Significant**—whether or not a topic is worthy of investigation

**Significance**—a.k.a., "statistical significance;" interpreted as "it is very likely that the findings we observed in the sample also exist in the population"

- Alpha level ($\alpha$), also referred to as p-value, determines the likelihood, or probability
- Traditional values are .05 & .01
- Remember to look at the p-value and the test statistic:
  - Significance $\rightarrow$ p-value should be less than .05, test statistic should be fairly large

Your Literature Review requires the summary of Five primary sources (actual studies)!

Start summarizing now using a word processor:

- List citation at top of page
- Summary should include:
  - Purpose of study
  - Methodology used
  - Description of sample
  - Results and conclusions
Class #3

Source of educational research data—typically human participants

Method of selecting participants should be guided by research question and design
- When goal of research is to generalize sample results to population—Large random sample is desired
- When goal of research is to describe a specific situation—Small purposive sample is desired
  - Unfortunately, sampling method is usually guided by convenience

Sampling Methods

Population (Target)—larger group to which results are applied

Accessible Population—population that is actually sampled; therefore sample is truly generalizable to population

Sample—actual group that is participating in the study

Random Sampling Methods
Can specify the probability of selection for each member of a population

Simple Random—population members have an equal and independent chance of being selected
Example:
- target population—9-12 grade students in Northwest Ohio schools
- accessible—9-12 grade students in Bowling Green
- sample—25% of 9-12 grade students in Bowling Green (N=2000)
- method—
  1. Assign numbers to all 2000 students
  2. Use table of random #'s until 1000 are chosen
- Advantage: sample is very representative of population
- Disadvantages: time consuming, must ID every member of population, doesn’t ensure representation of subgroups
**Stratified Random**—population is divided into subgroups, individuals are randomly selected from each group  
**Example:**  
- **target population**—9-12 grade students in Northwest Ohio schools  
- **accessible population**—9-12 grade students in Bowling Green  
- **sample**—25% of 9-12 grade students in Bowling Green (N=2000)  
- **method**—  
  1. Divide 9-12 Bowling Green students by grade  
  2. Select 25% of from each grade  

<table>
<thead>
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<th>9th grade</th>
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<th>11th grade</th>
<th>12th grade</th>
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<td>550</td>
<td>450</td>
<td>400</td>
<td>2000</td>
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<td>Sample (n)</td>
<td>150</td>
<td>138</td>
<td>112</td>
<td>100</td>
<td>500</td>
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</table>

- **Advantage:** sample is very representative of subgroups  
- **Disadvantages:** time consuming

**Cluster Random**—population is divided into clusters; clusters are randomly chosen  
**Example:**  
- **target population**—9-12 grade students in Northwest Ohio  
- **accessible population**—9-12 grade students from Wood County  
- **sample**—9-12 grade students from 3 of nine school districts in Wood County  
- **method**—  
  1. Assign numbers to the 9 school districts  
  2. Use table of random #’s to choose 3  
  3. All 9-12 grade students from the selected districts participate  

- **Advantage:** less time consuming  
- **Disadvantages:** may not be representative of population

**Two-Stage Random**—combining 2 random methods, (stratified-cluster, cluster-simple)  
**Example:** Cluster-simple  
- **target population**—9-12 grade students in Northwest Ohio  
- **accessible population**—9-12 grade students from Bowling Green County  
- **sample**—25% of the 9-12 grade students from 3 of nine school districts in Wood County  
- **method**—  
  1. Assign numbers to clusters  
  2. Randomly select 3 clusters  
  3. Select 25% from the 3 selected clusters  

- **Advantage:** depending on method—representation of population and subgroups  
- **Disadvantages:** time consuming to coordinate; may not be representative
Non-Random Sampling Methods

Probability of inclusion into a sample cannot be specified

**Systematic**—every nth individual selected; all subsequent selections are dependent upon 1st choice

- Example:
  - **target population**—9-12 grade students in Midwest
  - **accessible population**—9-12 grade students in Ames
  - **sample**—25% of 9-12 grade students in Ames (N=4000)
  - **method**—
    1. Identify selection ratio:
       \[
       \frac{\text{pop size}}{\text{sample size}} = \frac{4000}{1000} = 4
       \]
    2. Choose starting point randomly
    3. Select every 4th member until 1000 are chosen

- **Advantage**: sample is somewhat representative of population
- **Disadvantages**: biased sample if list is inappropriately ordered

**Convenience**—Choosing a group/individual to study because of their availability

- There may be times when convenience sampling suits a study’s purpose.

**Purposive**—Selection of participants is based upon your previous knowledge

**Snowball** (a.k.a., network or chain) sampling—participants recommend further participants

**Quota sampling**—individuals selected based upon characteristics
Recommended Sample Size (Minimums):
- **Survey/Questionnaire**: 100 participants (10% of population)
- **Correlational**: 30-50 participants
- **Experimental**: 15-30 participants per group
- **Quasi-experimental**: 15-30 participants per group
- **Causal-comparative**: 30 participants per group

- **REMEMBER...** A carefully selected small sample is better (i.e., more representative) than simply increasing the size of a sample

**Sampling Practice**

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<th>Simple Random</th>
<th>Cluster Random</th>
<th>Purposive</th>
<th>Snowball</th>
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<tr>
<td>Stratified Random</td>
<td>Systematic</td>
<td>Convenience</td>
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1. Five 2nd grade classrooms are randomly chosen from the four elementary schools in the district.

2. 25% of the teachers from each English, Math, and Science department in the district are selected to complete a survey.

3. Every 10th student is selected from a list of high school students.

4. A group of low achieving gifted/talented students are chosen to be interviewed on their attitudes toward the gifted/talented program.

5. 25% of all teachers employed by the Bowling Green school district are randomly selected to complete a survey.

6. A researcher studies his children’s literacy development.

7. Each participant is asked to provide a list of five friends who may be willing to participate.
Instrumentation

Instrumentation—the whole process of data collection addresses:
who will collect data?
when will it be collected?
how often will it be collected?
where will it be collected?
what data is to be collected using
which instrument?

Instrument—documents data collected

They can provide a variety of data types:
• Descriptions—verbal representations of participants, etc.
• Scores—numerical values assigned to test performance
• Measurements—numerical values resulting from instruments other than tests
• Opinions—views expressed by participants and informants
• Statements—authoritative verbal opinions

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<th>Researcher Completes</th>
<th>Subject Completes</th>
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<td>Rating scales</td>
<td>Questionnaires</td>
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<td>Interview schedule</td>
<td>Self-checklists</td>
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<td>Tally sheets</td>
<td>Attitude scales</td>
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<td>Flowcharts</td>
<td>Personality inventories</td>
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<td>Performance checklists</td>
<td>Achievement/aptitude tests</td>
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<td>Anecdotal records</td>
<td>Performance tests</td>
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<td>Time and motion logs</td>
<td>Projective devices</td>
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<td>Sociometric devices</td>
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Scales:
Likert—range of levels of agreement, satisfaction
Semantic Differential—indicate placement between two extremes
Pictorial—uses pictures to represent level of agreement

Item Formats:
Selection Items:
• True-false
• Multiple choice
• Matching
• Interpretive exercises

Supply Items
• Short-answer
• essay
Most instruments create some type of score:

Raw Score—not in relation to population/sample

Derived Score—translates a raw score into a usable score based on some standard; is in relation to population/sample; common standards used: age equivalent, grade equivalent, percentile rank, standard score (z score/T score)

Types of Instruments:

Norm-referenced
—individual score is compared to group; derived score
Examples: SAT, ACT, GRE

Criterion-referenced
—goal-oriented; score represents how achievement of criteria
Examples: * the 9 literacy tasks, Presidential fitness, teacher-made tests

Types of Measurement Scales:

Nominal—assign #'s to different categories; # does not have value, but is only a label
Examples: gender, school, treatment group, color

Ordinal—indicate rank placement of individuals within a group; # has value
intervals may not be equal
Examples: rank in graduating class, place in race

Interval—like ordinal but intervals are equal; has no real zero
Examples: temperature, test score

Ratio—like interval but has a real zero
Examples: money, height, weight, age, time

Steps To Develop Your Own Instrument

1. Identify variables to be assessed.
2. Review existing instruments that measure similar variables—you may want to follow the format or use some of the items.
3. Decide on format of questions (multiple choice, true-false, matching, rating, open-ended).
4. Compile/write items.
   —Make sure that each item is a measure of its variable and is clear and understandable.
   —Write several items that address each variable.
   —Develop instructions for taking instrument.
5. Have colleagues review instrument.
6. Revise items/instrument.
   —Make sure instrument isn't too long or repetitious.
7. Pilot instrument with group (20+) similar to sample.
   —Discuss instrument with pilot respondents to get feedback.
8. If possible, analyze pilot results to determine item reliability.
9. Revise items.
**Validity (truthfulness) & Reliability (consistency)**

**Validity**—whether or not the data measure what they purport to measure
- Types of validity (ways of determining if data are valid) for test data:
  - *Criterion validity*—two instruments measuring similar content are given concurrently and are correlated
  - *Content validity*—format, objectives, content examined by expert panel
  - *Construct validity*—construct (theory) of an instrument is analyzed
- Types of validity for non-test data:
  - *External criticism*—authenticity

**Reliability = Consistency**
- Types of reliability (ways of determining if data are reliable) for test data:
  - *Test-retest method*—give identical instrument twice
  - *Equivalent forms method*—give two forms of instrument
  - *Internal consistency (Split-half method)*—divide instrument into halves and score each or use Kuder-Richardson
  - *Observer Agreement*—compare scores obtained by two or more observers
- *Reliability Coefficient (0-1)*—expresses the relationship of scores of the same individuals on the same instrument

**Relationship between Validity and Reliability**

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<tr>
<th>Valid</th>
<th>Reliable</th>
<th>Invalid</th>
<th>Reliable</th>
<th>Invalid</th>
<th>Unreliable</th>
</tr>
</thead>
</table>

**Ways to LOWER Reliability:**
- administering an instrument differently
- using scoring mechanisms that rely on scorer subjectivity
- decreasing the # of participants taking the test(s)
- decreasing test items
- adding ambiguous and/or inconsistent items
- too short of a test-retest interval (less than a week)
- too long of a test-retest interval (more than a month)

**Ways to RAISE Reliability:**
- standardizing administration and scoring procedures
- increasing the # of participants taking the test
- increasing the number of test items (similar to original)
- removing items that obtained inconsistent responses
- replace items that everyone answered correctly or incorrectly
- use appropriate test-retest interval (1 week to 1 month)
Class #4B

Descriptive Statistics

Analyzing Quantitative Data

• Key is the separation of the researcher from the participants and the data—objectivity!
• Parameters—numerical indices that describe populations
• Statistics—numerical indices that describe samples

What Statistics Are Used For

• To summarize data in order to reveal what is typical and atypical about a group
• To show relative standing of individuals in a group
• To show relationships among variables
• To show similarities and differences among groups
• To identify error inherent in sample selection
• To test for significance of findings
• To make inferences about a population

Descriptive Statistics

Numerical indices and procedures that summarize and simplify data about samples

• **Graph/Polygon/Table**
  o frequency distribution table—text table that summarizes frequencies of scores
  o frequency polygon—representation of distribution of scores (line, histogram)
  o scatterplot—point plot on x-y axes of two quantitative variables
  o bar graph—summarizes groups
  o pie chart—displays the percent of individual within each response

• **Measures of central tendency:**
  o Mean (\(M\))
  o Median (\(Mdn\) or \(Md\))
  o Mode (\(Mo\))

• **Measures of variability:**
  o Range (\(R\))
  o Variance (\(s^2\))
  o Standard deviation (\(s\) or \(SD\))

• **Measures of relative position:**
  o Percentile rank (\(\%ile\) or \(PR\))
  o Stanine
  o Converted scores (z-score, T-score, grade-equivalent, etc.)

• **Measures of relationship:**
  o Pearson correlation coefficient (\(r\))
  o Many other correlation coefficients
Measures of Central Tendencies (Averages):

**Mean**—“average” of all scores; most appropriate for interval/ratio data

Symbols: \( \bar{X} \) = sample mean; \( \mu \) = population mean

\[ X = \frac{\text{sum of scores}}{\# \text{ of scores}} \]

**Median**—midpoint of scores distributed; 50% below & above; most appropriate for ordinal data

**Mode**—most frequent score; most appropriate for nominal data

Measures of Variability (Spread):

**Range**—distance between highest and lowest score; gives a quick estimate of variability

**Standard Deviation**—index of variability; comparison of each score to the mean

Symbols: \( s \) = standard deviation of sample (also SD)
\( \sigma \) = standard deviation of population

- small SD indicates that scores are close together
- large SD indicates that scores are spread out
- when we know the mean and SD, we can get a good idea of how the data is distributed

Distribution of Scores: how scores are distributed by range and frequency

**Normal Distribution**

mean, median, mode are equal
50% of scores fall on each side of the mean
total area under curve represents all scores

- 68% of the sample scores lie within 1 standard deviation above and below the mean
• 95% of the sample scores lie within 2 standard deviations above and below the mean
• 99.7% of the sample scores lie within 3 standard deviations above and below the mean

**Skewed Distributions**

not symmetrical
mean, median, mode are different
extreme scores on one end of the distribution

![Skewed Distribution Diagram](image)

**Negatively Skewed**—extreme scores are on the low end of the distribution

![Negatively Skewed Distribution Diagram](image)

**Positively Skewed**—extreme scores are on the high end of the distribution

![Positively Skewed Distribution Diagram](image)

**Measures of Relationship:**

—determines relationship between 2 quantitative variables
—ways to describe relationship:
  * scatterplots
  * correlation coefficients for linear relationships (r)
    o range -1 to +1
    o Pearson r (interval data)
    o Spearman Rho (ordinal data)

![Correlation Coefficients](image)

positive relationship (r=+1) negative relationship (r=-1) no relationship (r=0)
In-class Assignment: Descriptive Statistics

1. The question or hypothesis of my study is: ________________________________

2. My variables are: (1) ________________________________________________
   (2) _________________________ (others) ________________________________

3. I consider variable 1 to be: quantitative ____________ or categorical ____________

4. I consider variable 2 to be: quantitative ____________ or categorical ____________

5. I would summarize the results for each variable checked below (indicate with a check mark):

<table>
<thead>
<tr>
<th>Variable 1:</th>
<th>Variable 2:</th>
<th>Other:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Frequency polygon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Box plot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Median</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Standard deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Frequency table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Bar graph</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Pie chart</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. I would describe the relationship between variables 1 and 2 by (indicate with a check mark):
   a. Comparison of frequency polygons_______
   b. Comparison of averages ________________
   c. Crossbreak table(s) _________________
   d. Correlation coefficient ________________
   e. Scatterplot _________________________
Class # 5  
Inferential Statistics

- statistics derived from particular techniques that allow the researcher to make conclusions/inferences about the population from the studied sample. Consequently, we want to compare a sample to the population of similar samples.

- Two basic types of inference techniques are used to draw conclusions about the data—parametric and non-parametric tests.
  - **Parametric tests** are used to evaluate a hypothesis about the population. Parametric tests require certain assumptions about the population parameters, such as a normal distribution, homogeneity of variance, and a quantitative (interval/ratio) dependent variable.
  - **Non-parametric tests**
    - used when the assumptions for parametric tests cannot be fulfilled
    - usually do not state a hypothesis in terms of the population distribution, so they are often called distribution-free tests
    - are suited for data that utilize a nominal or ordinal scale
    - are not as sensitive as parametric tests—are more likely to fail in detecting a real difference between two treatments

**Basic Concepts for Parametric Tests**

Since the dependent variable for parametric tests MUST be quantitative, characteristics of this variable type are essential to conducting parametric tests.

- **Mean**
- **Standard deviation**
- **Standard Error of the Mean**
  - standard deviation of sampling errors
  - tells us how much we would expect our sample means to differ if we used other samples from the same population
  - allows us to compare our sample to a population of similar samples
- **Probability and Confidence Intervals**
  - p=.05 (95% accurate) or .01 (99% accurate) is most appropriate
  - p=probability of that the result occurred by chance or error (Type I error)
  - the lower the p, the less chance of making an error, the harder it is to achieve significance

**Hypothesis Testing**—testing the relationship between two variables

—test the null hypothesis, which states "no difference or relationship"
—Why? It is easier to prove disprove "nothing" than to prove "everything"

Example: Research textbooks will have a chapter on inferential statistics.

**Steps to Test Hypothesis:**

1. State alternative and null hypotheses  
   - directional→one-tailed test  
   - non-directional→two tailed test
2. Determine criteria, usually based upon: number of tails, alpha level, degrees of freedom, and test statistic.
3. Calculate test statistic
4. Compare the calculated test statistic to null (critical test statistic)
   - If difference is beyond level of significance, it is then significant→reject null
   - If difference is NOT beyond level of significance, it is NOT significant→fail to reject null
5. Draw conclusion.
Recommendations (Comparing Groups): Dependent variable= quantitative, Independent variable= categorical
1. Create frequency polygons for each group to decide which measure of central tendency is appropriate and if they follow a normal distribution
2. If possible use information about known groups, such as norms from standardized tests, to compare sample data
3. Calculate effect size as a measure of the magnitude of a difference between the two groups
   • this has become very important in recent years
   • effect size \((\hat{e}) = \frac{\text{mean of treatment group} - \text{mean of control group}}{\text{standard dev of control group}}\)
   • typically an effect size of 0.50 or larger signifies an important difference
4. Use inferential statistics very cautiously especially when dealing with non-random samples-be very careful in generalizing your results to the population

Recommendations (studying relationships): Dependent variable= quantitative, Independent variable= quantitative
1. Create a scatterplot of the relationship to determine which correlation coefficient should be calculated
2. Use both the scatterplot and correlation coefficient to determine significance
3. Typically the correlation coefficient is interpreted as follows:
   • .00 - .40 little practical importance
   • .41 - .60 some practical and theoretical importance
   • .61 - .80 very important
   • .81 + extremely important (may be out of error)
4. Use inferential statistics very cautiously especially when dealing with non-random samples-be very careful in generalizing your results to the population

Recommendations (Comparing Groups): Dependent variable= categorical, Independent variable= categorical
1. Create crossbreak tables for each category
2. Calculate contingency coefficient and chi square statistic to evaluate the relationships
3. Use inferential statistics very cautiously especially when dealing with non-random samples-be very careful in generalizing your results to the population
Parametric Techniques

*use when independent var is categorical (2 groups) and dependent variable quantitative*
- tests significance of difference between two means
- t test of independent means—compares 2 different groups
- t test of related means—compares pre and post test results

ANOVA—> F value
*use when independent var is categorical (3 or more groups) and dependent variable quantitative*
- tests significance of differences between 3 or more means as it analyzes variation between and within each group

ANCOVA—> F value
*use when independent var is categorical (2 or more groups) and dependent variable quantitative and want to equate groups on some variable*
- similar to ANOVA but are controlling for a variable (covariate) that may influence dep. variable. Many times the covariate may be pretest differences, therefore the groups are equated in terms of the covariate.

MANOVA—> Wilk’s Lambda
*use when independent var is categorical (2 or more groups) and have several dependent variables that are also quantitative*
- similar to ANOVA but use when there are several dependent variables.

Pearson Correlation—> r
*use when both independent and dependent variables are quantitative*
- calculates degree of relationship between two quantitative variables

Multiple Regression
*use when you have several independent variables and one dependent variable, all variables are quantitative*
- calculates the best predictors (independent variables) of the dependent variable

Non-Parametric Tests

Chi-Square
*use when both independent and dependent variables are categorical*
- like a correlation, but tests significance relationship between groups
# Statistical Test Grid

## Independent Variable

<table>
<thead>
<tr>
<th></th>
<th>Categorical</th>
<th>Quantitative</th>
</tr>
</thead>
</table>
| **Categorical** | Chi Square  
Test of Independence |  |
| **Quantitative** | t test (2)  
Single Sample  
Independent Samples  
Related Samples  
ANOVA (3+)  
ANCOVA  
MANOVA | Pearson Correlation  
Regression  
Multiple Regression (several IVs) |
Practice Problems
Identify which statistical test would be most appropriate for the following research questions (It is most helpful to first identify the dependent and independent variables as categorical or quantitative). Justify your choice.

1. Are SAT scores related to IQ?

2. Are males able to lift more weight than females?

3. Are students more motivated to learn after they have received a special method of instruction? The increase in motivation is measure by a pre and post test.

4. Is reading achievement significantly different among low, middle, and high income students?

5. What risk taking behaviors are the best predictors of suicidal behavior?

6. Is there a significant difference in math achievement between accelerated and non-accelerated math students?

7. Is alcohol use related to delinquent behavior among adolescents?
Class #6
Experimental Research

The (Never-Ending) Search for Causation
• Establishing causation among variables:
• Produces increased understanding of those variables
• Results in the ability to manipulate conditions in order to produce desired changes

Experimental Research
• Can demonstrate cause-and-effect very convincingly
• Very stringent research design requirements
• Experimental design requires:
  o Randomly selected participants who are randomly assigned to groups (experimental and control)
  o Independent treatment variable that can be applied to the experimental group
  o Dependent variable that can be measured in all groups

Quasi-Experimental Research
• Used in place of experimental research when random assignment to groups is not feasible
• Otherwise, very similar to true experimental research

Fundamentals of Experimental and Quasi-Experimental Research

Cause and effect:
• Incorporates a temporal element—the cause is a condition that exists prior to the effect; effect is a condition that occurs after the cause
• There exists a "logical connection"—cause-and-effect is demonstrated when manipulation of the independent variable results in differences in the dependent variable (as evidenced by comparing the experimental group to the control group)

Random selection and random assignment:
• Distinguish between "selection" and "assignment"
• Both help to ensure that groups are equivalent and to control for extraneous variables
• If you incorporate random selection and random assignment\(\rightarrow\)experimental research
• If you incorporate random selection but not random assignment\(\rightarrow\)quasi-experimental research

When to use experimental research design:
• If you strongly suspect a cause-and-effect relationship exists between two conditions, and
• At least randomly assigned group is available to participate, and
• The independent variable can be introduced to participants and can be manipulated, and
• The resulting dependent variable can be measured for all participants

Similarities Between Experimental and Quasi-Experimental Research
• Cause-and-effect relationship is hypothesized
• Participants are randomly selected and randomly assigned (experimental) or randomly selected and nonrandomly assigned (quasi-experimental)
• Application of an experimental treatment by researcher
• Following the treatment, all participants are measured on the dependent variable
• Data are usually quantitative (exception is single-subject designs); analyzed by looking for significant differences on the dependent variable
Internal and External Validity

- "Validity of research" refers to the degree to which the conclusions are accurate and generalizable
- Both experimental and quasi-experimental research are subject to threats to validity
- If threats are not controlled for, they may introduce error into the study, which will lead to misleading conclusions

Threats to Internal Validity

Internal validity—extent to which differences on the dependent variable are a direct result of the manipulation of the independent variable

- Differential selection of participants—participants are not selected/assigned randomly
- History—when factors other than treatment can influence the results; problematic over time
- Maturation—when changes occur in dependent variable that may be due to natural developmental changes; problematic over time
- Testing—also known as "pretest sensitization": pretest may give clues to treatment or posttest and may result in improved posttest scores
- Attrition (mortality)—loss of participants

Threats to External Validity

External validity—extent to which the results can be generalized to other groups or settings

- Population validity—degree of similarity among sample used, population from which it came, and target population
- Personological variables—application of findings based on individual differences
- Ecological validity—physical or emotional situation or setting that may have been unique to the experiment

Experimental Research

—examines cause and effect, but does so by focusing on a treatment (is manipulated) and outcome
—compares an experimental group (receives treatment) with a control group (no treatment)
—participants are randomly assigned to groups

- Example: Researcher investigates the effect of positive reinforcement on school achievement.
- Independent variable (treatment/cause)—positive reinforcement
- Dependent variable (outcome)—school achievement as measured in GPA
- Participants are randomly assigned to groups (participants may be matched according to extraneous variables). Treatment group receives positive reinforcement; the control group receives none. Groups are then compared with respect to GPA.

More Specific Experimental Designs:

- Posttest-only Control Group Design
  - Random assignment into groups
  - treatment group vs control group
  - Both groups are tested after treatment (posttest)
- Pretest-Posttest Control Group Design
  - Provides baseline
  - Random assignment into groups
  - treatment group vs control group
  - Both groups are tested before (pretest) and after(posttest) treatment
- Solomon Four-Group Design
  - Provides baseline
  - Eliminates pretest effects
  - Random assignment into 4 groups (2 receive pretest, 2 do not)
- 2 treatment groups vs. 2 control groups
- One treatment group and one control group are tested before (pretest) and after (posttest) treatment
- The other treatment group and the other control group are only tested after (posttest) treatment
- Matched Posttest-only Control Group Design
  - Equalizes groups
  - Pairs are matched and then randomly assigned to groups
  - treatment group vs control group
  - Both groups are tested after treatment (posttest)
- Matched Pretest-Posttest Control Group Design
  - Provides baseline
  - Equalizes groups with matching
  - Pairs are matched and then randomly assigned to groups
  - treatment group vs control group
  - Both groups are tested before (pretest) and after (posttest) treatment.

Quasi-Experimental Research

- also investigates cause and effect by manipulating a treatment
- does not randomly assign participants to groups
- usually uses existing groups
  Example: same as above
  - Researcher compares two 9th grade math classes that are already in existence.
  - Control over extraneous variables is sought.

More Specific Quasi-Experimental Designs:
- One-Shot Case Study
  - weak design
  - One group receives treatment and takes posttest
- One-Group Pretest-Posttest Design
  - weak design
  - provides baseline
  - One group takes pretest, receives treatment, and takes posttest
- Static Group Pretest-Posttest Design
  - provides baseline
  - Uses existing groups
  - treatment group vs control group
  - Both groups are tested before (pretest) and after (posttest) treatment
- Matching-Only Posttest-Only Control Group Design
  - equalizes groups somewhat
  - Uses existing groups, but matches pairs on certain characteristics
  - treatment group vs control group
  - Both groups are tested after treatment (posttest)
- Matching-Only Pretest-Posttest Control Group Design
  - provides baseline
  - equalizes groups somewhat
  - Uses existing groups, but matches pairs on certain characteristics
  - treatment group vs control group
  - Both groups are tested before (pretest) and after (posttest) treatment
- Counterbalanced Design
Numerous groups receive treatment, but in a different order

- **Time-Series Design**
  - Elaboration on "One-Group Pretest-Posttest Design"
  - One group receives treatment but are "tested" numerous times before and after treatment

- **Factorial Design**
  - Elaboration on the "Pretest-Posttest Control Group Design"
  - Study not only the effect of the independent variable, but also the interaction of the independent variable with other variables.
  - Multiple sets of treatment and control groups as defined by moderator variable
  - Treatment group vs control group
  - Both groups are tested before (pretest) and after (posttest) treatment

**Data Analysis:** *t* Test, ANOVA, ANCOVA.

**Causal-Comparative Research**
- Explores the possibility of cause-and-effect relationships when experimental and quasi-experimental approaches are not feasible
- Used when manipulation of the independent variable is not ethical or is not possible

**The Nature of Causal-Comparative Research**
- Conducted to explore possible cause-and-effect relationships
- Differs from experimental and quasi-experimental research:
  - Independent variable is not manipulated
  - Focuses first on the effect, then tries to determine possible causes (ex post facto)
  - Questions will remain about the effect following the cause, or vice versa
  - Other conditions must also be considered as "plausible causes"

**Example:** Researcher studies the effect of socioeconomic status (SES) on school achievement.

**Independent variable (cause)—** SES

**Dependent variable (effect)—** school achievement through GPA

- 3 groups of students would be identified—low, mid, and high SES levels.
- Groups would be equated on extraneous variables (IQ, absenteeism, and family status).
- Groups would be compared by GPA.

**Threats to Internal Validity—Key is to control extraneous variables!!!!!**
- Subject characteristics—since groups are based on some pre-identified characteristic (dropout vs non-drop out) many times these groups are not equivalent on other extraneous variables. Some ways to control for this are:
  - Matching of Subjects—pair up subjects (one from each group) on other extraneous variables. This may limit the size of the sample though.
  - Find or create homogenous sub-groups—sub-divide each group based on some other variable
  - Use ANCOVA to equalize groups on extraneous variables
  - Location, Data collector bias, Instrument decay, History, Regression

**Data Analysis:** *t* Test, ANOVA, ANCOVA
Essential Characteristics of Single-Subject Research

- Single-subject research involves the extensive collection of data on one subject at a time.
- An advantage of single-subject designs is that they can be applied in settings where group designs are difficult to put into play.
- Single-subject designs are most commonly used to study the changes in behavior an individual exhibits after exposure to a treatment or intervention of some sort.
- Single-subject researchers primarily use line graphs to present their data and to illustrate the effects of a particular intervention or treatment.

Single-Subject Designs

- Designs are described by A-B: A represents a baseline period where the subject is assessed several times; B represents a treatment or intervention.
- The basic approach of researchers using an A-B design is to expose the same subject, operating as his or her own control, to two conditions or phases.

Frequency of response across baseline and praise conditions
• When using an A-B-A design, (sometimes called a reversal design), researchers simply add another baseline period to the A-B design.
• In the A-B-A-B design, two baseline periods are combined with two treatment periods.
• The B-A-B design is used when an individual’s behavior is so severe or disturbing that a researcher cannot wait for a baseline to be established.
• In the A-B-C-B design, the “C” condition refers to a variation of the intervention in the “B” condition. The intervention is changed during the “C” phase typically to control for any extra attention the subject may have received during the “B” phase.

Multiple Baseline Designs
• Multiple-baseline designs are used with it is not possible or ethical to withdraw a treatment and return to baseline.
• When a multiple-baseline design is used, researchers do more than collect data on one behavior for one subject in one setting; they collect on several behaviors for one subject, obtaining a baseline for each during the same period of time.
• Multiple-baseline designs also are sometimes used to collect data on several subjects with regard to a single behavior, or to measure a subject’s behavior in two or more different settings.

Threats to Internal Validity in Single Subject Research
• Several threats to internal validity exist with regard to single-subject designs. These include the length of the baseline and intervention conditions, the number of variables changed when moving from one condition to another, the degree and speed of any change that occurs, whether or not the behavior returns to baseline levels, the independence of behaviors, and the number of baselines.
Controlling Threats in Single-Subject Studies

- Single-subject designs are most effective in controlling for subject characteristics, mortality testing, and history threats.
- They are less effective with location, data collector characteristics, maturation, and regression threats.
- They are especially weak when it comes to instrument decay, data-collector bias, attitude, and implementation threats.

External Validity and Single-Subject Research

- Single-subject studies are weak when it comes to generalizability.
- It is particularly important to replicate single-subject studies to determine whether they are worthy of generalization.

Other Single-Subject Designs

- Variations on the basic designs discussed in this chapter include the A-B-A-C-A design; the A-B-C-B-C design; and the multi-probe design.
Survey Research

- obtaining answers from a large group of people to a set of carefully designed and administered questions
- data describes aspect or characteristics of sample
- many times the researcher may conduct correlational or causal-comparative research with a survey/questionnaire.

Types of Surveys:

Cross-sectional—collects info at a single given time from a sample drawn from a predetermined population.

Longitudinal—collects info at different points in time to study changes over time
  - Trend—data is collected from different samples from a changing population at different points in time.
  - Cohort—data is collected from different samples from a specific population at different points in time. Population will not change.
  - Panel—data is collected from the same sample at different points in time.

Steps in Survey Research:
1. Define problem
2. ID target population
3. ID mode of data collection
   - direct administration
   - mail
   - telephone
   - personal interview
4. Select sample
5. Prepare instrument
   - types of questions: multiple choice, rating, true/false, short answer, open ended
6. Develop administration guidelines
7. Train
8. Pilot survey
9. Revise

Threats to Internal Validity
- Mortality
- Location
- Instrumentation
- Instrument Decay
Correlations
- Human (logical) thought tends to reflect linearity
- Measures of relationship between variables
- Can permit future predictions of one variable from knowledge of another
- Can raise questions about cause-and-effect patterns (can only be established with experimental research)

The Nature of Correlational Research
- Purpose is to discover corelationships between two or more variables; seeks out conditions that covary, or correlate, with each other
- Co-relationship is when an individual’s status on one variable tends to reflect the status on another
- Correlations help us:
  - Understand related events, behaviors, etc.
  - Predict future events, etc. from what we know about another
  - Sometimes obtain strong suggestions that one variable may be causing another

Cautions about Cause-and-Effect...
*Post hoc fallacy—post hoc ergo propter hoc* (“after the fact, because of the fact”)
- The “cause” can actually be the “effect” (or vice versa)
- This is a common fallacy of logical thinking

Topics for Correlational Research
- If a relationship is suspected
- If you wish to predict values on one variable from another
- If you need to establish instrument validity or reliability

Correlational Research Design
- Typically oriented by research questions or hypotheses
- A relatively straightforward design:
  - Identify variables for inclusion
  - Formulate questions or hypotheses
  - Select a random sample (preferably with $n > 30$)
  - Obtain data for each member of the sample on each variable being investigated
  - Compute correlations in order to determine degree of relationship

Bivariate (2 variables) Correlation Coefficient
- *Pearson product-moment correlation* (Pearson $r$ or $r$)—correlation between two continuous variables
Types of Multivariate (> 2 variables) Correlation Coefficients

- **Partial correlation** (partial r)—correlation between two variables with the effects of a third variable “partialed out”

- **Multiple regression**—used to determine degree of relationship between one continuous dependent variable ("criterion variable") and a combination of independent variables ("predictor variables")

- **Discriminant analysis**—analogous to MR, but criterion variable is dichotomous (e.g., "pass-fail")

- **Factor analysis**—used with a large number of correlated variables; variables are statistically grouped into clusters, known as "factors"

Interpretation of Correlation Coefficients

- Most coefficients range from -1.00 to +1.00 (some range from 0 to +1.00)
- ±1.00 = a perfect correlation/relationship; 0 = no correlation/relationship
- General rule of thumb for interpretation:

Threats to Internal Validity

- Subject Characteristics—other characteristics may explain relationship
  - Use Partial Correlation to control for other extraneous variables

- Location
- Instrument Decay—most likely with observational studies
- Data Collection Characteristics & Bias
- Testing
- Mortality
## Qualitative versus Quantitative Research

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Quantitative</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Explain and predict relationships, develop “laws” that make predictions possible</td>
<td>Understand what things mean to others</td>
</tr>
<tr>
<td><strong>Phrases</strong></td>
<td>Experimental, numbers, empirical, statistical</td>
<td>Descriptive, naturalistic, word-oriented</td>
</tr>
<tr>
<td><strong>Key Concepts</strong></td>
<td>Variables, operationalizing, reliability, hypotheses, validity, statistical significance, replication</td>
<td>Meaning, common-sense understanding, process, social construction, themes, trustworthiness</td>
</tr>
<tr>
<td><strong>Designs</strong></td>
<td>Structured, predetermined, formal, detailed plan of operation</td>
<td>Evolving, flexible, general, intuitive</td>
</tr>
<tr>
<td><strong>Sample</strong></td>
<td>Large, representative, treatment and control groups, random selection, control for extraneous variables</td>
<td>Small, purposive, theoretical, take into account as much context as possible</td>
</tr>
<tr>
<td><strong>Techniques or Methods</strong></td>
<td>Experiments, surveys, structured interviews and/or observations, data sets</td>
<td>Observation, participant observation open-ended interviews, review of documents and artifacts</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>Quantitative, counts, measures</td>
<td>Descriptive, people’s own words, personal documents, field notes, artifacts, official documents, transcripts, videotapes, audiotapes</td>
</tr>
<tr>
<td><strong>Instruments and Tools</strong></td>
<td>Inventories, surveys, tests, computers, indexes</td>
<td>Researcher, tape recorder, transcriber, notes</td>
</tr>
<tr>
<td><strong>Data Analysis</strong></td>
<td>Deductive, statistical, occurs at the conclusion of data collection</td>
<td>Inductive, ongoing, themes, concepts, occurs throughout data collection</td>
</tr>
<tr>
<td><strong>Generalizability</strong></td>
<td>Generalize sample findings to population</td>
<td>Limited generalizability—only to very particular situations similar to those studied</td>
</tr>
<tr>
<td><strong>Problems in Using Approach</strong></td>
<td>Controlling extraneous variables, obtrusiveness, validity</td>
<td>Time consuming, procedures not standardized, reliability</td>
</tr>
<tr>
<td><strong>Assumptions</strong></td>
<td>A single reality of truth exists waiting to be discovered, researcher is objective and separate from study,</td>
<td>Strive to understand “meaning” of experience, multiple realities, research in a naturalistic setting, researcher is the primary instrument, researcher becomes intimately familiar with the studied phenomenon, research process is inductive, outcome is descriptive</td>
</tr>
</tbody>
</table>

**Research Paradigms**—see separate handout
Five Approaches to Qualitative Research:

**Biography**
- "the study of a single individual and his or her experiences as told to the research or found in documents and archival material"

**Phenomenology**
- investigates/describes reactions to or perceptions of a particular phenomenon
- increase understanding of the participants' world
- seek to identify and describe the commonalities of perceptions that human beings have in how they interpret similar experience—essence

**Grounded Theory**
- generate theory that is grounded in systematically gathered and analyzed data
- Strauss and Corbin
- Data are collected and analyzed, a theory is suggested, more data are collected, theory is revised, more data collected—ya da ya da ya da!

**Case Studies**
- An in-depth investigation of an individual, group, situation, or program
- Three types of case studies:
  - Intrinsic—understand a particular individual or situation; used to explore some little-known phenomenon by studying it in depth.
  - Instrumental—study a case to draw "broader" conclusions
  - Multiple/collective—studies multiple cases at the same time as a part of an overall study

**Ethnography**
- A sociocultural analysis and holistic description of a social unit or phenomenon

**Historical**
- Describe, explain, and understand actions or events that occurred in the past

**Purposive Sampling Methods**
Qualitative researchers purposively select the participants they believe will yield the best understanding of whatever it is they are studying

**Types of Purposive Sampling**
- Typical—or representative of what is being studied
- Critical—is unusual or exceptional and will be particularly enlightening
- Homogeneous—all members possess certain trait or characteristic
- Theoretical—supports the understanding of a theory
- Snowball—participant recommends other similar participants
- Opportunistic—selected during the study to take advantage of a new circumstance
- Confirming—obtained to validate or disconfirm prelim findings
- Maximal Variation—selected to represent the diversity of perspectives

**Combining Qualitative and Quantitative Approaches**

1. **Triangulation**—simultaneously uses both methods, compares results to validate each other
2. **Explanatory**—first uses quantitative, then uses qualitative to refine quantitative findings
3. **Exploratory**—first uses qualitative to guide the quantitative methods; quantitative data is used to validate qualitative

*Your choice of qualitative or quantitative methods should be driven by your research questions—what you are studying and what you want to find out!*
Observation

Reasons to Observe:
- Observe what has become routine for the informant
- See firsthand
- Observe what an informant may be uncomfortable talking about
- Move beyond selective perceptions of informant

Elements to Observe:
- setting
- participant
- activities
- participant behaviors
- interactions
- language
- nonverbal communication
- frequency and duration of behaviors

Field notes should include:
- verbal descriptions of setting, people, and activities
- diagrams
- direct quotations
- observer comments
- reflections on:
  - analysis (emerging themes, patterns)
  - method (success/failure of procedures used, rapport, problems)
  - ethical dilemmas/conflicts
  - observer's frame of mind (mood, emotional state, bias)

Observer Effect
- Unexpected → "other-than-normal" behavior
- Knowledge of researcher's purpose → fulfill purpose
Interviewing

Goal of interviewing
• understand subject's perspective/interpretation of the world
• build relationship with informant
• build trust

Types of Interviews:
Structured or semi-structured—verbal questionnaires; participants select from a list of responses
Informal—resemble casual conversations,
Standardized open-ended—questions are developed before hand, open-ended responses are expected
Interview guide—topics/issues are outlined, but questions are developed during interview

The Interview Process
1. small talk
   breaks ice
   relaxes respondent and interviewer
2. business of the interview
   purpose/motives
   protection of respondent
   review agreement
3. questions/discussion
   begin w/noncontroversial questions-experiences, behaviors
   require minimum recall, easy to answer, focus on description
   opinion/feeling questions about behaviors just described
   knowledge/skill question
   relate to described experiences and feelings
   demographic questions

6 Kinds of Content Questions
• Background/demographic—what characteristics respondent has in relation to others
  ▪ "What is your occupation?"
• Knowledge—what factual knowledge the respondent has
  ▪ "How does one enroll in the program?"
• Experience/Behavior—what a person does or has done
  ▪ "If I followed you through a typical day, what would I see you doing?"
• Opinion/Belief—what a person thinks about...
  o goals, intentions, desires, values
    ▪ "What is your opinion about________?"
• Feeling—how a person emotionally responds to experiences or thoughts
  ▪ "How do you feel about________?"
• Sensory—what the respondent is sensitive to
  ▪ "When you walk through the doors of your mother’s house, what do you see?"

Interview Suggestions
• Respect individual and culture
• Be natural
• Develop rapport
• Ask same questions in different way
• Can’t understand response? Have participant repeat answer
• Avoid leading questions
• Vary communication control
• Ask only question at a time
• Don’t interrupt
• Tape interview!
• Obtain informed consent

Other Types of Interview Questions

Hypothetical Question—what the respondent might do in a certain situation
Suppose you won a million dollars. What would you do?

Devil’s Advocate Question—challenges respondent to consider opposing view
Some say people who lose their job did something to bring it on, what would you say to them?

Ideal Position Question—describes ideal situation
Describe the ideal instructor.

Interpretive Question—advances respondent’s interpretation and asks for reaction
Would you say that graduate school is different from what you expected?

Analyzing Qualitative Data

• Differs from the generic description of qualitative analysis
  o Research questions often emerge after data collection (and even analysis) have begun; they are not foreseen
  o Conclusions are drawn from a broad view of human behavior

• Analytical process is somewhat iterative and circular
  o Identify topics (through data collection)
  o Cluster topics into categories
  o Form categories into patterns
  o Draw explanations (conclusions) from patterns

• This on-going analytical process is known as logico-inductive or hypothetico-inductive analysis

• A very subjective process—bias is a strong possibility

Validity of Qualitative Research—Do the findings match the studied reality (ies)?

Methods to ensure valid inferences:
  o Triangulate: Use 3 or more data sources and data methods
  o Member check
  o Long term observation
  o Peer examination
  o Researcher clarifying one’s biases and prejudices

Reliability of Qualitative Research—Are the results dependable and consistent?

Methods to ensure reliability:
  o Present personal position and theory related to research
  o Triangulate data sources and methods
  o Carefully explain data collection and analyses
Class # 9A
Content Analysis

Content Analysis
- Study human behavior through analysis of their communication
  - Interview transcripts
  - Observation field notes
  - Textbooks
  - Essays
  - Newspapers
  - Brochures
  - Advertisements
  - Movies
  - Etc
- Seeks to reveal patterns or themes by categorizing information
- Relies upon coding schema

Constant Comparative Method (Lincoln & Guba, 1985)
1. Unitizing
   - smallest pieces of meaning information are cut up
   - units are coded for respondent, site, and episode
2. Categorizing
   - units are placed in "intuitive" categories
   - researcher attempts to identify properties for each category
   - categories are named/ rules for inclusion developed
   - units placed in named categories and reviewed in terms of rules
   - sorting process continues
   - categories are reviewed for overlap
   - categories are examined to determine possible relationships
3. Filling in patterns
   - incomplete/missing categories are fleshed out
     - collect more data that builds on known categories
   - stop data collection when:
     - incidents are exhausted
     - categories become saturated
     - regularities emerge
     - overextension occurs--new info does not relate to est. categories
4. Member checking
   - researcher offers his/her reconstruction of data to participant so they can determine if is a reasonable
     representation of reality
   - researcher may take reconstruction to an external individual for assessment

The Nature of Ethnographic Research
- Research process used in the study of human interactions in social settings
- Document or portray everyday experiences of individuals
- A highly descriptive, holistic approach to research
- Topics must involve people in groups
- May last from a week to several years
- Excellent at constructing a VERY detailed picture of human life and interactions
Ethnographic Concepts

- **Culture**—
  - The sum of a social group's observable patterns of behavior, customs, and ways of life
  - Ideas, beliefs, and knowledge that characterize a particular group of people
- **Holistic Perspective**—understand and describe the BIG picture
- **Contextualization**—need to always keep in mind the larger context of the situation
- **Emic Perspective**—the "insider's perspective of reality"
- **Thick Description**—describe what is seen and heard in great detail
- **Member Checking**—checking presentation of participant's perspective by having participants review written summary
- **Nonjudgmental Orientation**—refrain from making value judgments about unfamiliar practices

A Summary Description of Ethnographic Research

**Purpose**—to describe/explain segment of group social life as it pertains to education
**Hypotheses/questions**—begin as broad statements; emerge more specifically as data are collected
**Data**—qualitative; verbal descriptions of people, interactions, settings, etc. within the specific context
**Data sources**—people, settings, etc.
**Data collection**—done by researcher, through observations and interviews (naturalistic observation)
**Data analysis**—presentation of verbal descriptions through logical analysis in an attempt to discover themes/patterns that exist in a particular context

Strengths and Weaknesses of Ethnographic Research

**Strengths:**
- Its holistic nature (as opposed to a "snapshot study")

**Weaknesses:**
- A single observer calls into question the reliability of the data (and therefore, the validity of the results)
- Must determine if biases exist...if observations are accurate

The Nature of Descriptive Research and Historical Research

- Two fairly similar approaches to research
- **Summary description:**
  - **Purpose**—to show status by describing and then interpreting present (descriptive) and past (historical) situations, events, etc.
  - **Hypotheses/questions**—research questions are used more than hypotheses
  - **Data**—descriptions, analyses, opinions, scores, measurements, and statements from interviews, questionnaires, etc.
  - **Data sources**—participants, procedures, informants, settings, records, objects, documents
  - **Data collection**—done by researcher, through administration of tests, questionnaires, and interviews
  - **Data analysis**—presentation of data in organized fashion (historical); sometimes data are converted to numbers for simplification and/or further analyses (descriptive/historical)
- May be brief (descriptive) or substantially longer (historical)
Action Research

- A “catchall” label for research done by teachers, administrators, and other on-site educators
- Less formal research; Purpose is to solve local problems
- Major benefit—provides an immediate solution to a problem
- Major drawback—less precise; subject to errors (bias, validity, reliability); results in limited findings

The Action Research Process

1. Identify a problem or need
2. Collect information and resources
3. Prepare objectives, activities, procedures
4. Implement the project
5. Monitor the procedures, participant reactions, etc.
6. Identify strengths & weaknesses of the project
7. Revise project by focusing on the identified weaknesses
8. Assess on-going & long-term results of the project
## Research Designs

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Practice Problems

1. What is the effect of gender on GPA?

2. What is the relationship between student tardiness and detention?

3. What are students' perceptions of homework?

4. A class of students who receive computer-based tutorials in math is compared to a class of students who receive traditional tutorials. Do the students receiving computer-based tutorials outperform students who do not in math achievement?

5. What are the experiences of first year elementary teachers?

6. Do students approve of the new school lunch menu?

7. What is the effect of family status on self-esteem?

8. What disciplinary policies has BGHS implemented in the last 20 years?

9. What behavioral characteristics are associated with depression?

10. A group of physically challenged students receives an innovative therapy to increase mobility, while another group receives traditional therapy. Individuals were randomly assigned to groups. What is the effect of this treatment on these students' mobility?
Writing YOUR Research Proposal

Section I should address the following areas:

**Introduction & Rationale** (1 pg minimum)
- Introduces reader to problem
- Provides evidence that substantiates problem’s existence
- Substantiates need to conduct the proposed study
- Use citations

**Purpose of Study** (1/2 pg minimum)
- Presents clear purpose(s) of study
- Provides operational definitions of independent & dependent variables
- Briefly explains methodology

**Definition of Terms** (1/2 pg minimum)
- Provides constitutive definitions of variables and other unclear terms

**Research Question(s) or Alternative Hypotheses** (list)

Your literature review (Section 2) should address the following areas:

**Introduction** (1/2 pg minimum)
- provides reader with a context and historical perspective of the research
- presents the organizational structure of the literature review (subheadings of the body)
- *good place to cite secondary sources*

**Body** with at least two subheadings (4 pg minimum)
- research is organized under two or more subheadings
- each research study summarized addresses: sample, methods, results
- transitions are used to introduce each subheading
- five or more studies are reviewed
- majority of citations are within the past 5 to 10 years

**Summary** (1/2 pg minimum)
- recaps critical findings of research just presented
- discusses the gap in the research and how your research will fill this gap

Section 3 should address the following areas:

**Participants** (1/2 pg minimum)
- Describe sample - size and characteristics
- Describe sampling method

**Instrumentation** (1/2 pg minimum)
- Describe instrument(s) used to collect data
- Purpose, content, administration, and scoring
- Validity/reliability of instruments

**Design** (1/2 pg minimum)
- Identify the research design being used and how your study fits this design

**Procedures** (1/2 pg minimum)
- Describe procedures used to collect data so that other may replicate this study
- If using a treatment, describe here.

**Proposed Data Analysis**
- Describe the data analysis methods (descriptive & inferential) to be used and why they are being used

**Null Hypotheses** (if appropriate) - list

**Assumptions and Limitations** (1/2 pg minimum)
Helpful Hints for Writing Your Research Proposal

1. **Avoid run-ons.**

   **Mistake:** The students will take a learning styles inventory and the instructor will utilize appropriate teaching methods.

   **Correction:** The students will take a learning styles inventory, and the instructor will utilize appropriate teaching methods.

2. **Avoid fragments.**

   **Mistake:** While millions of people are dying of starvation. ("While" makes this a dependent clause).

   **Correction:** While millions of people are dying of starvation, we have an abundance of food.

3. **Use transitions** that bridge ideas between sentences, paragraph, and chapters.

   - **time transitions:** then, next, after, while, since
   - **cause-effect transitions:** because, since, therefore, consequently, as a result, thus
   - **agreement transitions:** moreover, furthermore, also, then, in fact, in addition, similarly
   - **contrast transitions:** however, but, on the other hand, yet, conversely, although, whereas

4. **Check for parallel structure.**

   **Mistake:** The students learned fractions, spelling, and read a book.

   **Correction:** The students learned fractions, spelled various words, and read a book.

5. **Don’t confuse which and that.** Use "that" when the clause is essential to the meaning of the sentence. Use "which" when the clause just adds further information and is set off by commas.

   **Proper use:** The animals that performed well in the first experiment were used in the second experiment.

   **Proper use:** This class, which requires a research proposal, meets once a week.

6. **Do NOT use personal pronouns** (only exception is for a qualitative study).

7. **Avoid general words like:** it, there

8. **Do NOT begin a sentence with a number.** Spell it out if necessary.

9. **Avoid contractions and other informal language:** look at, make, see if

10. **Avoid rhetorical questions.**

**Reminders for APA style**

**Citations for Direct quotes**—See APA, p. 117.

1. Must cite: author, year, AND page number.

2. End quotation mark immediately follows end of quote; period follows citation.

3. Follow examples below. Note: "and" is used in text; & is used in citation.

   Bhatti, Derezotes, Kim, and Specht (1989) state that "There is no solid evidence that counseling and psychotherapy can increase self-esteem" (p. 61).

   or

   "There is no solid evidence that counseling and psychotherapy can increase self-esteem" (Bhatti, Derezotes, Kim, & Specht, 1989, p. 61).
**Citations for Paraphrased Material**—See APA, p. 207.
1. Must cite author and year.
2. No quotation marks.
3. Follow APA examples for multiple authors on p. 208.

**References**—See APA, p. 222.
1. Double space all references.
2. For each reference, do not indent first line, indent (.5”) all subsequent lines.
3. Italicize titles of books and journals only. For journals, italics continue through the volume number and stops before the issue number.
4. Only journal titles are capitalized throughout title.

**Formatting**
1. Section headings are centered. Subheadings are left justified and italicized.
2. Page numbering—place in the upper right corner (.5” top, 1” right)
3. Margins: 1” top, bottom, left and right

**Follow APA paper example on p. 306!!!!!!**

*APA-Style Helper 2.0* ([http://www.apa.org/apa-style](http://www.apa.org/apa-style))