

# Week 6

# Quantitative Research Design

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# Overview

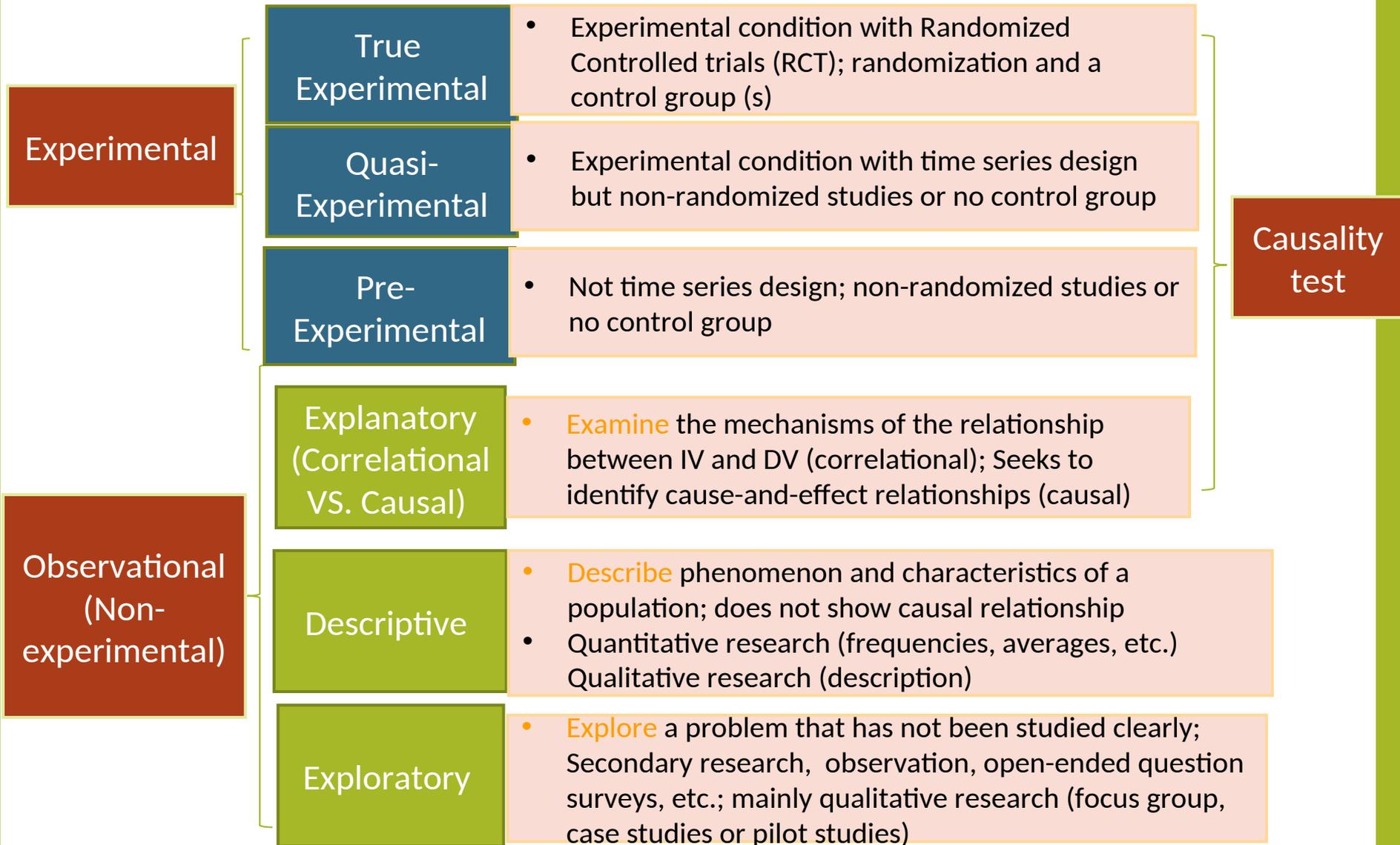
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- Types of Quantitative Research Design
- Criteria for Inferring Causality
- Internal Validity
- External Validity
- Non- Experimental Design
- Pre-Experimental Pilot Studies
- Quasi-Experimental Designs
- Experimental Designs

# What is Quantitative Research?

- Quantitative research is a systematic and scientific **investigation of data and their relationships**. (Cohen, Manion & Morrison, 2004)
- Main goal of quantitative study is prediction- correlation or causality
- Objectives are developing and employing mathematical models, theories and hypotheses pertaining to phenomena.

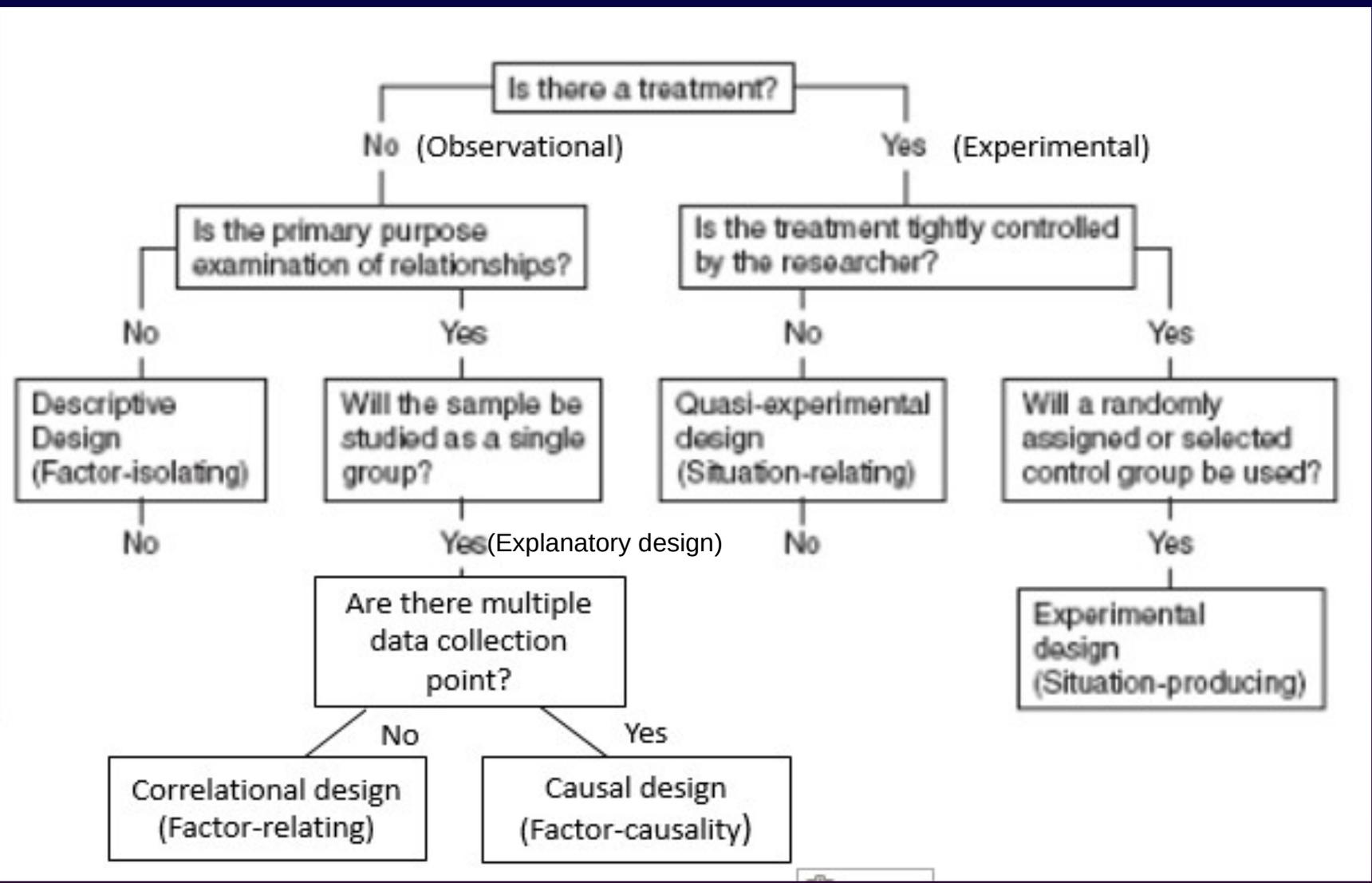
# Types of Quantitative Research Design



# Discuss

- 1) How do we decide what to use for our quantitative research?
- 2) When should we go descriptive?
- 3) When do we go for correlational research?
- 4) When do we conduct a causal-comparative research?
- 5) When do we go for quasi-experimental research?
- 6) When do we go for experimental research?

# Different Quantitative Studies



# Criteria for Inferring Causality

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- 1) Cause (independent variable) must precede the effect (dependent variable) in time
- 2) The two variables are empirically correlated with one another
- 3) The observed empirical correlation between the two variables can not be due to the influence of a third variable that causes the two under consideration

# Terms- Internal Validity

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- Depends on the extent to which the 3 criteria for causality are met
- Refers to whether or not causal inferences can be drawn from the results

# Terms- External Validity

- The extent to which we can generalize the findings of a study to settings and populations beyond the study conditions

# Terms- Randomization

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- Controls for *selection bias* in experimental designs
- Participants are divided into groups using procedures based on probability theory
- Improves the likelihood that the control group represents what the experimental group would look like had it not been exposed to the experimental stimulus

# Terms- Control Groups

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- Used in experimental design
- Often, control groups receive usual care in place of the experimental intervention
  - Compares experimental intervention to treatment as usual
- Ethical considerations require that services be provided to many control groups

# I. Non-Experimental Design

# Exploratory Research Design

## Purposes

- 1) Formulate a problem or define a problem more precisely
- 2) Develop hypothesis
- 3) Gain insights for developing an approach to the problem
- 4) Establish priorities for further research

## Methods

- 1) Survey of Experts
- 2) Pilot Surveys
- 3) Secondary Data Analysis
- 4) Qualitative Research

# Example of Exploratory Research Design

- A fresh or inconclusive murder case will be investigated using exploratory research because it has not been investigated clearly in the past. To gain a better understanding of how exploratory research is used to conduct a murder investigation, let us review this popular crime movie titled [Murder on the Orient Express](#).
- The **how** consists of the murder weapon, **how** it was used, the time he was murdered, etc. The last piece of information the detective needed to nail the culprit was the **why**.

# Example of Exploratory Research Design

- In order to find the relationship between an increased rate of charity and crime rate in a community, exploratory research or explanatory research can be used. Distinction between those two is that the former may use observations or open-ended questions to understand subjects and phenomenon for future research, while the latter may use valid and reliable variables (could be standardized measurements) to examine causal relationship. The former could be a pilot study of the latter.

# Descriptive Research Design

No testable variables and hypotheses, but rather describing a situation that has not been described before.

## Purposes

- 1) Describe the characteristics of relevant groups
- 2) Estimate the percentage of units in a certain group with a distinctive behavior
- 3) Identify what factors affecting DV

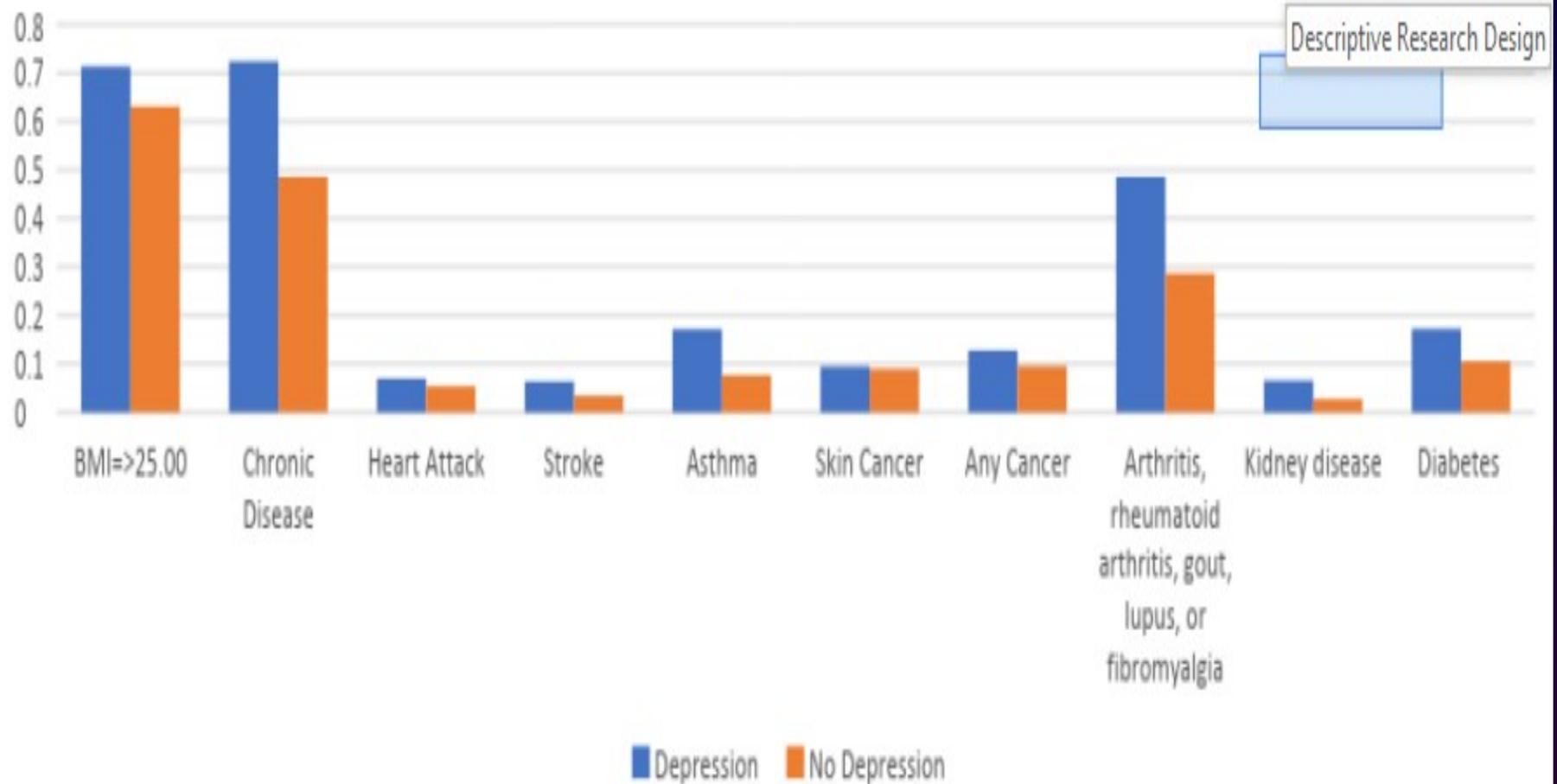
Question: What are the most important factors that influence the career choices of Nyack College students?  
Variable: Factors influencing career choices (Salary, career prospects, Religion)  
Group: Nyack College students

## 4) Somewhat show associations between two factors

Question: What proportion of Nyack College male and female students use the top 5 social networks?  
Variable: Use of top 5 social networks (i.e. Facebook, MySpace, Twitter, LinkedIn, and Classmates)  
Group:  
1. Male, Nyack College students  
2. Female, Nyack College students

Methods- Survey, Observation , Interviews, Portfolios

Figure 1: for Health Status in Comparison between People with Mental Illness (MI) and without Mental Illness (MI)



# Example of descriptive research

- To describe what factors **may** contribute to homelessness in NY, research staff conducted a survey in two homeless shelters to collect data. Based on literature review, the survey included history of domestic violence, mental illness, substance use, income and housing status before being homeless, etc.

# Explanatory Research Design

## Purposes

- 1) Determine the degree to which two variables are associated
- 2) Determine what factors affecting a problem by assessing the impact of factors on DV.
- 3) With longitudinal data, examine causation between two variables

## Methods

- 1) Survey
- 2) Secondary analysis
- 3) Interviews
- 4) Case analysis
- 5) Observation

- Finding a Causal relationship of two variables depends on the type of data

# Example of Explanatory Research Design

- Adolescent pregnancy has been an epidemic plague recently. Previous research indicated that low SES was found among adolescents who had given birth. The purpose of this correlational study will assess the relationship between SES and reproductive health behavior. For this study, reproductive health behavior measure (DV) and SES (i.e. IVs- income, parents' education level, immigration status and health insurance) were used, while other socio-demographic factors (i.e., race, etc.) were controlled. The study sample will be collected from two local high schools in Bergen county, NJ.
- Hypothesis- SES is positively associated with reproductive health behavior.

# Explanatory Research design

- Life satisfaction declines in middle age. In the US, two cultural characteristics (collectivistic culture and individualistic culture) are common. The purpose of this study is examining the impact of cultural difference on life satisfaction among middle aged people. This study will conduct a survey that include cultural variations and life satisfaction. An independent t-test will be conducted to investigate whether there are differences in life satisfaction across culture (collectivistic culture VS. Individualistic Culture).
- Hypothesis- There are differences life satisfaction scores between two groups.

# Explanatory Research Design

- Opioid crisis has received much attention, especially among adolescents, in the US. There are many factors affect opioid use among adolescents. Previous research indicated that psychosocial relationship factors (i.e., levels of family support and peer-pressure) may be associated with opioid use in adolescents. The purpose of this study is examining the relationship between psychosocial relationship factors and opioid use among youths. A researcher will use attitude toward opioid use survey (DV), family support measure (IV) and resistance to peer pressure measure (IV). A multiple regression was conducted for this study.
- Hypothesis-

# Explanatory Research Design

- At least 5 % of adolescents experience an episode of major depression. According to the diathesis-stress theories in the context life stress, a combined effect of life stress and biological factor (i.e., family history of depression) have a great influence on the development of depression among youths. This study will examine the effect of life stress and family history of depression on adolescent depression. A depression rating scale (DV), major life events scale (IV) and family history of depression (IV) will be used. This study will conduct a multiple regression analysis.
- Hypothesis-

# Explanatory Research Design

- There is a growing body of research on violence among bipolar disorder. However, the relationship between violence and bipolar disorder is still uncertain. This study's purpose is to examine the relationship between violence and bipolar disorder in the prison. A hypomanic personality scale (HPS-20) (DV) and a severe violence scale will be used for this study. A Pearson's correlation analysis will be conducted to test the correlation between IV and DV.
- Hypothesis-The score of HPS-20 is positively associated with severe violence scale. – Should make sure.

# Explanatory research

- Substance abuse among adolescents is an ongoing problem. Research indicated that psychosocial factors including family functioning , economic hardship, and peer pressure can contribute to substance abuse among adolescents. The purpose of this study is to identify factors affecting substance abuse. This study will collect data from three local high schools in NJ. This study will use family support measure (IV), resistance to peer pressure measure (IV) and family economic hardship measure (IV) and Revised POSIT substance use/abuse scale (DV). A multiple regression analysis will be conducted to examine the effect of factors on substance use disorder.
- Hypothesis-

# Explanatory Research Design

- An estimate of 76.6% of those involved in the correctional systems reoffend once released into the community. Psychological distress is one of the important determinant of recidivism. Thus, mental health problems has garnered great attention for released prisoners. Recently, a local agency launched a new program for mental health need of released prisoners. The agency is tracking recidivism rates of program participants. This study used Brief symptom inventory-18 to measure psychological distress of released prisoners. A logistic regression was used to test whether psychological distress is associated with recidivism of released prisoners within 5 year.
- Hypothesis-

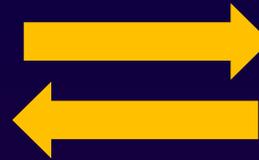
# Environmental Resources

Crime Rate (?)

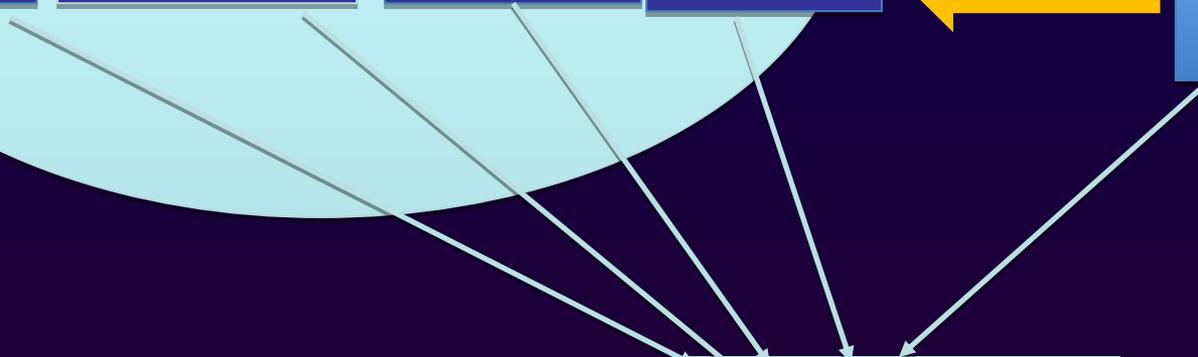
Employment

Education

Poverty



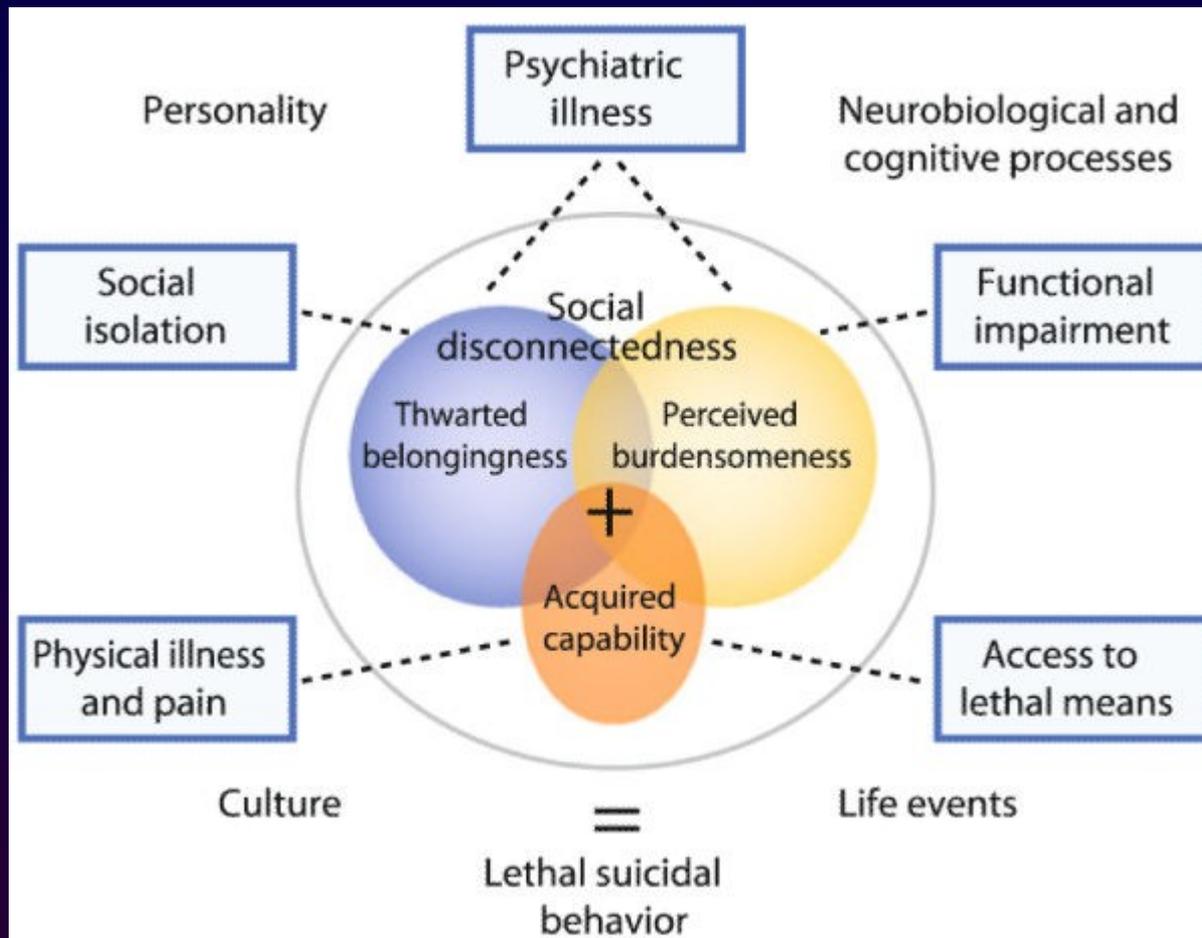
Mental health problems



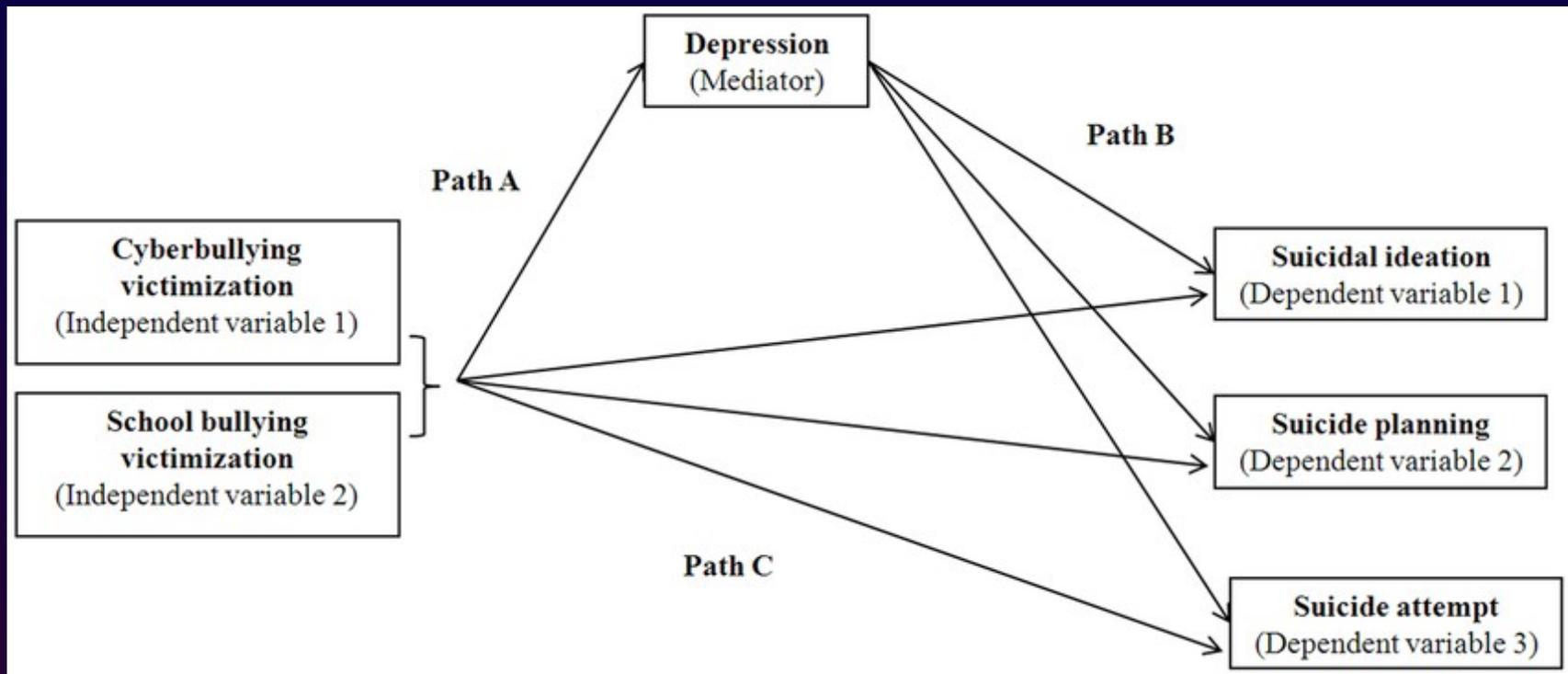
Recidivism  
(rearrest)

# Explanatory research

- During this critical period of development and adolescent research suicide remains a major public health problem in the US. Experience of school bullying can cause trauma, which in turn increase suicide ideation among adolescents. The purpose of this research is examining relationships among school bullying, trauma and suicide ideation. For this study, experience of school bullying (IV), child and adolescent trauma screen (MV) and suicide ideation (DV) were identified as variables. A mediation analysis will be conducted to find a mediation effect of trauma between school bullying and suicide ideation.
- Hypothesis- Relationship between IV and DV is mediated by trauma among adolescents.



## Interpersonal theory of suicide



[https://www.researchgate.net/figure/Mediational-model-for-study-of-the-relationship-between-cyberbullying-and-school-bullying\\_fig5\\_264389671](https://www.researchgate.net/figure/Mediational-model-for-study-of-the-relationship-between-cyberbullying-and-school-bullying_fig5_264389671)

## II. Experimental Design

Pre-experimental design	Quasi-experimental design	True experimental design
<ul style="list-style-type: none"> <li>• One shot case design</li> <li>• One group pretest-post test design</li> </ul>	<ul style="list-style-type: none"> <li>• Nonequivalent comparison groups design</li> <li>• Time series design</li> </ul>	<ul style="list-style-type: none"> <li>• Post-test only control design</li> <li>• Pre-test post-test control group design</li> <li>• Solomon four group design</li> <li>• Alternative Treatment Design with Pretest</li> <li>• Dismantling studies</li> </ul>
<p><b><u>Features</u></b></p> <ul style="list-style-type: none"> <li>• Manipulation of independent variables</li> <li>• Limited control over the extraneous variable</li> <li>• No randomization and control group</li> </ul>	<p><b><u>Features</u></b></p> <ul style="list-style-type: none"> <li>• Manipulation of independent variables</li> <li>• Absence of either randomization and control group</li> </ul>	<p><b><u>Features</u></b></p> <ul style="list-style-type: none"> <li>• Manipulation of independent variables</li> <li>• Presence of both randomization and control group</li> </ul>

# Pre-experimental Pilot Studies

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- Very limited degree of internal validity
- Exploratory or descriptive purposes, such as:
  - To generate tentative exploratory or descriptive information regarding a new intervention about which little is known
  - To learn whether it is feasible to provide the new intervention as intended
  - To identify obstacles in carrying out methodological aspects of a more internally valid design that is planned for the future
  - To see if the hypothesis for a more rigorous study remains plausible based on the pilot study results

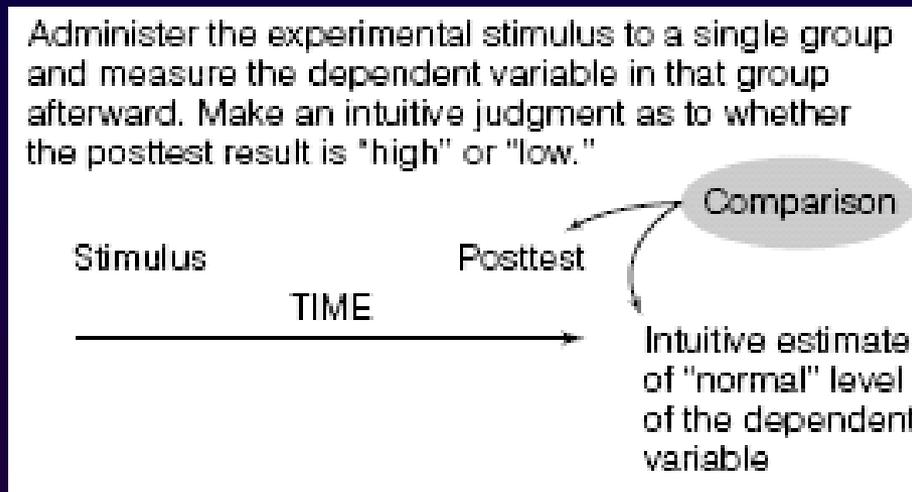
# Common Pre-Experimental Designs

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- One-shot Case Study
- One-Group Pretest-Posttest Design
- Posttest-Only Design with Nonequivalent Groups

# One-Shot Case Study

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X

O

Fails to control for any threats to internal validity

# One Group Pretest-posttest Design

## THE ONE-GROUP PRETEST-POSTTEST DESIGN

Measure the dependent variable in a single group, administer the experimental stimulus, and then remeasure the dependent variable. Compare pretest and posttest results.



01

X

02

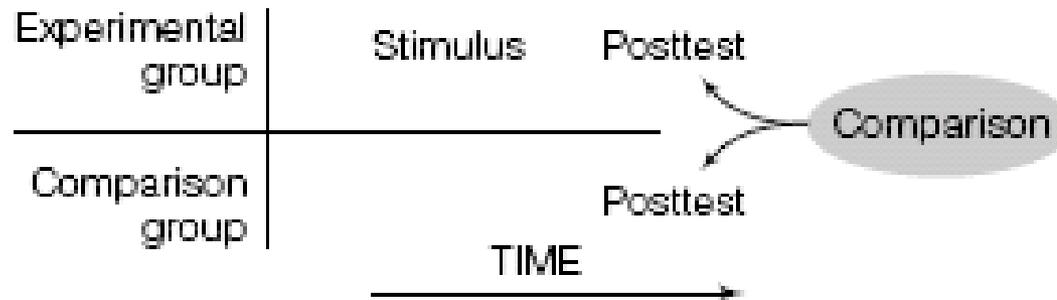
Establishes correlation and time order but does not account for factors other than the independent variable that might cause change in the dependent variable

# Pre-experimental Research

- CBT is well-known EBP for treatment of anxiety. Especially youths who experience **school bullying** suffer from symptoms of anxiety. Previous study indicated that CBT could be effective for adolescents who suffer from anxiety disorder. 35 youths who recently experience school bullying were referred to the local agency. Agency will provide CBT for these youths. The purpose of this study is to examine the effective of CBT for youths who experience school bullying. A researcher will conduct pre- & post-test (paired samples t-test) to examine the effectiveness of CBT by measuring anxiety level of youths.
- Hypothesis- Anxiety level is decreased after the 4-months CBT.

# Posttest Only Design with Nonequivalent Groups

Administer the experimental stimulus to one group (the experimental group), then measure the dependent variable in both the experimental group and a comparison group.



X

O

O

Can not infer that any difference between the two groups was caused by the intervention

# Quasi-experimental Designs

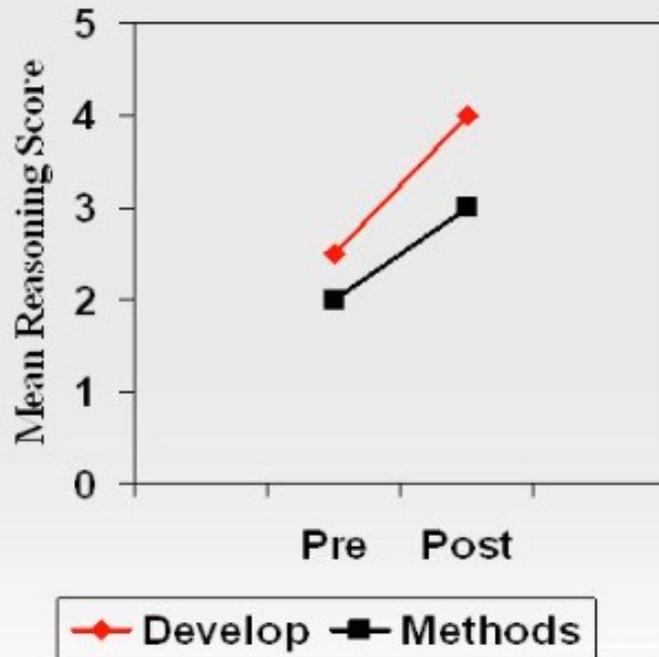
- Designs that attempt to control for threats to internal validity and thus permit causal inferences but are distinguished from true experiments primarily by the lack of random assignment of subjects
- Useful when it is not feasible to obtain a control group
- When conducted properly can obtain a reasonable degree of internal validity
- Three common quasi-experimental designs will be examined:
  - Nonequivalent comparison group designs
  - Simple time-series designs
  - Multiple time-series designs

# Nonequivalent Comparison Groups Designs

- Two existing groups that appear to be similar are identified or created
- The dependent variable is assessed before and after an intervention is introduced to one of the groups
- Comparison group does not receive the intervention

$O_1$	$X$	$O_2$
$O_1$		$O_2$

# Example of Nonequivalent Comparison Control Designs



- **Intervention: critical thinking seminar**
- **Research Methods students receive the intervention (i.e., participate in the critical thinking seminar)**
- **Developmental Psychology students are used as a nonequivalent control group (i.e., do not attend the seminar)**

# Time-Series Designs (Single Subject Research Design)

- A simple interrupted time-series design attempts to develop causal inferences based on a comparison of trends over multiple measurements before and after an intervention is introduced and requires no comparison group

O<sub>1</sub> O<sub>2</sub> O<sub>3</sub> O<sub>4</sub> O<sub>5</sub> X O<sub>6</sub> O<sub>7</sub> O<sub>8</sub> O<sub>9</sub> O<sub>10</sub>

- A multiple time series design- add a comparison group to the simple interrupted time- series designs

O<sub>1</sub> O<sub>2</sub> O<sub>3</sub> O<sub>4</sub> O<sub>5</sub> X O<sub>6</sub> O<sub>7</sub> O<sub>8</sub> O<sub>9</sub> O<sub>10</sub>  
O<sub>1</sub> O<sub>2</sub> O<sub>3</sub> O<sub>4</sub> O<sub>5</sub> O<sub>6</sub> O<sub>7</sub> O<sub>8</sub> O<sub>9</sub> O<sub>10</sub>

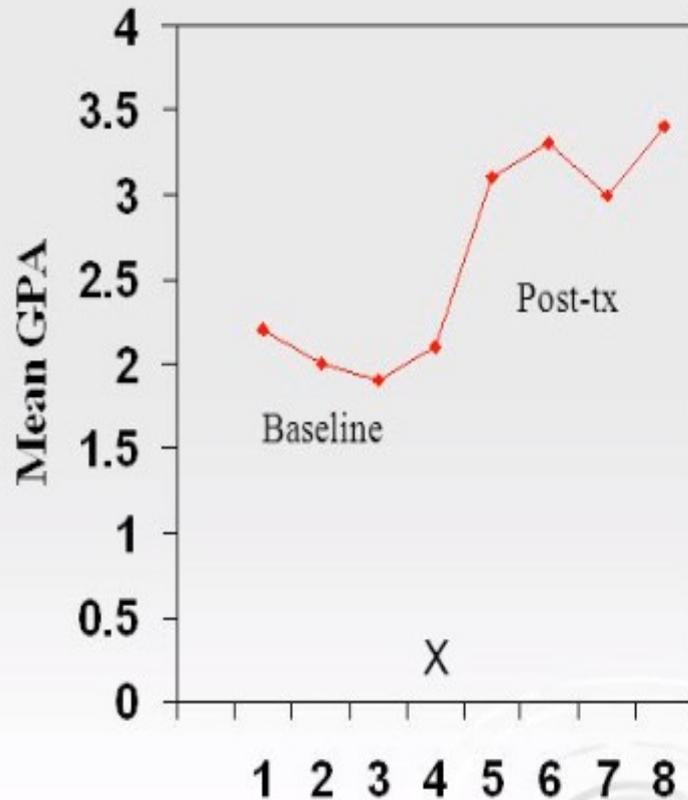
# Single Subject Research (Evaluation) Design (SSRD)

- Also known as Single case, single subject designs, or *N*-or-1 designs
- “SSRDs... are research formats that permit uncontrolled program evaluation and controlled experiments with only one subject, one group, or one system” (Wong, 2015)
- “SSRD refers to the repeated collection of information on a single client or client system over a period of time in a planned systematic fashion” (Campbell, 1992, p.336)

# What are Single System Research Designs (SSRD)?

- May be used to evaluate individuals, group work, or communities (micro, mezzo or macro)
- Contain both quantitative and qualitative aspects
- Qualitative – Using only outcome measures (Narratives) with sufficient reliability and validity; can use simple dichotomous measures (e.g. school attendance, urine test, etc.); can make visual inference from line graphs
- Quantitative- Usually quantitative measurement; presentation of SSRD data as simple line graphs; no inferential statistics

# Example of Time-series design



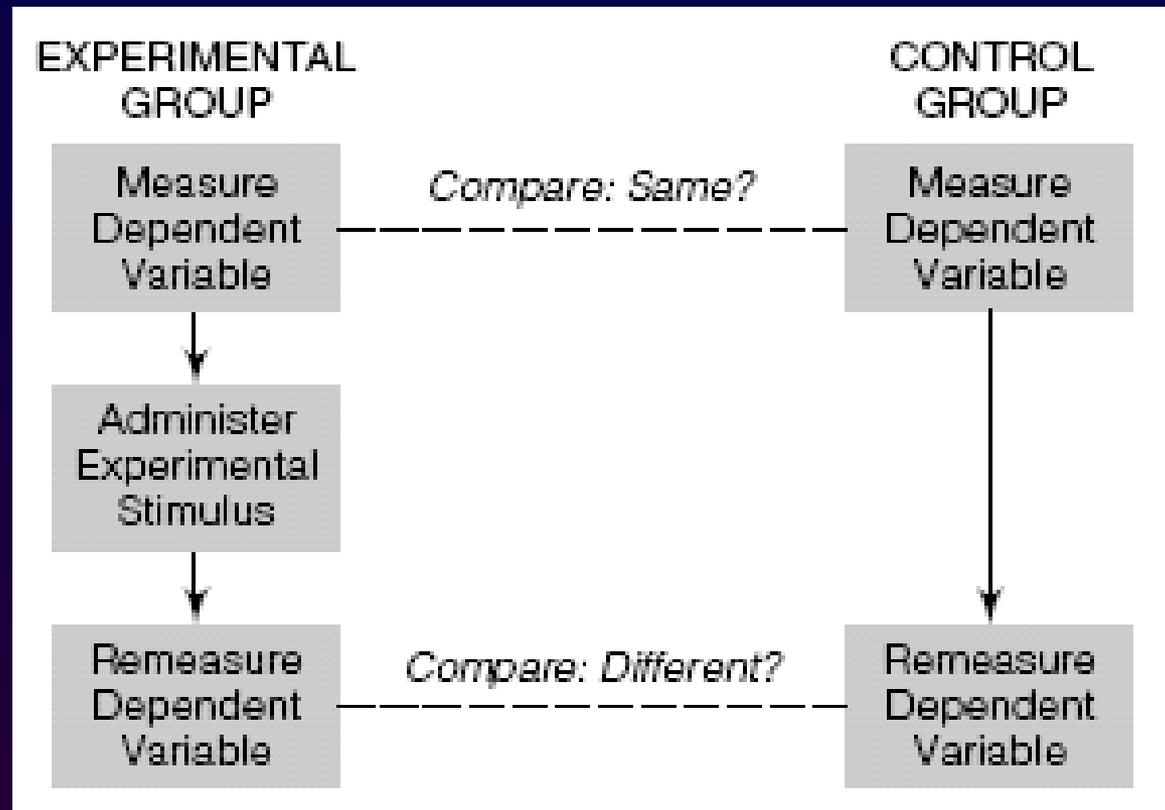
- **Intervention:**  
**Course to change students' study habits, implemented during the summer (after semester 4).**
- **DV: semester GPA**

# Experimental Designs

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- Best causal evidence comes from designs with strong internal validity
- Experimental designs provide maximum control for threats to internal validity

# Diagram of a Basic Experimental Design



R            O<sub>1</sub>    X    O<sub>2</sub>  
R            O<sub>1</sub>            O<sub>2</sub>

# Pretest-Posttest Control Group Design

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- $R$      $O1$      $X$      $O2$
- $R$      $O1$              $O2$

- Does not control for possible impact of testing and retesting

# POSTTEST-ONLY CONTROL GROUP DESIGN

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- $R \quad X \quad O$
- $R \quad O$

- Avoids testing/retesting impact
- Pre-testing not possible in some experiments
- Assumes that the process of random assignment removes any significant initial differences between experimental and control groups

# Solomon Four-Group Design

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- $R$      $O1$      $X$      $O2$
  - $R$      $O1$              $O2$
  - $R$              $X$      $O2$
  - $R$                      $O2$
- 
- Assesses amount of pretest-posttest change while checking for testing effects

# Alternative Treatment Design with Pretest

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- $R$        $O1$        $XA$        $O2$
- $R$        $O1$        $XB$        $O2$
- $R$        $O1$                        $O2$

- If the first two rows both show approximately the same amounts of improvement, and both amounts are more than in the third row, that would indicate that both treatments are approximately equally effective. But if the third row shows the same degree of improvement as in the first two rows, then neither treatment would appear to be effective. Instead, we would attribute the improvement in all three rows to an alternative explanation such as history or the passage of time.
- Some experiments use the first two rows of this design but not the third row. They compare the two treatments to each other but not to a control group. They can have conclusive, valid findings if one group improves significantly more than the other. But suppose they both have roughly the same amount of improvement. The temptation would be to call them equally effective. However, with no control group, we cannot rule out threats to internal validity, such as history or the passage of time, as alternative explanations of the improvement in both groups

# Dismantling Studies

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- $R$        $O1$        $XAB$        $O2$
- $R$        $O1$        $XA$        $O2$
- $R$        $O1$        $XB$        $O2$
- $R$        $O1$                        $O2$

- Shows not only whether an intervention is effective, but also which components of the intervention may or may not be necessary to achieve its effects.