



Title of Resource Activity: Determining Statistical Design and Analysis

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Brief Description: This activity provides students with 8 descriptions of research and asks them to identify elements of the research design in order to match the most appropriate statistic to the study. An answer key is provided as well as a brief guide for determining the appropriate statistical analysis.

Keywords: Matching Statistics to Designs; Identifying IVs & DVs; Identifying NOIR; Identifying Between vs. Within-Subjects Designs

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Instructors:

This activity should take approximately 30 minutes. Students could work individually or in groups to answer the questions.

Name: _____

Determining Design and Statistical Analysis

For each of the studies, please indicate the following:

- | | |
|--|--|
| 1) Independent variable(s). True/quasi? | 5) The level of measurement (NOIR) of the DV |
| 2) Is there more than 1 IV? | 6) Between(BS) or within-subjects (WS)? |
| 3) The levels the independent variable(s) | 7) What type of design is being used? |
| 4) Dependent variable.
(for correlation, list all variables here) | 8) What is the appropriate statistic? |

**If a question isn't applicable to a particular design, please note that as well*

Study 1: A team of cognitive psychologists conducted a study on the effects of sleep deprivation on short-term memory decay. Forty-eight subjects stayed in a lab for two days. Twenty-four of the subjects are randomly assigned to a condition in which they are not permitted to sleep during that period. The other twenty-four are allowed to sleep whenever they want. At the end of the two days, the subjects complete a task that involves reading a list of 20 words, then recalling as many words as possible.

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|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

Study 2: A researcher examined the effect of different kinds of music on general math ability. Forty-eight subjects were randomly assigned to do a series of math tasks under one of three conditions: 16 while listening to soft gentle music, 16 while listening to loud intense music, and 16 while in silence. The math quiz contained arithmetic, geometry, and word problems. There were 25 items that were 2 points each.

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|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

Study 3: A health psychologist conducted a study on the how the number of hours a person exercised each week relates to the number of days being sick per year. Participants were randomly selected from the community and provided self-reports through a series of questions on the topics of interest.

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|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

Study 4: A study was designed to test the effects of science fiction movies on participants' belief in the supernatural. A scale was designed to measure the degree that a subject believes in the supernatural on a 1-7 Likert Scale (high scores indicate high levels of belief). Fifty-seven subjects, selected via random digit dialing (RDD) responded to the scale before and after watching Return of the Jedi, a popular science fiction movie.

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|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

Study 5: A researcher at a drug treatment center wanted to determine the best combination of treatments that would lead to more substance free days. This researcher believed there were two key factors in helping drug addiction: type of treatment and type of counseling. The researcher was interested in either residential or outpatient treatment programs and either cognitive-behavioral, psychodynamic, or client-centered counseling approaches. As new clients enrolled at the center they were randomly assigned to one of six experimental groups. After 3 months of treatment, each client's symptoms were measured.

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|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

Study 6: An organizational psychologist is hired as a consultant by a person planning to open a coffee house for college students. The coffee house owner wants to know if her customers will drink more coffee depending on the ambience of the coffee house. To test this, the psychologist sets up three similar rooms, each with its own theme (Tropical; Old Library; or New York Café) then arranges to have thirty students spend an afternoon in each room while being allowed to drink all the coffee they like. (The order in which they sit in the rooms is counterbalanced.) The amount each participant drinks is recorded for each of the three themes.

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|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

Study 7: A director of a small psychotherapy clinic is trying to plan hiring of temporary staff to assist with intake. She is wondering if there was any difference in the use of the clinic during different seasons of the year. Last year, there were a total of 128 new clients. To see if there is a difference by season she looks at how many clients previously enrolled during each season.

- | | |
|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

Study 8: A manager at a retail store in the mall wants to increase profit. The manager wants to see if the store's layout (one main circular path vs. a grid system of paths) influences how much money is spent depending on whether there is a sale. The belief is that when there is a sale customers like a grid layout, while customers prefer a circular layout when there is no sale. Over two days the manager alternates the store layout, and has the same group of customers come each day. Based on random assignment, half of the customers told there is a sale (20 % will be taken off the final purchases), while the other half is told there is no sale. At the end of each day, the manager calculates the profit.

- | | |
|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 8) _____ |

ANSWER KEY

Determining Design and Statistical Analysis

For each of the studies, please indicate the following:

- | | |
|--|--|
| 1) Independent variable(s). True/quasi? | 5) The level of measurement (NOIR) of the DV |
| 2) Is there more than 1 IV? | 6) Between(BS) or within-subjects (WS)? |
| 3) The levels the independent variable(s) | 7) What type of design is being used? |
| 4) Dependent variable.
(for correlation, list all variables here) | 8) What is the appropriate statistic? |

Study 1: A team of cognitive psychologists conducted a study on the effects of sleep deprivation on short-term memory decay. Forty-eight subjects stayed in a lab for two days. Twenty-four of the subjects are randomly assigned to a condition in which they are not permitted to sleep during that period. The other twenty-four are allowed to sleep whenever they want. At the end of the two days, the subjects complete a task that involves reading a list of 20 words, then recalling as many words as possible.

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|---|----------------------------------|
| 1) Sleep Deprivation (True) | 5) Ratio |
| 2) No | 6) Between-Subjects |
| 3) No Sleep vs. Sleep Whenever | 7) Two-Group (Simple Experiment) |
| 4) Short-term memory decay (recall list 20 words) | 8) t test for independent means |

Study 2: A researcher examined the effect of different kinds of music on general math ability. Forty-eight subjects were randomly assigned to do a series of math tasks under one of three conditions: 16 while listening to soft gentle music, 16 while listening to loud intense music, and 16 while in silence. The math quiz contained arithmetic, geometry, and word problems. There were 25 items that were 2 points each.

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|---|---|
| 1) Type of Music (True) | 5) Ratio |
| 2) No | 6) Between-Subjects |
| 3) Soft/Gentle vs. Loud/Intense vs. Silence | 7) Multi-Group Design |
| 4) Score on Quiz | 8) One-Way Analysis of Variance (ANOVA) |

Study 3: A health psychologist conducted a study on the how the number of hours a person exercised each week relates to the number of days being sick per year. Participants were randomly selected from the community and provided self-reports through a series of questions on the topics of interest.

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|--|----------------------------|
| 1) Not Applicable (Correlational Design) | 5) Ratio |
| 2) Not Applicable | 6) Not Applicable |
| 3) Not Applicable (Correlational Design) | 7) Survey |
| 4) Hours exercised & Number of Sick Days | 8) Correlation (Bivariate) |

Study 4: A study was designed to test the effects of science fiction movies on participants' belief in the supernatural. A scale was designed to measure the degree that a subject believes in the supernatural (high scores indicate high levels of belief). Fifty-seven subjects, selected via random digit dialing (RDD) responded to the scale before and after watching Return of the Jedi, a popular science fiction movie.

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|----------------------------------|--|
| 1) Science Fiction Movies (True) | 5) Interval |
| 2) No | 6) Within-Subjects |
| 3) Pre & Post Watching Movie | 7) Two-Group (Pre-Post) |
| 4) Belief in Supernatural | 8) t test for dependent means (Paired Samples) |

Study 5: A researcher at a drug treatment center wanted to determine the best combination of treatments that would lead to more substance free days. This researcher believed there were two key factors in helping drug addiction: type of treatment and type of counseling. The researcher was interested in either residential or outpatient treatment programs and either cognitive-behavioral, psychodynamic, or client-centered counseling approaches. As new clients enrolled at the center they were randomly assigned to one of six experimental groups. After 3 months of treatment, each client's symptoms were measured.

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|---|---|
| 1) Treatment Type (True); Counseling Type (True) | 5) Ratio |
| 2) Yes | 6) Between-subjects |
| 3) Treatment (Residential vs. Outpatient)
Counseling (Cognitive-Behavioral vs.
Psychodynamic vs.
Client-Centered Counseling) | 7) 2 x 3 Factorial Design |
| 4) Symptom Free Days | 8) GLM-Univariate (Factorial/Two-Way ANOVA) |

Study 6: An organizational psychologist is hired as a consultant by a person planning to open a coffee house for college students. The coffee house owner wants to know if her customers will drink more coffee depending on the ambience of the coffee house. To test this, the psychologist sets up three similar rooms, each with its own theme (Tropical; Old Library; or New York Café) then arranges to have thirty students spend an afternoon in each room while being allowed to drink all the coffee they like. (The order in which they sit in the rooms is counterbalanced.) The amount each participant drinks is recorded for each of the three themes.

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|---|---|
| 1) Coffee House Ambience (True) | 5) Ratio |
| 2) No | 6) Within-Subjects |
| 3) Tropical vs. Old Library vs. New York Café | 7) Multi-Group Design (Repeated Measures) |
| 4) Amount of Coffee Consumption | 8) GLM-Univariate (Repeated Measures ANOVA) |

Study 7: A director of a small psychotherapy clinic is trying to plan hiring of temporary staff to assist with intake. She is wondering if there was any difference in the use of the clinic during different seasons of the year. Last year, there were a total of 128 new clients. To see if there is a difference by season she looks at how many clients previously enrolled during each season.

- | | |
|---------------------------------------|-------------------|
| 1) Not Applicable (not an experiment) | 5) Ratio |
| 2) No | 6) Not Applicable |
| 3) Not Applicable (not an experiment) | 7) Archival |
| 4) Season and Client Enrollment | 8) Chi-square |

Study 8: A manager at a retail store in the mall wants to increase profit. The manager wants to see if the store's layout (one main circular path vs. a grid system of paths) influences how much money is spent depending on whether there is a sale. The belief is that when there is a sale customers like a grid layout, while customers prefer a circular layout when there is no sale. Over two days the manager alternates the store layout, and has the same group of customers come each day. Based on random assignment, half of the customers told there is a sale (20 % will be taken off the final purchases), while the other half is told there is no sale. At the end of each day, the manager calculates the profit.

- | | |
|---|---|
| 1) Store Layout (True); Sale (True) | 5) Ratio |
| 2) Yes | 6) Within-Subject (Layout); Between-subjects (Sale) |
| 3) Store Layout (Circle vs. Grid)
Sale (20% off vs. No Discount) | 7) 2 x 2 Mixed Design |
| 4) Profit | 8) GLM-Univariate (Factorial/Two-Way ANOVA) |

Brief Guide: Determining the Appropriate Statistical Analysis

Things You Need to Know

1. Scales of Measurement

- Is your variable categorical/nominal (i.e. distinct groups), or continuous/interval/ratio (i.e. scores on a scale)?

2. Nature of the Independent Variable

- How many group/levels are there?
- How many IVs are there (1 or more)?
- True vs. Quasi – for analyses we treat them the same
- Between-subjects or within-subjects

Summary Chart

<u>Design Elements</u>	<u>Example</u>	<u>Statistic</u>
Several items measuring the same construct	Want to see if 10 items thought to measure love, all measure the same thing.	Cronbach alpha (determines scale reliability)
1+ categorical variables; looking for even distribution of cases per category	Determine if number of males/females differs by year in school.	Chi-square
2 continuous variables	Determine association between intelligence and GRE scores.	Correlation (Bivariate)
3+ continuous variables (1 of which you are trying to predict that serves as the DV)	Want to determine what the best predictor is of counseling skill (college grades; emotional intelligence; hours of experience)	Regression (Linear)
<u>Two-Group/Simple Experiment:</u> 1 IV; 2 levels (Between-Subjects); 1 DV	Males vs Females on verbal ability	T-test for independent means
<u>Two-Group/Pre-Post Design:</u> 1 IV; 2 levels (Within-Subjects); 1 DV	Mood before and after an exercise program	T-test for dependent means (Paired Samples T-test)
<u>Multi-Group Design:</u> 1 IV; 3+ levels (Between-Subjects); 1 DV	Effectiveness of psychoanalysis vs. cognitive-behavioral vs. no treatment on depression	One-way Analysis of Variance (ANOVA)
<u>Multi-Group Design/Repeated Measures:</u> 1 IV; 3+ levels (Within-Subjects); 1 DV	Stress level measured each week following either a week of problem-focused coping; emotional-focused coping; or nothing.	GLM-Repeated Measures Analysis of Variance (ANOVA)
<u>Factorial Design:</u> 2+ IV; 2+ levels each (Between-Subjects); 1 DV	Want to test the effect of product advertising (magazine vs. tv) and product cost (low vs. high) on sales	GLM-Univariate (Factorial/Two-way ANOVA)
<u>Mixed Design:</u> 1 IV; 2+ levels (Between-Subjects) 1 IV; 2+ levels (Within-Subjects) 1 DV	Want to test if there is a change in willingness to help before/after a course on public service and if it varies by gender.	GLM-Repeated Measures Analysis of Variance (ANOVA)

Note. Chart uses names for statistical tests used in SPSS.