



Causal-Comparative Research & Single Subject Research

Stephen E. Brock, Ph.D., NCSP
California State University, Sacramento

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Correlation vs. Group Comparison

Correlational	Group Comparison
1 group	2 or more groups
2 or more variables	1 independent variable
Extent to which 2 or more variables are related to each other	Extent to which 2 or more groups are different from each other
Identifies relationships among variables	Makes comparisons between groups

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Types of Group Comparison Research

- ◆ Causal-comparative
 - AKA Ex Post Facto (Latin for after the fact).
 - Researcher does not form the groups.
 - Groups to be compared are formed before the study begins. A pre-existing variable defines the group.
- ◆ Quasi Experiment
 - Researcher forms the groups .
 - Groups to be compared are not formed before the study begins.
 - Individuals are not randomly assigned.
 - Intact groups are randomly assigned to a treatment condition.
- ◆ True Experiment
 - Researcher forms the groups.
 - Groups to be compared are not formed before the study begins.
 - Individuals are randomly assigned.

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Portfolio Activity #8 Mini-proposal 3

- ◆ Briefly describe a causal-comparative research project relevant to one of your identified research topics.
 - In small groups discuss your mini-proposal ideas and be prepared to share your discussions with the rest of the class

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Causal-Comparative Research

- ◆ Groups defined by difference on some **pre-existing** variable (the independent variable).
 - Causal Comparative - group difference(s) exist(s) before the study begins (e.g., SES, Gender, ADHD).
 - ◆ Group membership is the independent variable
 - Experiment - group difference(s) are assigned by the researcher (e.g., type of instruction, an approach to counseling).
 - ◆ Group differences do not exist before the study begins

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Causal-Comparative Research

- ◆ The question being asked is whether, and to what degree, groups also differ on another variable (the dependent variable or measure).
 - Causal Comparative - Do children from high SES (IV) backgrounds attain higher achievement levels (DV) than children from low SES backgrounds?
 - Experiment - Do children who learn to read via Reading Mastery (IV) attain higher achievement levels (DV) than children who learn to read via a whole language approach?
 1. What would make this "Experiment" a "Causal Comparative Study?"
 2. Why might an educational researcher want to make this into such a study (i.e., turn it into a causal comparative study)?

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Reasons for Employing a Causal-Comparative Approach

- ◆ Causal-Comparative methods are *typically* used because the variable under study (the IV)...
 - cannot be directly manipulated.
 - ◆ Gender
 - ◆ Age
 - ◆ Others?
 - should not be manipulated.
 - ◆ Destructive habits
 - ◆ Disease or disorder
 - ◆ Others?
- ◆ Why else would a causal-comparative method be used????

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Reasons for Employing a Causal-Comparative Approach

- ◆ These methods are also sometimes used to help determine if the more complicated and expensive experimental design is worthwhile.
 - Did our prior discussion identify this as a possible reasons for conducting a Causal-Comparative study of Reading Mastery?

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Variables Often Examined in Causal-Comparative Studies

- ◆ Internal
 - Organismic
 - Ability
 - Personal Characteristic
- ◆ External
 - Family-related
 - School-related
- ◆ Identify examples in each of these five categories.

These would be the IV in a causal-comparative study

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The Two Basic Research Designs

	Group	IV	DV
Case A	E	X	O
	C	X	O
Case B	E	X ₁	O
	E	X ₂	O

Symbols:
E = Experimental group
C = Comparison group
X = Independent variable
O = Dependent variable

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Control Procedures

- ◆ In an ex post facto study, it is difficult to make conclusions about a causal relationship between two variables.
- ◆ One cannot be sure that the two groups do not differ with respect to variables other than the variable under study.
- ◆ Need to consider the possibility that dependent measure changes (results) are due to factors other than the independent variable (group membership).

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Control Procedures

- ◆ Sometimes you are aware of these alternative explanations for group differences before you begin a study.
 - For example, in my study of the effect of ADHD on reading comprehension I was aware that ADHD often co-exists with reading disabilities.
 - The presence of ADHD children with reading disabilities in my sample would have been a "confounding variable."

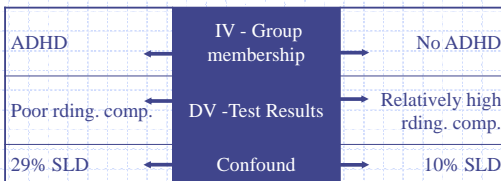
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Control Procedures

- ◆ Confounding Variables
 - "Any variable on which groups in an experiment systematically differ, other than the variable whose effect the research is interested in determining, is a confounding variable" (Crowl, 1996, p. 274).
- ◆ Because of its inability to randomly assign participants, confounds are especially problematic when conducting an ex post facto study.
- ◆ The random assignment of an experiment minimizes such confounding effects.

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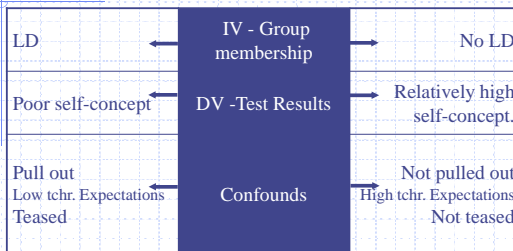
Is ADHD Associated with Relative Reading Comprehension Difficulties?



How might a causal-comparative study attempt to address this confound?

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Do learning disabilities cause low self concepts?



How might a causal-comparative study attempt to address these confounds?

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Sample Selection Control Procedures

- ◆ **Matched Pair Design**
 - Systematically select participant pairs who are similar in all important ways other than the independent variable.
- ◆ **Homogenous Grouping Design**
 - With the exception of the independent variable (group membership) make sure that participants in both groups are very similar in all important ways.

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Data Analysis Control Procedures

- ◆ Factorial analysis of variance.
 - A statistical way to assess the effects of potential confounds on the dependent measure.
- ◆ Analysis of Covariance
 - Adjusts scores on the dependent variable for initial differences on some other variable related to the dependent variable.

Pretest Score	IV Group Membership	DV Post-Test Score
110	X	O
112		Q ₇

Data Analysis

- ◆ Descriptive Statistics
 - Mean
 - Standard Deviation
- ◆ Inferential Statistics
 - t-test
 - ◆ The difference between 2 dependent measure means
 - ANOVA
 - ◆ The difference between 3 or more dependent measure means
 - Chi Square
 - ◆ The difference between the frequency of occurrence of the dependent measure.

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Single Subject Research

- ◆ "...involves multiple measurements of the behavior of a single individual at different points in time prior to, during, and following the use of some intervention designed to change the individual's behavior" (Crowl, 1996, p. 324).
- ◆ Differs from case studies in that this research attempts to control some aspect of the environment.

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Single Subject Research

- ◆ The objective is to determine if an intervention has significantly affected the behavior of the subject.
- ◆ The previously discussed observational strategies are often used to provide the data to be analyzed.
- ◆ The design used in FAAs and in RTI
 - See handout for an example of a Single subject research / [RTI](#) data presentation.

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Single Subject Research

- ◆ Single-Subject versus Group Designs
 - Unlike an experiment there is no control group in single-subject research
- ◆ Validity determined by...
 - Repeated and consistent measurement
 - Baseline stability
 - The single variable rule

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Types of Single Subject Research

- ◆ A-B-A Withdrawal
- ◆ Multiple Baselines
- ◆ Alternating Treatments

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A-B-A Withdrawal

- ◆ A-B Design

O O O O O	X O X O X O
Baseline Phase A	Treatment Phase B

- ◆ A-B-A Design

O O O O O	X O X O X O	O O O O O
Baseline Phase A	Treatment Phase B	Baseline Phase A

NOTE: O = measurement, X = treatments

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A-B-A-B Design

Week	Phase	Words Read Per Minute
1	BL	15
2	BL	18
3	BL	15
4	BL	18
5	BL	15
6	BL	18
7	IV-1	18
8	IV-1	22
9	IV-1	20
10	IV-1	22
11	IV-1	25
12	IV-1	25
13	IV-1	25
14	IV-1	25
15	IV-1	25
16	IV-1	25
17	IV-1	25
18	IV-1	25
19	BL	25
20	BL	28
21	BL	30
22	BL	32
23	BL	35
24	BL	38

See handout

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Multiple Baseline

- ◆ Employed when it is impossible to return to the baseline (e.g., the intervention has resulted in permanent change in behavior), or when there are several interventions to be implemented

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Alternating Treatments

- ◆ The **Alternating Treatments Design** is used to directly compare the effects of two or more different experimental variables across the same span of time in the same subject.
- ◆ Effective in controlling for systematic changes in the subject or setting across time.
- ◆ Disadvantages
 - inability to deal with irreversible effects
 - potential generalization from one condition to the other
 - interpretation problems due a variety of interactions, carryover, and order effects.

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Single Subject Research

- ◆ *CREATING SINGLE-SUBJECT DESIGN GRAPHS WITH MICROSOFT EXCEL™*
 - by James E. Carr & Eric O. Burkholder
 - ◆ <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1284121>

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Single Subject Research

- ◆ More about single subject designs:
 - <http://www.baam.emich.edu/baamessentials/baamsinglesubject.htm>
 - http://silcom.com/~dwsmith/Critical_Assessment/ssn1wksh.html

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Single Subject Research

- ◆ Example of an intervention appropriate for a single subject research project.
 - ***A Behavioral Intervention for Increasing On-task Behavior.***

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Increasing On-task Behavior

- ◆ A token economy program for increasing on-task behavior that can be used during seatwork and other learning situations.
- ◆ Primary components of this program include immediate reinforcers, several daily mini-conferences with the teacher, and daily and weekly rewards.
- ◆ Some have criticized token economies because of their reliance on extrinsic reinforcers.
- ◆ Others have suggested that the use extrinsic reinforcers do not negatively impact the intrinsic motivation of students as it relates to classroom tasks.

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Beginning the Program

- ◆ Ensure that students understand program expectations and procedures.
- ◆ Behaviors to be rewarded should be operationally defined and understood by both student and teacher.
 - Specific on-task target behaviors may include *begin work immediately, work quietly, remain seated, ask good questions, complete work and follow instructions.*
 - A teacher may choose to target some or all of these behaviors.
 - Regardless, the behaviors should be framed in positive language, focusing on desired student behaviors.

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Immediate Reinforcers

- ◆ As frequently as possible the student should be given immediate behavior-specific verbal praise whenever one of the targeted on-task behaviors is observed.
 - Comments such as "Good" or "Nice" should be expanded to include a statement specifying the specific behavior for which the student is being praised.
 - Such behavior specific verbal praise is most effective when given immediately following display of appropriate behavior(s).
 - Particular attention should also be given to increasing the amount of praise relative to the amount of negative comments.

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Mini-Conferences

- ◆ At several times during the day the teacher has a one to two minute mini-conference with the student.
 - The number of mini-conferences held is a decision made by the teacher. As a general rule, the more conferences held the better.
 - However, it is essential that it be feasible for the teacher to consistently participate in all scheduled conferences.
 - A natural time for these conferences to be held is just before each recess and lunch period, and just before the end of the school day.

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Daily Rewards

- ◆ If the student reaches the on-task behavior goal, one or more daily rewards, specified in a previously written behavior contract, would be given.
 - One reward possibility, that would also facilitate home-school communication, is to send home a positive note to the student's parent(s).
 - It is critical that the agreed upon reward be meaningful to the specific student.
 - If a variety of desirable rewards can be identified, an effective method for delivering reinforcement is to make each reward be a surprise.

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Daily Reward Option

SUPER WORKER REPORT

Date: _____

Dear _____

Your child met the on-task behavior goal today. It would be appropriate for you to do something special for your child tonight to reinforce this good work.

Sincerely,

Classroom teacher

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Weekly Rewards

- ◆ An optional component of this program involves setting a weekly goal and reward.
 - An example of such a reward might be lunch with the teacher, or a special in class activity.
- ◆ During each mini-conference, the teacher may also want to graph each week's goal attainment.
- ◆ It is important to note that especially among younger children, these long-term rewards are less effective and should not replace immediate and daily rewards and tracking of progress for any student.

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Weekly Reward Chart

WEEKLY CONTRACT

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Daily Total					

My weekly total goal is

This week's total

If I meet my weekly goal, I will earn _____

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Next Week

- ◆ Next class meeting: Experimental Research
- ◆ Read *Educational Research* Chapter 10.
- ◆ Portfolio Element #9 Due: Mini-proposal 4.
 - Briefly describe an experimental research project relevant to one of you identified research topics.

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