



Research Methodology Group UOPX Research Community

Causal-Comparative Research

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Topics in Research Designs

- Correlational Research
 - March 2, 2023
- Causal-Comparative Research
 - April 20, 2023
- Repeated Measures Research
 - July 13, 2023
- Regression Research
 - August 3, 2023

Agenda

- Definitions of Causal-Comparative Research
- Comparisons with Correlational Research
- Comparisons with Experimental Research
- Causal-Comparative Research Purpose Statements
- Causal-Comparative Research Questions and Hypotheses
- Examples of Causal-Comparative Research
- References
- Discussion and Q&A

Definition of Causal-Comparative Research

“Causal-comparative research is a methodology used to identify cause-effect relationships between independent and dependent variables.

Researchers can study cause and effect in retrospect. This can help determine the consequences or causes of differences already existing among or between different groups of people.

When you think of Casual Comparative Research, it will almost always consist of the following:

- A method or set of methods to identify cause/effect relationships
- A set of individuals (or entities) that are NOT selected randomly – they were intended to participate in this specific study
- Variables are represented in two or more groups (cannot be less than two, otherwise there is no differentiation between them)
- Non-manipulated independent variables – *typically, it’s a suggested relationship (since we can’t control the independent variable completely)”

(<https://www.questionpro.com/blog/causal-comparative-research/>)

Definition of Causal-Comparative Research (cont.)

“Casual Comparative Research is broken down into two types:

Retrospective Comparative Research: Involves investigating a particular question.... after the effects have occurred. As an attempt to see if a specific variable does influence another variable.

Prospective Comparative Research: This type of Casual Comparative Research is characterized by being initiated by the researcher and starting with the causes and determined to analyze the effects of a given condition. This type of investigation is much less common than the Retrospective type of investigation.”

(<https://www.questionpro.com/blog/causal-comparative-research/>)

“A causal-comparative design is a research design that seeks to find relationships between independent and dependent variables after an action or event has already occurred. The researcher's goal is to determine whether the independent variable affected the outcome, or dependent variable, by comparing two or more groups of individuals ... causal-comparative research [is] also referred to as *ex post facto research* ...”

(Sage Research Methods, in *Encyclopedia of Research Design*, 2010)

Comparisons with Correlational Research

- Similarities:
 - Both methods are useful when experimental research has been deemed impossible or unethical as the research design for a particular question.
 - Both designs attempt to determine relationships among variables, but neither allows for the actual manipulation of these variables.
 - Thus, neither can definitively state that a true cause-and-effect relationship occurred between these variables.
 - Finally, neither type of design randomly places subjects into control and experimental groups, which limits the generalizability of the results.
- Differences:
 - In causal-comparative research, the researcher investigates the effect of an independent variable on a dependent variable by comparing two or more groups of individuals.
 - In correlational research, the researcher works with only one group of individuals. Instead of comparing two groups, the correlational researcher examines the effect of one or more independent variables on the dependent variable within the same group of subjects.

Comparisons with Experimental Research

- Similarities:
 - Unlike correlational research, both experimental research and causal-comparative research typically compare two or more groups of subjects. Research subjects are generally split into groups on the basis of the independent variable that is the focus of the study.
 - Goal of both types of research is to determine what effect the independent variable may or may not have on the dependent variable or variables.
- Differences:
 - In true experimental research designs, the researcher manipulates the independent variable in the experimental group. Because the researcher has more control over the variables in an experimental research study, the argument that the independent variable caused the change in the dependent variable is much stronger.
 - In causal-comparative research, the research subjects are already in groups because the action or event has already occurred, whereas subjects in experimental research designs are randomly selected prior to the manipulation of the variables. Random sampling allows for wider generalizations to be made from the results of an experimental research study.

Comparison of Causal-Comparative, Correlational, and Experimental Research

<i>Method</i>	<i>Investigates Cause-Effect</i>	<i>Manipulates Variable</i>	<i>Randomly Assigns Participants to Groups</i>	<i>Involves Group Comparisons</i>	<i>Studies Groups or Individuals</i>	<i>Focus</i>	<i>Identifies Variables for Experimental Exploration</i>
Causal-comparative research	Yes	No (it already occurred)	No (groups formed prior to study)	Yes	Two or more groups of individuals and one independent variable	Focus on differences of variables between groups	Yes
Correlational research	No	No	No (only one group)	No	Two or more variables and one group of individuals	Focus on relationship among variables	Yes
Experimental research	Yes	Yes	Yes	Yes	Groups or individuals depending on design	Depends on design; focuses on cause/effect of variables	Yes

(Sage Research Methods, in *Encyclopedia of Research Design*, 2010)

Causal-Comparative Research Purpose Statements

Elements of Purpose Statements:

- Type of quantitative research (e.g., quasi-experimental, ex post facto, ...)
- Research variables
- Location of study [e.g., business or organization (sector or specific), place, ...]

Frequently used wording:

The purpose of this quantitative causal-comparative [or, ex post facto] research study is to determine if variable A affects variable B within the business [or, organizational] sector.

The purpose of this quantitative causal-comparative [or, ex post facto] research study is to identify the cause-effect relationship between independent variable A and dependent variable B for individuals in the business [or, organization].

The purpose of this quantitative causal-comparative [or, ex post facto] research study is to determine if treatment variable A will lead to the outcome [response] variable B at location [or, place].

Causal-Comparative Research Questions (RQ) and Hypotheses

Frequently used wording:

RQ: How does variable A affect variable B in [location of study]?

RQ: What is the cause-effect relationship between independent variable A and dependent variable B in [location of study]?

RQ: How does treatment variable A lead to outcome [response] variable B in [location of study]?

Hypotheses:

H0: Variable A does not affect variable B in [location of study].

H1: Variable A weakly [or moderately, or strongly] affects variable B by [brief description of the mechanism] in [location of study].

... and similarly

Example of Causal-Comparative Research (1)

Article title:

“Academic Procrastination and Performance in Distance Education: A Causal-comparative Study in an Online Learning Environment”

Authors:

Hasan Ucar, Anadolu University, Turkey

Aras Bozkurt, Anadolu University, Turkey

Olaf Zawacki-Richter, University of Oldenburg, Germany

Journal:

Turkish Online Journal of Distance Education, October 2021, Volume 22, Number 4, Article 2, 12 pages

Example of Causal-Comparative Research (1) (cont.)

Problem:

- To know the procrastination behaviors of the learners in online distance learning in order to take the necessary precautions in addressing academic procrastination tendency, as it is significantly related to course performance and accomplishment.

Purposes:

- To explore whether male and female learners in online distance learning would have different academic procrastination tendencies.
- To examine whether different procrastination scores produced differences in academic performance.
- To explore whether academic procrastination tendency was able to predict the academic performance of online learners.

Example of Causal-Comparative Research (1) (cont.)

Research Questions and Hypotheses:

RQ 1. Do male and female learners significantly differ in their level of procrastination tendencies?

Research hypothesis 1: Online male and female learners will score the same on academic procrastination.

RQ 2. Do procrastination tendency differences produce differences in the academic performance of online learners?

Research hypothesis 2: Online learners who scored lower on academic procrastination tendency will have better academic performance than that of those who scored higher on academic procrastination tendency.

RQ 3. Does academic procrastination tendency predict the academic performance of online learners?

Research hypothesis 3: The academic procrastination tendency of online learners will predict their academic performance.

Example of Causal-Comparative Research (1) (cont.)

Methodology

- Research design: quantitative causal-comparative
- Participants:
 - 1,200 online undergraduate learners taking an online English course at a state university in Turkey were invited to take an online survey
 - 333 survey responses (after adjustments) [27.75%]
- Instrument:
 - Turkish version of the *Tuckman Procrastination Scale* (1991)
 - Widely used, 14-item scale to measure the academic procrastination tendency of learners
- Data analysis:
 - Independent samples t-tests to compare means of:
 - Male and female learners' level of procrastination tendencies (RQ 1)
 - Low and high procrastinators, to determine whether there was a statistical difference in their academic performance scores (RQ 2)
 - Simple linear regression (SLR) model to predict the relationship between academic procrastination tendency and academic performance (RQ 3)

Example of Causal-Comparative Research (1) (cont.)

Results

- RQ 1:
 - Although the female learners' average mean score ($M = 34.8$, $SD = 4.1$) was slightly higher than the male learners' average mean score ($M = 34.1$, $SD = 5.2$), the difference was not statistically significant ($t(331) = 1.18$, $p = 0.23$) in terms of academic procrastination.
 - Research hypothesis 1 was confirmed.
- RQ 2:
 - On average, low procrastinators had better academic performance ($M = 54.76$, $SD = 10.6$, $SE = 0.83$) than that of high procrastinators ($M = 49.65$, $SD = 10.5$, $SE = 0.81$).
 - This difference was statistically significant ($t(331) = 4.38$, $p < 0.01$) with close to a medium-sized effect ($d = 0.48$).
 - Research hypothesis 2 was confirmed.

Example of Causal-Comparative Research (1) (cont.)

Results (cont.)

- RQ 3:
 - SLR suggested that learners' academic procrastination tendencies explained 2.3% of the variance ($R^2 = 0.023$; $F(1,131) = 7.808$, $p < 0.05$).
 - In other words, the learners' academic procrastination tendencies significantly predicted academic performance ($B = -0.35$, $t = -2.79$, $p < 0.05$).
 - Research hypothesis 3 was confirmed.

Findings

- Based on age span and socio-economic status of the undergraduate learners, future research should consider different demographics to better examine and gain more insight into the academic procrastination phenomenon.
- Low procrastinators had better academic performance [consistent with literature].
- Online learners' academic procrastination tendencies significantly predicted academic performance [consistent with literature].

Example of Causal-Comparative Research (2)

Article title:

“STEM Certification in Georgia’s Schools: A Causal Comparative Study Using the Georgia Student Growth Model”

Authors:

David E. Proudfoot, University of Phoenix

Michael Green, University of Phoenix

Jan W. Otter, University of Phoenix

David L. Cook, University of Phoenix

Journal:

Georgia Educational Researcher, 2018, Volume 15, Issue 1, Article 2

Example of Causal-Comparative Research (2) (cont.)

Problem:

- As Georgia schools become STEM certified, to understand how certification has influenced achievement in math and science as well as important non-STEM disciplines such as English language arts and social studies.

Purpose:

- To better understand the early results of current Georgia schools who receive either the GaDOE STEM Certification or the AdvancED STEM Certification to guide administrators and teachers in school reform and to improve efforts to prepare students to be college and career ready in a globally competitive society.

Example of Causal-Comparative Research (2) (cont.)

Research Questions:

RQ 1: Is there a difference in the median growth percentiles in fourth grade English language arts for STEM certified schools when compared to non-STEM schools?

RQ 2: Is there a difference in the median growth percentiles in fourth grade math for STEM certified schools when compared to non-STEM schools?

RQ 3: Is there a difference in the median growth percentiles in fourth grade science for STEM certified schools when compared to non-STEM schools?

RQ 4: Is there a difference in the median growth percentiles in fourth grade social studies for STEM certified schools when compared to non-STEM schools?

Example of Causal-Comparative Research (2) (cont.)

Research Questions (cont.):

RQ 5: Is there a difference in the median growth percentiles in fifth grade English language arts for STEM certified schools when compared to non-STEM schools?

RQ 6: Is there a difference in the median growth percentiles in fifth grade math for STEM certified schools when compared to non-STEM schools?

RQ 7: Is there a difference in the median growth percentiles in fifth grade science for STEM certified schools when compared to non-STEM schools?

RQ 8: Is there a difference in the median growth percentiles in fifth grade social studies for STEM certified schools when compared to non-STEM schools?

Example of Causal-Comparative Research (2) (cont.)

Methodology

- Research design: quantitative causal-comparative
- Participants:
 - Grades 4 and 5 English language arts (ELA), mathematics, science, and social studies classes in STEM and non-STEM schools in Georgia
- Measurement:
 - Median growth percentiles (MGP) between STEM certified and non-STEM schools as developed through the Georgia School Growth Model (GSGM)
- Data analysis:
 - A purposive sampling technique was used within the Metropolitan Regional Educational Service Agency (Metro RESA).
 - Since the data were not normal for many of the subgroups, the non-parametric statistical analysis technique, Mann-Whitney U test, which evaluates whether the mean ranks for two groups differ significantly from each other, was used.
 - Homogeneity of variances permitted the use of a pooled variance between the non-STEM and STEM certified data.
 - When the homogeneity assumption did not hold for a set of comparative groups (Grade 5 ELA), a random sample was taken from the non-STEM group that was equivalent to number of STEM schools identified for study; homogeneity failed, so the median test was used (not highly conclusive).

Example of Causal-Comparative Research (2) (cont.)

Results

- Fourth grade ELA was the only group to show a significant difference in MGPs between the STEM certified schools (Mdn = 62.50) and the non-STEM schools (Mdn = 52), $U = 2122.00$, $p = .004$, 2-tailed, $\eta^2 = .02$ [estimate of effect size, meaning about 2% of total variance of fourth grade ELA MGPs was explained by STEM certified schools compared to non-STEM schools, i.e., low or small effect size].
- Interestingly, both the fourth and fifth grade social studies groups had a higher mean rank for the non-STEM groups than the STEM groups.
- All other content areas showed a higher mean rank for the STEM groups.
- The greatest differences between the STEM and non-STEM groups were in the area of ELA for both and fourth and fifth grades.

Findings

- Based on the statistical differences noted between STEM certified and non-STEM schools, support was provided for completing a STEM school certification process in order to increase MGPs for fourth grade ELA.
- No support was provided for completing a STEM school certification process in order to increase MGPs for other content areas in other grade levels. [Surprising, based on anticipated growth, given the available literature at the time.]

References

Brewer, E.W., & Kubn, J. (2012). Sage research methods. In *Encyclopedia of research design*. SAGE Publications, Inc. <https://doi.org/10.4135/9781412961288>

Johnson, B. (2000, April 24-28). It's (beyond) time to drop the terms causal-comparative and correlational research in educational research methods textbooks [Conference paper]. Annual Meeting of the American Educational Research Association, New Orleans, LA, United States. <https://eric.ed.gov/?id=ED445010>

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For Further Help: Quantitative Office Hours (go to Home page of Research Methodology Group in MS Teams)



A cross disciplinary community of researchers consists of committee of methodologists and members who are experts or interested in social science research methods and designs.

Resources



2023 Research Method Webinar Calendar



Research Method Webinar Recordings 2018-2022



Quantitative Resources, Conferences, Journals



Qualitative Resources, Conferences, and Journals

Research Methodology Office Hours

Quantitative - Mondays 10 am-12 noon AZ

Qualitative - Tuesdays 9 am-11 am & 12 noon -2pm AZ

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Discussion and Q&A