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# Research Methodology Group
# UOPX Research Community

## Correlational Research

March 2, 2023

Dr. Frederick P. Lawrence

# Topics in Multivariate Statistics

- Controlling Overall Type I Error with Statistically Dependent Analyses
  - December 12, 2019
- Principal Components Analysis and Factor Analysis
  - September 23, 2021
- Correlation
  - March 10, 2022
- ANOVA/ANCOVA & MANOVA/MANCOVA
  - April 28, 2022
- Repeated Measures Designs
  - July 14, 2022
- Logistic Regression
  - August 11, 2022

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# Agenda

- Definitions of Correlational Research
- Types of Correlational Designs
- Six-step Process for Designing a Correlational Study
- Correlation Analysis Methods
- Correlational Research Purpose Statements
- Correlational Research Questions and Hypotheses
- Examples of Correlational Research
- References
- Discussion and Q&A
- Correlation and Correlational Design Resources

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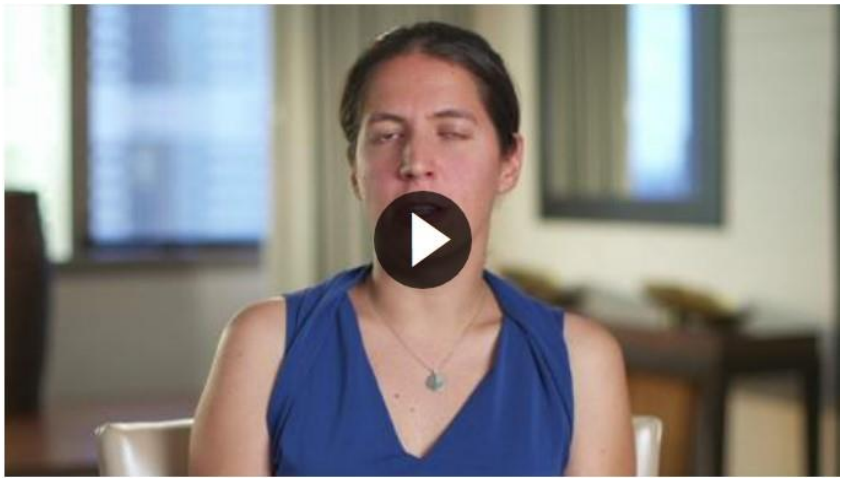
# Dr. Simine Vazire Defines Correlational Research (2016 SAGE video)

Professor of Psychology Ethics and Wellbeing at the University of Melbourne, Victoria, Australia



SPEAKER: So correlational research is when we observe variables and look at the associations between them. And we don't manipulate anything. We don't change anything. We just observe things as they are. So for example, if we want to know what correlates with happiness-- we want to know who's happier, who's less happy-- we might look at personality correlates. So for example, how does extroversion correlate with happiness? And we just measure those two variables in a group of people, and we look at the correlation. And we find a positive correlation. So the more extroverted a person is, the more likely they are to be happy.

https://widgets.ebscohost.com/prod/customlink/proxify/proxify.php?count=1&encode=1&proxy=https%3A%2F%2Fgo.openathens.net%2Fredirector%2Fphoenix.edu%3Furl%3D&target=https://sk.sagepub.com/video/simine-vazire-defines-correlational-research

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# Definition of Correlational Research (Creswell)

"Correlational designs provide an opportunity for you to predict scores and explain the relationship among variables. In correlational research designs, investigators use the correlation statistical test to describe and measure the degree of association (or relationship) between two or more variables or sets of scores. In this design, the researchers do not attempt to control or manipulate the variables as in an experiment; instead, they relate, using the correlation statistic, two or more scores for each individual (e.g., a student motivation and a student achievement score for each individual)." (Creswell, 2005, p. 325)

- Two types of correlational designs:
  - Exploratory designs
    - Relational research (Cohen & Manion, 1994)
    - "accounting for variance" research (Punch, 1998)
    - Explanatory research (Fraenkel & Wallen, 2000; Creswell, 2005)
  - Predictive designs

# Definition of Correlational Research (Creswell) (cont.)

- Exploratory designs

  "An explanatory research design is a correlational design in which the researcher is interested in the extent to which two variables (or more) co-vary, that is, where changes in one variable are reflected in changes in the other. Explanatory designs consist of a simple association between two variables …or more than two." (Creswell, 2005, p. 327)

- Predictive designs

  "The purpose of a prediction research design is to identify variables that will positively predict an outcome or criterion. In this form of research, the investigator identifies one or more *predictor variables* and a criterion (or outcome) variable. A predictor variable is the variable used to make a forecast about an outcome in correlational research…. The outcome being predicted in correlational research, however, is called the *criterion variable*." (Creswell, 2005, p. 328)

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# Definition of Correlational Research (UOP Material)

Purpose: To investigate the extent to which variations in one factor correspond with variations in one or more other factors based on correlation coefficients.

Examples:

- A study investigating the relationship between employee salary average as the criterion variable and a number of other variables of interest
- A factor-analytic study of several personality tests
- A study to predict success in graduate school based on intercorrelational patterns for undergraduate variables

Characteristics:

- Appropriate where variables are complex and are not suitable to the experimental method and controlled manipulation
- Permits the measurement of several variables and their interrelationships simultaneously and in a realistic setting
- Examines the degrees of relationship rather than causality examined in an experimental design

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# Definition of Correlational Research (UOP Material) (cont.)

Limitations:

- It only identifies covariation among variables; cause-and-effect relationships cannot be measured or inferred.
- It is less rigorous than the experimental approach because it involves less control over the independent variables.
- It is prone to identify spurious relational patterns or elements, which have little or no reliability or validity. An example is the correlation between ice cream sales and the murder rate in the month of August.
- The relational patterns are often arbitrary and ambiguous.
- It encourages a "shotgun" approach to research, indiscriminately throwing in data from miscellaneous sources and defying any meaningful or useful interpretation.

So, for correlational research at University of Phoenix:

- DO NOT assign roles of dependent and independent to variables
- DO refer to one variable as the “criterion variable” and the other variable(s) as “variable(s) of interest” OR all the variables as “variables of interest”

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# Six-step Process for Designing a Correlational Study

Step 1. Determine if a correlational study best addresses the research problem.

Step 2. Identify individuals to study.

Step 3. Identify two or more measures for each individual in the study.

Step 4. Collect data and monitor potential threats.

Step 5. Analyze the data and represent the results.

Step 6. Interpret the results.

(Creswell, 2005, pp. 338-340)

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# Correlation Analysis Methods

| Variables | Parametric | Nonparametric |
|---|---|---|
| Two (bivariate) | Pearson's product-moment correlation coefficient (*r*) | Nominal data:<br>- Contingency coefficient<br>Ordinal data:<br>- Spearman rank correlation coefficient<br>- Kendall rank correlation coefficient<br>- Kendall partial rank correlation coefficient |
| One with (two or more) | Multiple correlation coefficient (*R*) | none |
| (Two or more) with (two or more) | Canonical correlation analysis | none |

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# Correlational 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 quasi-experimental [or, ex post facto] correlational research study is to investigate [or, explore] the relationship [or, linear relationship] between variable A [or, variable set A] and variable B [or, variable set B] within the business [or, organizational] sector.

The purpose of this quantitative quasi-experimental [or, ex post facto] correlational research study is to investigate [or, explore] the effects of the treatment variable A [or, variable set A] on the outcome [or, response] variable B [or, variable set B] for individuals in the business [or, organization].

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

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# Correlational Research Questions (RQ) and Hypotheses

Frequently used wording:

RQ: What is the relationship [or, linear relationship] between variable A [or, variable set A] and variable B [or, variable set B] in [location of study]?

Alternate wording, more specific and, hence, (perhaps) clearer:

RQ: To what extent [or, To what degree] is there a relationship [or, linear relationship] between variable A [or, variable set A] and variable B [or, variable set B] in [location of study]?

Hypotheses:

H0: There is no relationship [or, linear relationship] between variable A [or, variable set A] and variable B [or, variable set B] in [location of study].

H1: There is a relationship [or, linear relationship] between variable A [or, variable set A] and variable B [or, variable set B] in [location of study].

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# Example of Correlational Research (1)

Same example in Short Burst Learning (SBL) video "How to Use SPSS Statistics to Run a Correlation" on the Research Hub.

Courtesy: Laerd Statistics and SPSS Statistics, IBM Corporation

https://statistics.laerd.com/spss-tutorials/pearsons-product-moment-correlation-using-spss-statistics.php

Research Purpose: To investigate the relationship between a person's height and how well he or she performs in a long jump

RQ: To what extent is there a relationship between a person's height and how well he or she performs in a long jump?

Hypotheses:

H0: There is no relationship between a person's height and how well he or she performs in a long jump.

H1: There is a relationship between a person's height and how well he or she performs in a long jump.

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# Example of Correlational Research (1) (cont.)

Sample of 14 untrained individuals was randomly chosen from the general population, and their height and distance in a long jump were measured.

A correlation analysis was performed using the parametric correlation coefficient, Pearson's Product Moment [Pearson Correlation].

**Correlations**

| | | Height | Jump_Dist |
|---|---|---|---|
| Height | Pearson Correlation | 1 | .706** |
| | Sig. (2-tailed) | | .005 |
| | N | 14 | 14 |
| Jump_Dist | Pearson Correlation | .706** | 1 |
| | Sig. (2-tailed) | .005 | |
| | N | 14 | 14 |

**. Correlation is significant at the 0.01 level (2-tailed).

Published with written permission from SPSS Statistics, IBM Corporation.

Results:

- Statistically significant
  - *p*-value [Sig.] = .005 for a 2-tailed test
- There was a strong, positive correlation (*r* = .706) between height and distance jumped in a long jump.

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# Example of Correlational Research (2)


Video | Case Study

Add to list

## A Correlation Study of Happiness, Motivation and Stress from Creative Pursuits

**Academic:** V. Krishna Kumar PhD

**Publisher:** SAGE Publications, Ltd.

**Original publication date:** 2023

**Length:** 00:27:15

**Methods:** Correlation, Questionnaire design, Methodology, Principal components analysis

**Abstract:**

V. Krishna Kumar, PhD, professor emeritus, Westchester University, discusses a correlation study of happiness, motivation and stress from creative pursuits, including research design, recruitment, ethical considerations, data collection and analysis, research findings, challenges faced, and lessons learned.

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# References


Cohen, L., & Manion, L. (1994). *Research methods in education* (4th ed.). London and New York: Routledge.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson.

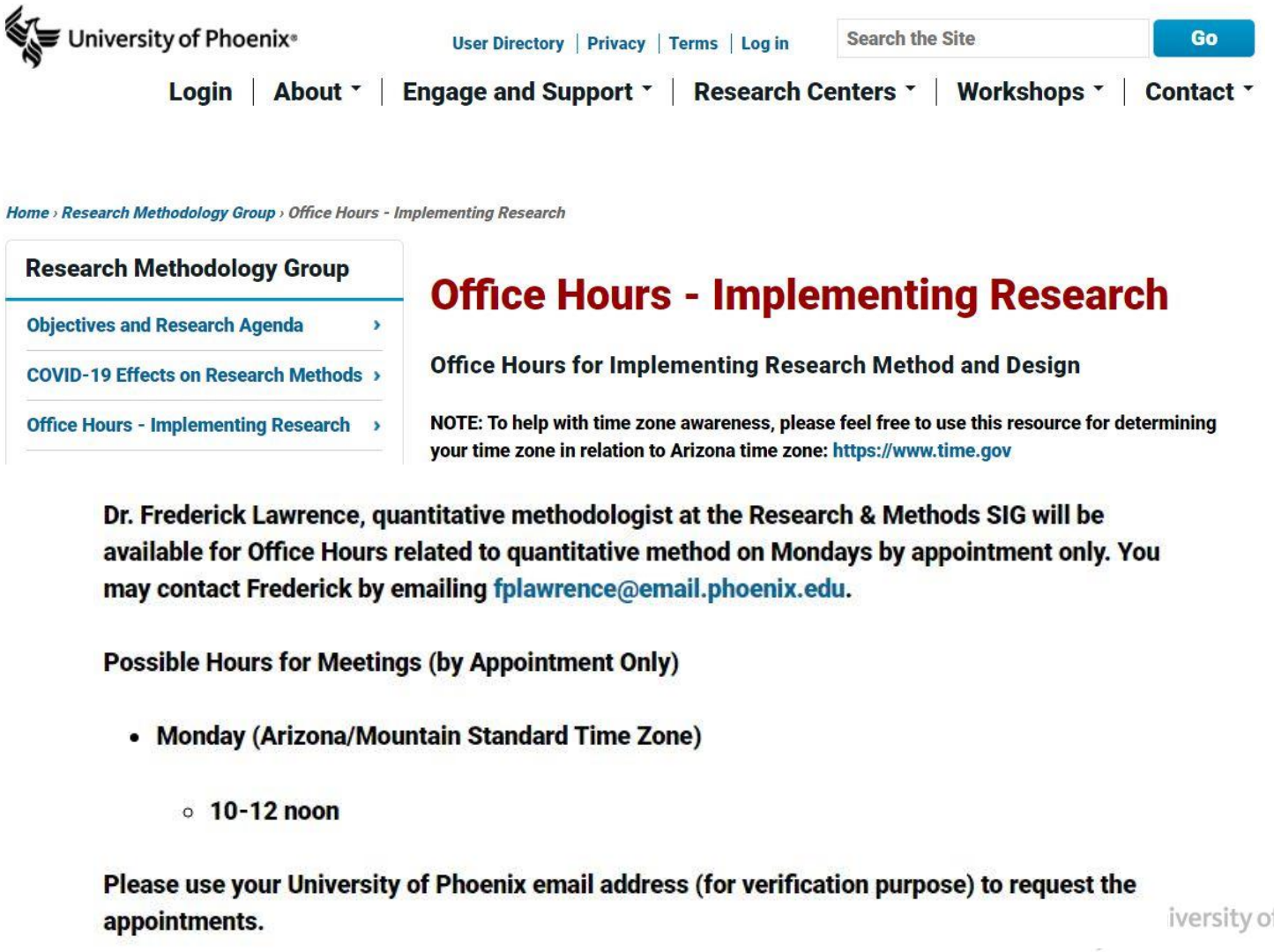
Fraenkel, J. R., & Wallen, N. E. (2000). *How to design and evaluate research in education* (4th ed.). Boston: McGraw-Hill.

Punch, K. F. (1998). *Introduction to social research: Quantitative and qualitative approaches*. London: Sage.

University of Phoenix. (n.d.) *Quantitative research designs*. University of Phoenix Material. RES/711 Version 3.

Vazire, S. (Academic). (2016). Simine Vazire defines correlational research [Video]. SAGE Knowledge. https://dx.doi.org/10.4135/9781473960220

# For Further Help: Quantitative Office Hours



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## Office Hours - Implementing Research

### Office Hours for Implementing Research Method and Design

NOTE: To help with time zone awareness, please feel free to use this resource for determining your time zone in relation to Arizona time zone: https://www.time.gov

Dr. Frederick Lawrence, quantitative methodologist at the Research & Methods SIG will be available for Office Hours related to quantitative method on Mondays by appointment only. You may contact Frederick by emailing fplawrence@email.phoenix.edu.

Possible Hours for Meetings (by Appointment Only)

- Monday (Arizona/Mountain Standard Time Zone)
  - 10-12 noon

Please use your University of Phoenix email address (for verification purpose) to request the appointments.

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# Discussion and Q&A

# Correlation and Correlational Design Resources

Web-based

Research methods knowledge base
http://www.socialresearchmethods.net/kb/

> "A comprehensive web-based textbook that addresses all of the topics in a typical introductory undergraduate or graduate course in social research methods. . . . It is a fully hyperlinked text that can be integrated easily into an existing course structure or used as a sourcebook for the experienced researcher who simply wants to browse." (Except from the description on the website.) A favorite online reference source for methods.

Lohninger, H. Learning by simulations (Web site)
http://www.vias.org/simulations/simusoft_rdistri.html

> An interactive web site with learning tools that illustrates various science and computational principles. The **Probability Density Function of the Correlation Coefficient Calculator** clearly demonstrated the effect on correlations when too few observations are used. This is a great graphical reference to send learners to when they are trying to do correlations with really small samples.

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# Correlation and Correlational Design Resources (cont.)

http://researchonline.blogspot.com

A collection of interesting and sometimes valuable explanations of research methods.

School of Psychology University of New England *WebStat: Chapter 2 – Research Design: Non-experimental designs*.

Clearly written short summary of the advantages of Correlational Design. http://www.une.edu.au/WebStat/unit_materials/c2_research_design/design_nonexperimental.htm

Lee, J.-J. (2007). Correlational, comparative study: What is a valid research design? *Hallym International Journal of Aging*, *9*(1), 59-76. http://ihome.cuhk.edu.hk/~b051716/CU/Correlational,%20Comparative%20Study,%20what%20is%20a%20valid%20research%20design.pdf

This is an interesting article that illustrates the importance of probabilistic sampling when using correlational designs in comparative studies where the researcher wants to be able to generalize.

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# Correlation and Correlational Design Resources (cont.)

http://www.statsoft.com/textbook/stbasic.html

Excellent series of clear explanations of Basic Statistical procedures.

Books

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

I don't know if this is still available, but it has been a standard reference on correlation and regression for a number of years. It is clearly written and easy to follow. You can read it for explanations or when you need it the detailed explanation of computational approaches.

Cramer, D., & Howitt, D. (2004). *The Sage dictionary of statistics*. London: Sage.

A good reference to own because of the excellent examples provided throughout.

Rodgers, J. L., & Nicewander, W. A. (1988). Thirteen ways to look at the correlation coefficient. *The American Statistician, 42, 59–66. doi:* 10.2307/2685263

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# Correlation and Correlational Design Resources (cont.)

Rosenfeld, R. (1992). *The McGraw-Hill 36 hour business statistics course*. New York: McGraw-Hill.

Solid book with easy to understand descriptions and excellent applied business examples.

Rowntree, D. (2004). *Statistics without tears: A primer for non-mathematicians* (Classic reprint). Boston: Allyn and Bacon.

Very readable and highly understandable explanations. Good reference when explaining correlation to learners who fear math.

Salkind, N. J. (2004). *Statistics for people who (think they) hate statistics* (2nd ed.). Thousand Oaks, CA: Sage.

One of the most readable statistics books I have used. Even written with a sense of humor. Uses a smiley face "difficulty scale." 5 smileys = "You don't even have to figure anything out!" One feature I really like are the decision tree flow diagrams for making design and analysis decisions. Learners readily understand and follow these flow charts and can translate them into the "decisions" they have to make to get to their design and analysis.

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# Correlation and Correlational Design Resources (cont.)

Spiegel, M. R. (2000). *Statistics: Crash course: Schaum's easy outlines*. New York: McGraw Hill.

Handy quick guide to most essential statistical processes. Chapter 11 covers correlation theory and computations.

Trochim, W. (2001). *Research methods knowledge base* Atomicdogpublishing.com ISBN: 1931442487