

# **Quantitative Method: Experimental Method**

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# Experimental Design

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- Standard form for Experimental Design
  - Participants
  - Materials
  - Procedures
  - Measures

# Experimental Design: Generic Guide

**Table 8.4** A Checklist of Questions for Designing an Experimental Procedure

	Who are the participants in the study?
	What is the population to which the results of the participants will be generalized?
	How were the participants selected? Was a random selection method used?
	How will the participants be randomly assigned? Will they be matched? How?
	How many participants will be in the experimental and control group(s)?
	What is the dependent variable or variables (i.e., outcome variable) in the study? How will it be measured? Will it be measured before and after the experiment?
	What is the treatment condition(s)? How was it operationalized?
	Will variables be covaried in the experiment? How will they be measured?
	What experimental research design will be used? What would a visual model of this design look like?
	What instrument(s) will be used to measure the outcome in the study? Why was it chosen? Who developed it? Does it have established validity and reliability? Has permission been sought to use it?
	What are the steps in the procedure (e.g., random assignment of participants to groups, collection of demographic information, administration of pretest, administration of treatment(s), administration of posttest)?
	What are potential threats to internal and external validity for the experimental design and procedure? How will they be addressed?
	Will a pilot test of the experiment be conducted?
	What statistics will be used to analyze the data (e.g., descriptive and inferential)?
	How will the results be interpreted?

# Experimental Design: Participants

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- Describe the participant selection process (random or nonrandom)
- Identify features that may influence the outcome
  - match participants in terms of a certain characteristic and then assign one individual from each matched set to each group
  - Using covariates as moderating variables
- Mention number of participants in each group
  - power analysis (Lipsey, 1990) to identify the appropriate sample size

# Experimental Design: Participants

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Study by Enns and Hackett (1990)

## *Participants*

The participants were 150 undergraduate women enrolled in both lower-and upper-division courses in sociology, psychology, and communications at a mid-sized university and a community college, both on the west coast. [*The authors described the participants in this study.*]

Source: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W. Creswell and J. David Creswell

# Experimental Design: Instrumentation and Materials

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- Explain the instrument(s) that participants complete, typically before the experiment begins and at its end.
  - validity and reliability
- Materials used for the experimental treatment
  - Example: One group participate in a computer-assisted learning plan
  - handouts, lessons, and special written instructions
  - Pilot test of materials or any training required to administer the materials

# Experimental Design: Instrumentation and Materials

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## Study by Enns and Hackett (1990)

### *Instruments*

Manipulation checks. As a check on participants' perception of the experimental manipulation and as an assessment of participants' perceived similarity to the three counselors, two subscales of Berryman-Fink and Verderber's (1985) Attributions of the Term Feminist Scale were revised and used in this study as the Counselor Description Questionnaire (CDQ) and the Personal Description Questionnaire (PDQ). ... Berryman-Fink and Verderber (1985) reported internal consistency reliabilities of .86 and .89 for the original versions of these two subscales. *[Authors discussed the instruments and the reliability of the scales for the dependent variable in the study.]*

Source: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W. Creswell and J. David Creswell

# Experimental Design: Procedures

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- Identify the type of experimental design
  - pre-experimental designs (no control group)
  - quasi-experiments (control and experimental groups, but without random assignment)
  - true experiments (randomly assigns the participants to treatment groups)
  - single-subject designs (observing the behavior of a single individual or a small number of individuals over time)



# Experimental Design: Procedures

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- Identify the type of experimental design
- Identify what is being compared in the experiments

# Experimental Design: Procedures

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- Identify the type of experimental design
- Identify what is being compared in the experiments
- Provide an illustration of the specific research design to be used
  - Campbell and Stanley (1963, p. 6)

- *X* represents an exposure of a group to an experimental variable or event, the effects of which are to be measured.
- *O* represents an observation or measurement recorded on an instrument.
  - *X*s and *O*s in a given row are applied to the same specific persons. *X*s and *O*s in the same column, or placed vertically relative to each other, are simultaneous.
    - The left-to-right dimension indicates the temporal order of procedures in the experiment (sometimes indicated with an arrow).
- The symbol *R* indicates random assignment.
- Separation of parallel rows by a horizontal line indicates that comparison groups are not equal (or equated) by random assignment. No horizontal line between the groups displays random assignment of individuals to treatment groups.

# Experimental Design: Procedures

## Example 8.4 True Experimental Designs

### Pretest-Posttest Control-Group Design

A traditional, classical design, this procedure involves random assignment of participants to two groups. Both groups are administered both a pretest and a posttest, but the treatment is provided only to experimental Group A.

Group A  $R—O—X—O$

Group B  $R—O—O$

### Posttest-Only Control-Group Design

This design controls for any confounding effects of a pretest and is a popular experimental design. The participants are randomly assigned to groups, a treatment is given only to the experimental group, and both groups are measured on the posttest.

Group A  $R————X————O$

Group B  $R————O$

### Solomon Four-Group Design

A special case of a 2 X 2 factorial design, this procedure involves the random assignment of participants to four groups. Pretests and treatments are varied for the four groups. All groups receive a posttest.

Group A  $R—O—X—O$

Group B  $R—O————O$

Group C  $R————X—O$

Group D  $R————O$

# Experimental Design: Procedures

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## Study by Enns and Hackett (1990)

### *Procedure*

All experimental sessions were conducted individually. The experimenter, an advanced doctoral student in counseling psychology, greeted each subject, explained the purpose of the study as assessing students' reactions to counseling, and administered the ATF. The ATF was then collected and scored while each subject completed a demographic data form and reviewed a set of instructions for viewing the videotape. The first half of the sample was randomly assigned to one of the twelve videotapes (3 Approaches  $\times$  2 Statements  $\times$  2 Counselors), and a median was obtained on the ATF. The median for the first half of the sample was then used to categorize the second half of the group as feminist or nonfeminist, and the remainder of the participants was randomly assigned to conditions separately from each feminist orientation group to ensure nearly equal cell sizes. The median on the final sample was checked and a few participants recategorized by the final median split, which resulted in 12 or 13 participants per cell.

After viewing the videotape that corresponded to their experimental assignment, participants completed the dependent measures and were debriefed. [pp. 35–36; *Authors described the procedure used in the experiment.*]

# Experimental Design: Threats to Validity

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- Examples of Internal Threats
  - Mortality: Participants drop out during an experiment, and hence, unknown outcome for these individuals.
  - Selection: Selection of participants with certain characteristics that predispose them to have certain outcomes.
  - Diffusion of treatment: Communication between participants in the control and experimental groups that can influence the outcome

# Experimental Design: Threats to Validity

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- External Threats

**Table 8.6** Types of Threats to External Validity

<b>Types of Threats to External Validity</b>	<b>Description of Threat</b>	<b>In Response, Actions the Researcher Can Take</b>
Interaction of selection and treatment	Because of the narrow characteristics of participants in the experiment, the researcher cannot generalize to individuals who do not have the characteristics of participants.	The researcher restricts claims about groups to which the results cannot be generalized. The researcher conducts additional experiments with groups with different characteristics.
Interaction of setting and treatment	Because of the characteristics of the setting of participants in an experiment, a researcher cannot generalize to individuals in other settings.	The researcher needs to conduct additional experiments in new settings to see if the same results occur as in the initial setting.
Interaction of history and treatment	Because results of an experiment are time-bound, a researcher cannot generalize the results to past or future situations.	The researcher needs to replicate the study at later times to determine if the same results occur as in the earlier time.

Source: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, by John W. Creswell and J. David Creswell