

Quantitative Research Methods

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- 1 Outline
- 2 Research Methods
 - Quantitative or Qualitative: Examples
- 3 Quantitative Research
 - Quantitative Research Design
 - Research Instrument

Research Methods

- Research is aimed at generating knowledge
- Research methods are the approaches (strategies, techniques, tools etc.) employed in generating knowledge
- Three broad categories of research methods:

Quantitative Employs quantitative data and quantitative techniques for data analysis. Quantitative data deal with numerical values to which mathematical calculations and statistical analyses can be meaningfully applied. There is a lot of work before data collection. The researcher knows what will be analysed before the data are collected.

Qualitative Employs qualitative techniques for data analysis. Qualitative data deal with descriptions, text audio-video recordings etc. Researcher wants to gain in-depth insights, understand experiences and provide interpretations etc. Analysis of such data may include application of labels, categorisation, and providing rich explanations etc.

Mixed Employs a combination of quantitative and qualitative techniques. Provides more contextualised results. Enables triangulation.

Mixed Methods

- The methods applied need to complement, reinforce, validate results from the counterpart.
- Just including quantitative and qualitative methods that focus on different matters is not enough.
- Triangulation means verification of results from more than one source.

Example:

One might analyse examination results to gain an understanding of the effect of a particular method of instruction (with an appropriate study design). But one can also conduct either individual indepth interviews or focus group discussions to obtain descriptions and explanations of student experiences with the relevant methods of instruction. This information can help to contextualise and explain the examination results observed.

Qualitative or Quantitative: Examples from survey data

Determine whether the data obtained from each of the following items are quantitative or qualitative?

- What is your marital status?
 - 1 Married
 - 2 Common Law relationship
 - 3 Widow or widower
 - 4 Divorced
 - 5 Single
- What is your total monthly income?
 - 1 Less than \$20,000
 - 2 \$20,001 – \$60,000
 - 3 \$60,001 – \$110,000
 - 4 \$110,000 – \$200,000
 - 5 \$200,000 – \$300,000
 - 6 \$300,001 – \$450,000
 - 7 more than \$450,000

Qualitative or Quantitative: Examples from survey data

- To what extent do you agree or disagree with the following statement?
You can't do anything about most of the things that happen to you.
 - 1 Completely disagree
 - 2 Disagree
 - 3 Neither agree nor disagree
 - 4 Agree
 - 5 Completely agree

Quantitative Research Design

Indicating that your research is quantitative, qualitative or mixed methods doesn't say much about your research. You need to drill down further to identify the research design. **The research design addresses how subjects or participants are assigned to the research conditions.**

Quantitative Research Design

- Experiment

- ▶ The researcher is able to control the major sources of variation and determine cause and effect
- ▶ **Randomization is a key feature.** Necessary for causal inference.
- ▶ Strongest basis for research conclusions
- ▶ Fairly easy when dealing with inanimate research participants and subjects
- ▶ Can violate ethical standards and be inhumane for some areas of interest
- ▶ Applied often in
 - ★ Laboratory work (chemistry, biology, physics, material science etc.)
 - ★ Work on crops
 - ★ Work on medicine etc.
- ▶ Example: effects of three fertilisers on crop yield

Quantitative Research Design

- Quasi-Experiment

- ▶ Researcher can control some but not all sources of variation
- ▶ Random assignment of participants/ subjects to treatment conditions is not possible
- ▶ Assignment of subject might be inhumane, violate ethical standards or disrupt the order of things too much
- ▶ Strict causal conclusions can't really be made but there might be good evidence in favour of some conclusions.
- ▶ Applied often in
 - ★ Education
 - ★ Social Sciences/ Humanities
 - ★ Psychology etc.
- ▶ Example: effects of an approach to instruction on achievement

Quantitative Research Design

- Correlational (Observational) Study

- ▶ The research participants/ subjects are observed in their natural environment.
- ▶ There are many pitfalls to causal inferences
- ▶ Inferences can gain strength with several replications in various places
- ▶ Applied often in
 - ★ Public Health
 - ★ Social Sciences
 - ★ Education etc.
- ▶ Example: effects of smoking on health

Think of a study that you are undertaking or attempting to undertake. What is the type of study design? Explain your answer.

Research Instrument

The research instrument is the tool that will be used to make measurements.

- Identify the tool to be used
- Describe the measurements to be made including the scale
- Provide information on the (known) validity and reliability of the measurements
- Provide justification for the tool and the measurement scale
- **Relevant information is usually available in the literature**
- **The tool to use will be informed by and linked to the research question**

For questionnaires and similar instruments, justification for the items, what the measure and how different items will be combined (constructs) including validity and reliability is necessary!

Data Collection Methods

Description of the data collection method is usually done close to identification of the research design.

There are many data collection methods that may apply to various research designs. In each case, details on how the method is executed are important.

- Interviews
- Surveys
 - ▶ various types
 - ▶ Need to describe sampling methodology and survey execution
- Experiments
 - ▶ Need to describe the experimental design
- Observation
- Abstraction
- Autocapture (esp metadata)

The data collection method chosen will be informed by the instrument to be used and the measurements to be made.

- Data collection methods need to be explained and justified.
- If there are competing alternatives, the basis for your choice needs to be documented

Questions