FACHBEREICH INFORMATIK

Lecture
Empirical Model Building and Methods
(Empirische Modellbildung und Methoden)

Prof. Dr. Dr. h.c. Dieter Rombach
Dr. Andreas Jedlitschka

SS 2015

Chapter 3.3.2 – Non-experimental Design

Fraunhofer IESE

AG·SE

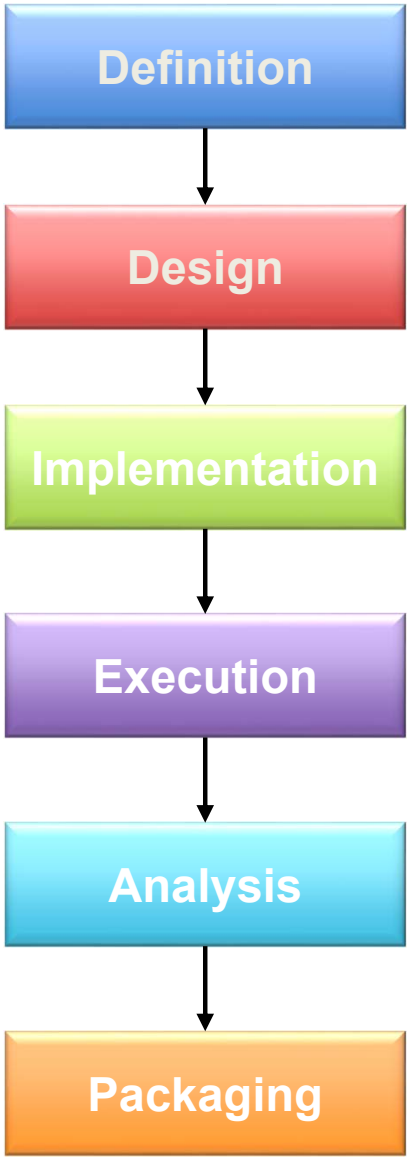
Chapter objectives

At the end of this chapter, you should …

- know non-experimental study types, in particular, case study, survey, interview, and observation.
- understand which decisions should be made during the design of a case study, survey, interview, and observation.
- understand the tasks related to the design and preparation of case study, survey, interview, and observation.
- understand the differences between case study, survey, interview, observation, and (controlled) experiment.

(Survey), Interviews and observations can be also be used as data collection methods within an experimental design.

Empirical Process - Design



Operationalize study goals and hypotheses

Make study plan

- what needs to be done
- by whom and when

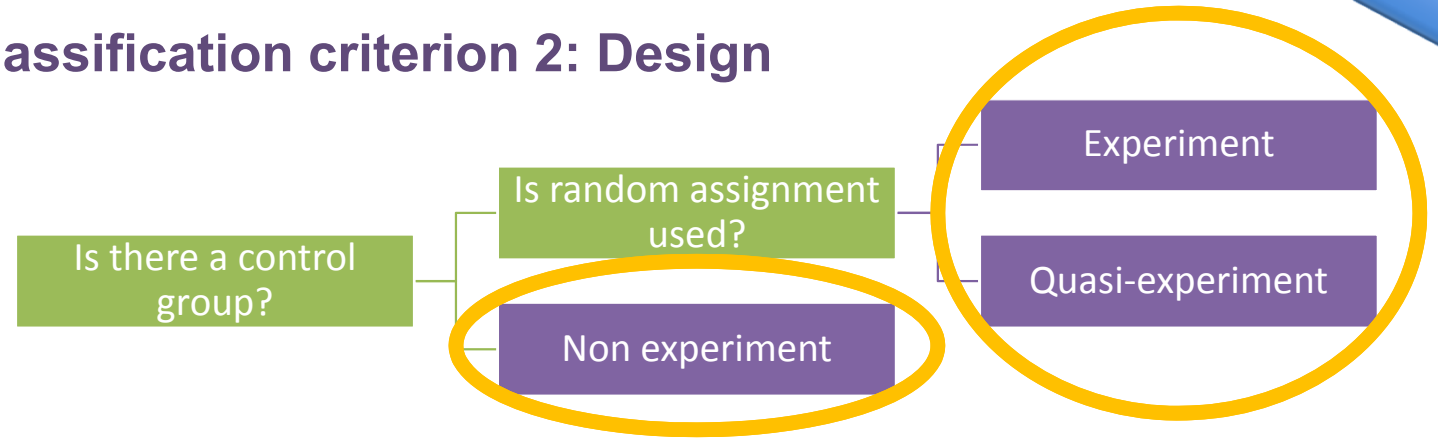
Types of Empirical Studies

From Chapter 3.2 - Definition

Classification criterion 1: Purpose

- explorative, descriptive, and causal

Classification criterion 2: Design



Classification criterion 3: Method

- in SE we usually distinguish: **(controlled) experiment, case study, and survey**
- Other methods include: Action research, observational study, interviews, focus groups, phenomenology, ethnography, …

Design

I. Experimental design

II. Non experimental design

3.3.1 Case study

3.3.2 Survey

3.3.3 Interview

3.3.4 Observation

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Definitions

- Empirical inquiry, in which
  - a contemporary phenomenon is investigated within **its real-life context**
  - boundaries between phenomenon and its context are not clearly evident

- Empirical inquiry, which
  - copes with the technical distinctive situation in which there will be many more variables of interest than data points.
  - relies on **multiple sources of evidence** (data needs to be converged).
  - benefits from prior development of theoretical propositions to guide data collection and analysis.

Cf. Perry DE, Sim SE, Easterbrook S (2005) Case studies for software engineers, 29th Annual IEEE/NASA Software Engineering Workshop—Tutorial Notes pp 96–159

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Types of Case Studies (1/2)

- Explanatory
  - Presumed causal links in real-life interventions that are too complex to be studied in experiments
  - Adjudicates between competing explanations
  - Example: How important is implementation bias in requirements engineering?
    - Rival theories: existing architectures are useful for anchoring, vs. existing architectures are over-constraining during RE
- Descriptive
  - Describes an intervention and the real-life context in which it occurred
  - Describes sequence of events and underlying mechanisms
  - Example: How does pair programming actually work?
  - Example: How do software immigrants naturalize?

Perry DE, Sim SE, Easterbrook S (2005) Case studies for software engineers, 29th Annual IEEE/NASA Software Engineering Workshop—Tutorial Notes pp 96–159

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Types of Case Studies (2/2)

- Causal
  - Looks for causal relationship between concepts
  - Example: Requirements errors are more likely to cause safety-related defects than programming errors
    - See study by Robyn Lutz on the Voyager and Galileo spacecraft
- Exploratory
  - Explore situations in which the intervention being evaluated has no clear, single set of outcomes.
  - Criteria or parameters instead of purpose
  - Example: Christopher Columbus' voyage to the new world
  - Example: What do CMM level 3 organizations have in common?

Perry DE, Sim SE, Easterbrook S (2005) Case studies for software engineers, 29th Annual IEEE/NASA Software Engineering Workshop—Tutorial Notes pp 96–159

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Main points to consider:

- research questions set out from the beginning of the study
- data is collected in a planned and consistent manner
- inferences are made from the data to answer the research question
- a phenomenon is explored, or an explanation is produced, or a description or a causal analysis of the phenomenon is provided
- threats to validity are addressed in a systematic way

Main difference in comparison to experiments

- Flexible design strategy
  - Iterative and incrementally

BUT: Changing objectives -> new case study

Cf. Perry DE, Sim SE, Easterbrook S (2005) Case studies for software engineers, 29th Annual IEEE/NASA Software Engineering Workshop—Tutorial Notes pp 96–159

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Components in designing case studies:

- Study's questions : "how", "why"
- Study's (theoretical) propositions
  - Pointing attention
  - Limiting scope
  - Suggesting possible links between phenomena
- Study's units of analysis
  - Main units must be at the same level as the study questions
  - Units must be comparable to those previously studied
- Logic linking the data to the propositions
  - Matching pieces of information to rival patterns that can be derived from the propositions
- Criteria for interpreting results
  - Iteration between propositions and data and matching sufficiently contrasting rival patterns to data;
  - There is no precise way of setting the criteria

Cf. Perry DE, Sim SE, Easterbrook S (2005) Case studies for software engineers, 29th Annual IEEE/NASA Software Engineering Workshop—Tutorial Notes pp 96–159

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Design checklist

1. What is the case and its units of analysis?
2. Are clear objectives, preliminary research questions, hypotheses (if any) defined in advance?
3. Is the theoretical basis—relation to existing literature or other cases—defined?
4. Are the authors' intentions with the research made clear?
5. Is the case adequately defined (size, domain, process, subjects…)?
6. Is a cause–effect relation under study? If yes, is it possible to distinguish the cause from other factors using the proposed design?
7. Does the design involve data from multiple sources (data triangulation), using multiple methods (method triangulation)?
8. Is there a rationale behind the selection of subjects, roles, artifacts, viewpoints, etc.?
9. Is the specified case relevant to validly address the research questions (construct validity)?
10. Is the integrity of individuals/organizations taken into account?

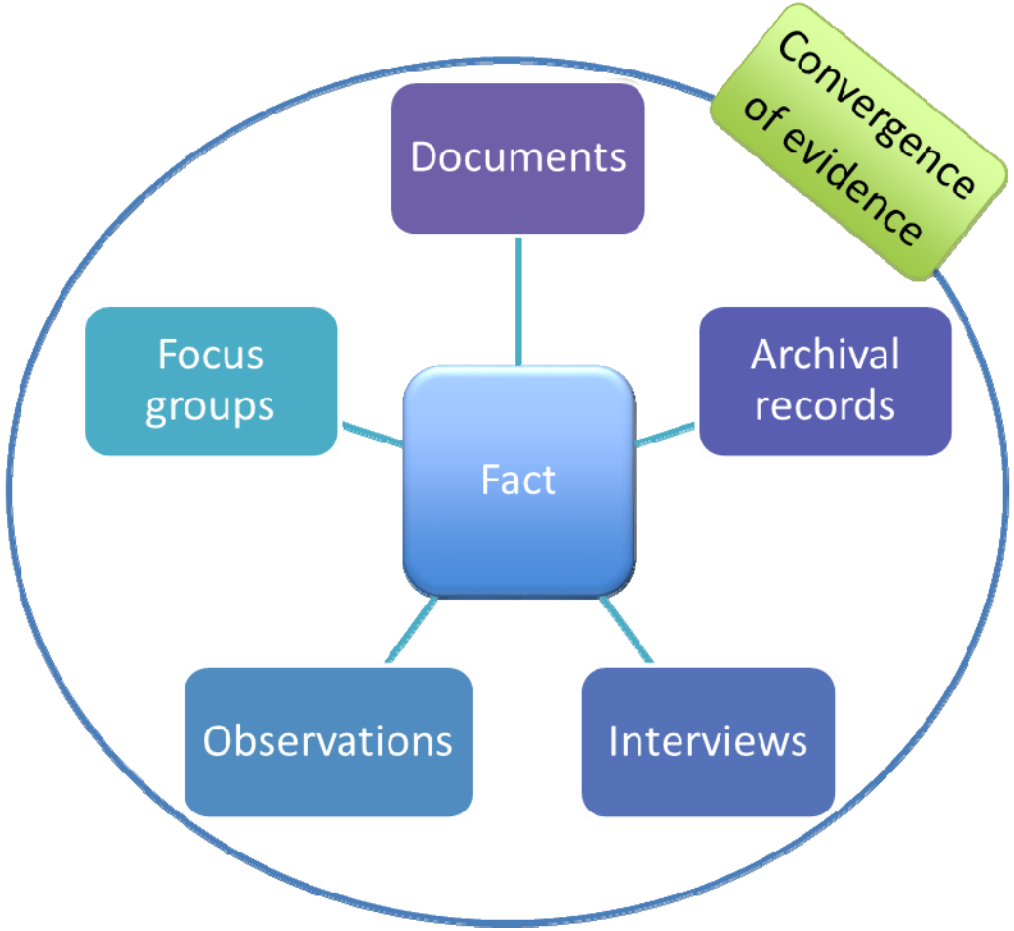
Cf. Runeson, P. and Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. Emp. Softw. Engg. 14, 2 (April 2009), 131-164.

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Data collection methods:

- qualitative, quantitative, combination, and …
- triangulation "to bring the data together"



Data collection methods and principles

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation

3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Principles of data collection (1/2)

- Use multiple data sources
  - Triangulation, i.e. searching convergent findings from different sources (→ Increase construct validity)
- Create a case study database
  - Content
    - Case study notes (clear & available for later use)
    - Case study documents
    - Tabular materials (collected & created)
    - Narratives (initial open-ended answers to the study questions suggested by investigators)
  - Separate from the final report to be written

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Principles of data collection (2/2)

- Maintain an chain of information
  - Explicit documentation of the traceability between research questions and case study procedures.
    - Ensure the collection of all data required for answering the research questions.
    - Justify the collection of each data item.
  - Design and use the case study protocol for supporting data collection and analysis.
  - Storage of actual data in the data base for later reviews including elicitation circumstances.
  - Explicit citation of data sources and data base location in the final report and conclusions

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Data collection checklist

11. Is a case study protocol for data collection and analysis derived (what, why, how, when)? Are procedures for its update defined?
12. Are multiple data sources and collection methods planned (triangulation)?
13. Are measurement instruments and procedures well defined measurement definitions, interview questions)?
14. Are the planned methods and measurements sufficient to fulfill the objective of the study?
15. Is the study design approved by a review board, and has informed consent obtained from individuals and organizations?
16. Is data collected according to the case study protocol?
17. Is the observed phenomenon correctly implemented (e.g. to what extent is a design method under study actually used)?
18. Is data recorded to enable further analysis?
19. Are sensitive results identified (for individuals, the organization or the project)?
20. Are the data collection procedures well traceable?
21. Does the collected data provide ability to address the research question?

Cf. Runeson, P. and Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. Emp. Softw. Engg. 14, 2 (April 2009), 131-164.

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Threats to validity

Threat to	Phase of research in which tactic occurs	Case study tactic
Construct Validity	Data collection Data collection Composition	• Use multiple sources of evidence • Establish chain of evidence • Have key informants review draft report
Internal Validity	Data analysis Data analysis Data analysis Data analysis	• Do pattern-matching • Do explanation-building • Address rival explanations • Use logic models
External Validity	Research design Research design	• Use theory in single-case studies • Use replication logic in multiple-case studies
Reliability	Data collection Data collection	• Use case study protocol • Develop case study database

Investigator desired' skills

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

- Asking good questions
  - Interpret the answers
- Being a good "listener"
  - Not trapped by own preconceptions or ideologies
- Being adaptive and flexible
  - Perceive newly encountered situations as opportunities (not at threats)
- Grasp of the issue being studied
  - Not to miss important clues
  - Understand when a deviation is acceptable
  - Data is not "mechanically" recorded
  - "real-time" interpretation of information (e.g., in order to being able to react on contradictions among sources of evidence)
- Lack of bias
  - not using a case study to substantiate a preconceived position
  - Openness to contrary findings

Case Study

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Analysis checklist

22. Is the analysis methodology defined, including roles and review procedures?
23. Is a chain of evidence shown with traceable inferences from data to research questions and existing theory?
24. Are alternative perspectives and explanations used in the analysis?
25. Is a cause–effect relation under study? If yes, is it possible to distinguish the cause from other factors in the analysis?
26. Are there clear conclusions from the analysis, including recommendations for practice/further research?
27. Are threats to the validity analyzed in a systematic way and countermeasures taken? (Construct, internal, external, reliability) question?

Reporting checklist

28. Are the case and its units of analysis adequately presented?
29. Are the objective, the research questions and corresponding answers reported?
38. Is the report suitable for its audience, easy to read and well structured?

Cf. Runeson, P. and Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. Emp. Softw. Engg. 14, 2 (April 2009), 131-164.

Case Study: Criticism

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Typical criticism towards case studies and answers

- Criticism: Lack of systematic handling of data (Lack of rigor!)
  - Answer: Systematically reporting of all data and procedures, …
- Criticism : Little basis for scientific generalization!
  - Answer: Purpose is to generalize to theoretical propositions and not to population as in statistical research
    - Analytic generalization instead of statistical generalization
- Criticism: Take too long, end up with massive, unreadable documents
  - Answer:
    - Duration depends on the research question.
    - Analysis and documentation depend on the choices of investigators

"… one major lesson is that good case studies are difficult to do"
(Yin, 2002, p.11)

Design

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

I. (Quasi-) experimental design

II. Quasi-experimental and non experimental design

3.3.1 Case study

3.3.2 Survey

3.3.3 Interview

3.3.4 Observation

Survey

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Survey research vs. survey

- Survey is the data collection tool to perform survey research

When to use surveys?

- Mainly descriptive
- Form of research question: “what”, “who”, “how”
  - Information about characteristics, actions, opinions, attitudes
  - Assess needs, evaluate demand, examine impact
- Quantitative
  - subjective
    - E.g., individual’s opinions, attitudes and preferences
  - objective
    - E.g., demographic information
- Large sample (or whole population)
- Often performed “after an event”

Survey

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation

3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Purpose

"… to answer questions that have been raised, to solve problems that have been posed or observed, to assess needs and set goals, to determine whether or not specific objectives have been met, to establish baselines against which future comparisons can be made, to analyze trends across time, and generally, ***to describe what exists, in what amount, and in what context****."*
(Isaac and Michael, 1997, p. 136)

Strength

"… is asking people about their firsthand experiences: ***what they have done, their current situations, their feelings and perceptions****.*
Avoid asking questions about which people do not have informed answers."
(Fowler, 1998)

Survey

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

What are the main purposes of surveys?

- **Describing** a population with respect to important variables
- **Explaining** differences in the population based on variables or their correlation
- **Explore** a population in a pre-study to identify important variables or relevant variable values

Survey

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Survey designs

- Cross-sectional
  - Data collected at one point in time (from a sample)
- Longitudinal
  - Correlational research, repeated observations of same variables over a period time (usually a long period)
  - Trend
    - Different samples from a general population
  - Cohort
    - Different sample from the same specific population
  - Panel
    - Same sample

Survey

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Data collection methods

- Quantitative
  - e.g., structured questionnaires
    - Using rating and ranking scales
    - Asking for numbers, frequencies
- Administered
  - printed
  - by mail
  - online
  - phone

Questionnaire design and administration

Survey

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Survey protocol

- It is similar to the experiment protocol w.r.t.:
  - Research goal, research questions, and propositions
  - Select target population
  - Design the survey instrument (questionnaire)
  - Administer the survey
  - Collect, validate and analyze the data
  - Answer the research question

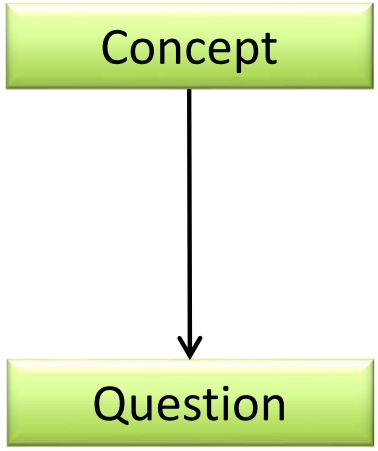
- Main differences w.r.t. experiment protocol
  - Operationalization
    - Kind of respondents, # of respondents, how to reach respondents and how to motivate participation
    - Quality of responses, search for standard instruments, adapt them if necessary (but carefully!)
    - Demographic questions
    - Debriefing questions

A2. Survey: Types of Questions

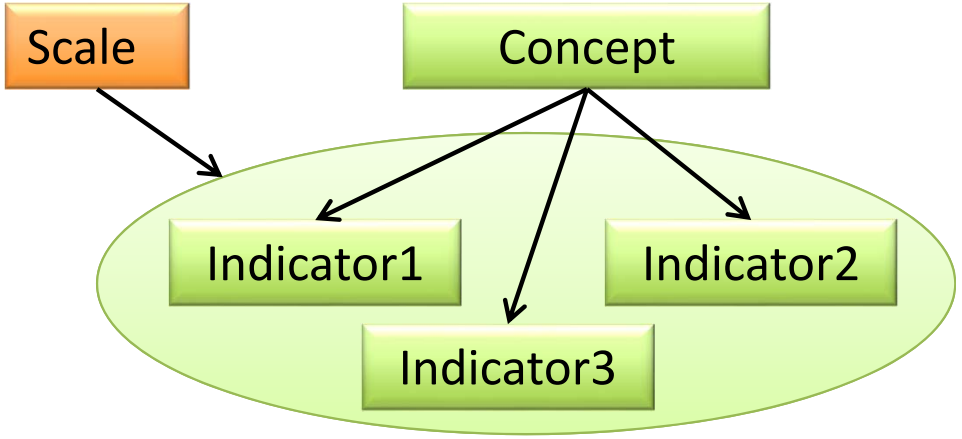
3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Question types: Closed or open-end questions

- Closed questions (forced-choice):
  - Respondents must selecting predefined and fixed answer categories
    - e.g. single choice, multiple choice, numeric, date
    - Never forget the category "don't know"/"none of these"/"does not apply"
  - Advantages: Easy quantitative evaluation



Suggestion: Ask multiple indicators of a single concept, and then create a scale by combining those indicators.



A2. Survey: Types of Questions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Question types: Closed or open-end questions

- Open-end questions:
  - Respondents formulate their answers in their own words
  - It requires coding scheme for analysis
    - Code refers to a concept and its identification through explicit criteria.
    - It may refers to tasks, events, processes, strategies, practices, meanings, participants/roles, perspective, interactions, conditions, constraints, consequences, context, etc.
  - More complex analysis
  - Advantages:
    - wider spectrum of possible insights
    - less dependent on prior knowledge of questionnaire designers

Suggestion: Include an open-end question giving respondents the opportunity to add any additional comments they might have.

A2. Survey: Types of Questions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Question types: Example

Closed question

On a scale from 1: “completely useful” to 5: “completely useless”, how useful do you consider UML for….?

○ 1: completely useful	⊗ 2: useful	○ 3: neither useful nor useless	○ 4: useless	○ 5: completely useless

Open question

How useful do you consider UML for …?

“For me the usefulness of a diagram depends on: (1) the type of project you are working on, (2) how many people you're working with and (3) the software development process you are using…..

I worked in a company that builds large systems using the Model-Driven-Architecture approach and UML. It worked well and saved countless weeks of work, since code was directly generated from the models…..”

A2. Survey: Types of Questions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation

3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Good questions …

- Are clear and use simple language (understandable)
- Single purpose (not using “and” to combine two aspects)
- Avoid biased terms or suggestions
- Are concise
- Are specific
- Are possible to answer
- Are relevant
- Complete, precise, unambiguous, understandable
  - Use simple and complete sentences
  - Avoid jargon and specialized terminology
  - Avoid (double) negatives
  - What exactly does the question refer to?

A2. Survey: Types of Questions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 D
3.7

Response option

- Reflect the concepts and fit with the wording of the question
- Mutually exclusive
  - can select only one appropriate answer
- Exhaustive
  - all possible answers are listed (including, e.g., “other“, “don’t know”)

To what extent do you agree or disagree with this statement: “Listening to classical music is good for a person’s emotional health.”

❑ Strongly agree
❑ Somewhat agree
❑ Neither agree nor disagree
❑ Somewhat disagree
❑ Strongly disagree
❑ No opinion

What was your total income from all sources in 2003? _____ Total income for 2003

vs.

Which category best describes your total income from all sources in 2003?

❑ $10,000. or less
❑ $10,001. to $20,000.
❑ $20,001. to $35,000.
❑ $35,001. to $50,000.
❑ $50,001. or above

A2. Survey: Types of Questions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation

3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Response option

- Ranking scales
  - Direct ranking
    - A rank order is associated exactly to one object
  - Successive interval ranking
    - First, objects are associated to rankings
    - Then, objects within a rank order are ranked
- Rating scales
  - Numbers
  - Verbal
  - Symbols
  - Graphical

A2. Survey: Types of Questions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Response option: Examples of rating scales

- Numerical

irrelevant	1	2	3	4	5	relevant

Irrelevant	-2	-1	0	1	2	relevant

- Verbal

Frequency	Always	Often	Sometimes	Seldom	Never
Intensity	Way too much	Too much	Just right	Too little	Way too little
Likelihood	Definitively	Probably	Maybe	Probably not	Never
Appraisal	Very good	Good	Fair	Poor	Very poor
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

A2. Survey: Types of Questions

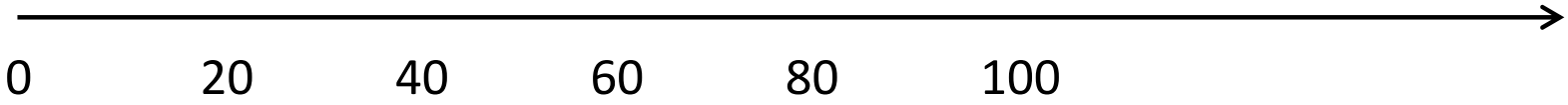
3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Response option: Examples of rating scales

- Symbols

irrelevant	--	-	0	+	++	relevant
disadvantage	☹		😐		☺	advantange

- Graphical



- Combinations

Appraisal	1: Very good	2: Good	3: Fair	4: Poor	5: Very poor
	1: Strongly agree	2: Agree	3: Neither agree nor disagree	4: Disagree	5: Strongly disagree

A2. Survey: Order of questions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Order of questions

- Initial questions affect answers to subsequent ones.
- Start with easy, salient, non-threatening but necessary questions.
- Put more difficult or threatening questions near the end (e.g., demographic questions).
- Keep questions dealing with the same topic together.
- Do not include questions that are redundant or are not likely to be analyzed.
- Do not ask for information that you get from other sources.

A2. Survey: Questions format

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Questions format

- Should be as short as possible.
- Should be visually attractive and nicely reproduced
- Should be spread out and uncluttered
  - better to have more than 1 page than cramped page
- Should be broken into logical sections when possible
- Should have clear skip patterns for contingency questions
- Should have clear spaces for respondents to mark answers
  - use boxes [1]
  - parentheses (X)
  - or numbers to circle ①
  - avoid lines to put check on X
- The amount of space provided for responses to open-end questions will affect how much respondents write.

A2. Survey: Instructions

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation

3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Instructions for respondents

- Provide general instructions in beginning of self-administered survey
  - Brief explanation could include:
    - why doing survey
    - why answers are important
    - how to answer questions
    - stress confidentiality (if appropriate)
  - Do NOT ask permission, assume respondent will want to participate.

- Provide specific instructions to questions as necessary

A2. Survey: Validation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Questionnaire validation

- Pre-testing the instrument (pilot-test) :
  - Use respondents similar to the intended sample
  - Test:
    - Question clarity
      - failure to answer?
      - multiple answers?
      - “other” answers?
      - qualified answers?
  - Find out if time to complete is acceptable
  - Find out whether instructions, flow, and layout are clear

- Do not forget pilot-testing after revisions

A2. Survey: Administration

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Survey administration:

- Supervised
  - An interviewer asks questions, answers clarification questions, and records answers (one-on-one, e.g. telephone)
- Unsupervised
  - The participant is completely on his/her own with the questionnaire (e.g. web-based)
  - Issues: multiple participation, question misunderstandings, joke answers, random answers
- Semi-supervised
  - An interviewer gives some introduction to a group of participants and answers questions, but the filling-in is unsupervised

Try to find a measure to identify respondents and non-respondents

- e.g., give ID to questionnaire and participant

A2. Survey: Validity and Reliability

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Validity

- The degree to which the instrument really measures what it was designed to measure
- Assessing validity is methodically quite difficult and is beyond the scope of this course
  - Studies of patterns of associations (construct, predictive, discriminate validity)
  - Comparison of results from alternative forms of the same question
  - Comparing answers to survey questions with information derived from other sources, such as records
  - Asking the same question twice to the same respondent, and comparing the results (i.e., reliability; but impacts validity)

Reliability

- The degree to which the instrument will give the consistent results when re-used in comparable situations
  - the validity is limited by the reliability
- Assessing it, requires a number of respondents answering the questionnaire again after some time (e.g., a few weeks)
  - questions that are difficult to decide for the respondents typically lead to low reliability

Survey protocol

Design

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

I. (Quasi-) experimental design

II. Quasi-experimental and non experimental design

3.3.1 Case study

3.3.2 Survey

3.3.3 Interview

3.3.4 Observation

Interview

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Interviewing is the process of directing a conversation so as to collect information.

[Michael Angrosino: Doing Ethnographic and Observational research, Sage 2007]

Purpose

- Elicitation of individuals' experiences, opinions or impressions about something.
- Identification or specification of terminology (conceptual frameworks) used in a particular setting.

Approach

- Asking questions
- Using predefined closed or/and open questions
- Using interview protocol

Interview

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Interview protocol

- It is similar to the experiment protocol w.r.t.:
  - Research goal, research questions, and propositions
  - Select target population
  - Design the interview guideline
  - Conduct the interviews
  - Collect, validate and analyze the data
  - Answer the research question

- Main differences w.r.t. experiment protocol
  - Operationalization
    - Kind of respondents, #of respondents, how to reach respondents and how to motivate participation
    - Quality of responses,
    - Expertise of the interviewer
    - Demographic questions
    - Debriefing questions

Interview

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Interview protocol

- Contains a guideline for performing the interview and collecting required data.
- Contains the questions (depending on the type of interview) and the instructions to perform the interview.
- It addresses
  - General information about the interviewee, e.g. name, age and gender.
  - Information for contextualizing people's answers, e.g. role, number of years of experience and number of years in the company.
  - Information about the interview execution, e.g. start and end time, interviewer, place and date.
  - Instructions for the interviewer.
  - Set of (ordered) questions, i.e., what the researcher needs to know in order to answer the research questions of interest.

Execution of an interview

Interview: Classification

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Structured interview

- Closed, standardized and quantitative.
- It used for eliciting specific and well defined data.
- Researchers knows in advance which data should be elicited for answering the research questions.
- It based on a interview protocol with closed questions, which the interviewer should follow.

Unstructured interview

- Open, non-standardized and qualitative.
- Explorative, i.e. it attempts to elicit as much information as possible on a broadly defined topic.
- It is “open-ended” conversation.
- Interviewer has a single and general question in background.
- Interviewee answers freely and may ask also questions.

Interview: Classification

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Semi-structured interview

- The interview protocol attempts to ensure that some foreseen topics are covered, the consistency and coherence between interviews.
- It combines open-ended and closed questions defined in a interview protocol.
- Interviewer is allowed to rephrase and to add questions according to the interviewee's response.

Design

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

I. (Quasi-) experimental design

II. Quasi-experimental and non experimental design

3.3.1 Case study

3.3.2 Survey

3.3.3 Interview

3.3.4 Observation

Observation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation

3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Observation is the act of perceiving the activities and interrelationships of people in the field setting through the five senses of the researcher.

[Michael Angrosino: Doing Ethnographic and Observational research, Sage 2007]

Observation is the act of noting a phenomenon, often with instruments, and recording it for scientific purposes.

[Michael Angrosino: Doing Ethnographic and Observational research, Sage 2007]

Purpose

- Elicitation of firsthand behaviors and interactions that might not be perceived otherwise.
- e.g. understanding or describing strengths, drawbacks, deviations and variations of existing or (new) software technologies, decision processes, the organizational structures, or information communication flows (often under realistic cirumstances).

Observation becomes scientific when … (Judd, 1991)

- … it serves a defined research purpose.
- … it is planned deliberately.
- … it is recorded systematically.
- … it is subjected to checks and controls of quality.

Observation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Classifications (1/3)

- Participant or non participant
  - **Participant** observation
    - Researcher adopts an integrated full-time role with the participants
    - Researcher becomes a participant.
    - Researcher may “see better through others eyes”, but usually has difficulties in documenting observations systematically.
    - Might yield a loss of objectivity.
  - **Non-participant** observation
    - Researcher adopts a ‘fly on the wall’ approach.
    - Researcher is present (visible) for collecting data.
    - Systematic documentation of observations, but understanding subjects‘ insights may require additional interviews or focus groups.
    - Temptation of the participants to talk to the researcher.
    - Unless multiple observers are used (which is not always feasible) it is reliant on the selective subjectivity of the observer.
    - Using videos to record observations has the potential for overcoming this source of subjectivity.

Observation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Classifications (2/3)

- Open or hidden observation
  - Open
    - Subjects know that they are being observed
    - Hawthrone-effect
  - Hidden
    - Subjects “ignore” they are being observing
    - Ethical issues, e.g., informed consent

Observation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Classifications (3/3)

- Free observation
  - Open, unstandardized and qualitative
  - Explorative, i.e., it refers to under-investigated phenomenon
  - It requires a comprehensive and detailed observation protocol
- Semi-standardized observation
  - Explorative and descriptive
  - For a subset of well known research questions and concepts, data is collected by using a standardized observation protocol
- Standardized observation
  - All data is collected by using predefined and fixed observation protocols (and codes)

Observation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Instruments for recording observations

- Observational protocols used for eliciting
  - General information, e.g. place, date, duration, observed people, observer.
  - Descriptive data, e.g. events, duration, participants.
  - Reflective notes, e.g. comments about the research questions, constructs, codes, possible patterns, hunches.
- Standardized codes
  - Code refers to a concept and its identification through explicit criteria.
  - It may refer to tasks, events, processes, strategies, practices, meanings, participants/roles, perspective, interactions, conditions, constraints, consequences, context, etc.
- Checklist
  - It is used only if the researcher knows in advance what aspects are relevant
- Tape recorder and video cameras
  - It requires additional effort for review and transcription.
  - Potential to increase objectivity

Observation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Steps

- Preparation
  - Selecting the specific setting to be observed.
    - Who or what to observe? where? when? for how long?
    - Sampling -> different approach than for experiments
  - Selecting the observation mode.
    - Will or not the observer interact with people?
    - How will events be recorded?
- Design of the observational protocols and instruments
- Training
  - Scope: Study design, observational protocols, codes and instruments
  - It support the consistent elicitation of data by several observers
- Fieldwork
- Data analysis

Sampling: The size of the sample depends on the characteristics of the group you are studying, on your own resources, and on the objectives of the study

[Michael Angrosino: Doing Ethnographic and Observational research, Sage 2007]

Observation

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

The reliability of observational research is a matter of systematic recording and analysis of data and the repetition of observations regularly over a course of time.

[Michael Angrosino: Doing Ethnographic and Observational research, Sage 2007]

How to increase the credibility of observational field notes?

- Tape-recording the events
- Two or more observers for collecting information simultaneously
- Summary sheet, i.e. resume of the data collected in a particular situation.
  - It can be used to (a) plan the next contact, (b) suggest new or revised codes, (c) support the coordination in multi-sites studies, or (d) to summarize data for further analysis.
- Feedback Session, i.e., presenting results to participants and eliciting their feedback

Observations

3.1 Introduction
3.2 Definition
3.3 Design
I. Experimental design
Non experimental design
3.3.1 Case study
3.3.2 Survey
3.3.3 Interview
3.3.4 Observation
3.4 Implementation
3.5 Execution
3.6 Data analysis
3.7 Packaging

Observation protocol

- It is similar to the experiment protocol w.r.t.:
  - Research goal, research questions, and propositions
  - Select target population
  - Design the data collection instruments
  - Conduct the observation
  - Collect, validate and analyze the data
  - Answer the research question

- Main differences w.r.t. experiment protocol
  - Operationalization
    - Kind of respondents, #of respondents, how to reach respondents and how to motivate participation
    - Quality of responses,
    - Expertise of the interviewer
    - Validation
    - Demographic questions
    - Debriefing questions

References

- Bortz, J. and Döring, N. (2006). Forschungsmethoden und Evaluation für Human- und Sozialwissenschaftler (4 Auflage). Berlin: Springer Verlag.
- Flick, U. (2007) Designing Qualitative Research. In: The SAGE Qualitative Research Kit, SAGE Publications.
- Flick, U., von Kardoff, E. and Steinke, I. (2007) Qualitative Forschung – Ein Handbuch,, 5th Edition, Rowohlts Enzyklopädie.
- Fowler, F. J. (1993), Survey Research Methods. Sage: CA.
- Fowler, F. J. (1995), Improving Survey Questions. Sage: CA.
- Given, L. (2008). The Sage Encyclopedia of Qualitative Research Methods. London: SAGE Publications
- Isaac, S., and Michael, W. B. (1997). Handbook in research and evaluation: A collection of principles, methods, and strategies useful in the planning, design, and evaluation of studies in education and the behavioral sciences. (3rd Ed.). San Diego: Educational and Industrial Testing Services.
- Judd, C.M., Smith, E.R. and Kidder L.H. (1991). Research methods in social relations. 6th Edition, Harcourt Brace Jovanovich College Publishers.
- Kvale, S. (2007) Doing Interviews. In: The SAGE Qualitative Research Kit, SAGE Publications.
- Miles, M. and Huberman, M. (1994). An expanded Sourcebook Qualitative Data Analysis. (2nd Edition). Thousand Oaks: SAGE Publications.
- Yin, R. K (2002) Case Study Research. Design and Methods. Third edition. Thousand Oaks: Sage.
- American Association of Public Opinion Research, “Best Practices for Survey and Public Opinion Research.” http://www.aapor.org/ethics/best.html
- Runeson, P. and Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. Emp. Softw. Engg. 14, 2 (April 2009), 131-164.