Qualitative Research Method

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Qualitative Research Methods

- Its aim is to give a complete, detailed descriptions of the phenomena to be studied
- Objective facts + values
- **Key philosophical assumption** - understanding how people make sense of their worlds and the experiences people have
- **Key concern** - knowing or understanding from the participants’ perspectives
- **Key focus** - understanding (rather than predicting or controlling) social settings or social phenomena
Qualitative ---

- In qualitative research, the researcher constructs knowledge in collaboration with research participants through interaction and reflection.
- Knowledge is considered as a social construct.
- Tries to include values and motives of the actors in the Knowledge Construction Process.
- Focus is to have a deeper understanding of the selected phenomena in its holistic state.
Nature of Qualitative Research

- the problem is general and ask general questions about the phenomena being studied
- As the researcher gets increasing understanding of the phenomena, he/she asks specific questions
- The methodology is decided over the course of investigation
Qualitative Data

• Mostly words, phrases, sentences and may include visual images, audio and video recordings.
• Obtained from recordings of interviews, field notes of observations, and analysis of documents as well as reflective notes of the researcher.
• Most the of qualitative data is organised, summarised, described and interpreted
When to choose?

1. Describe the phenomena
2. Build a theory
   a) To gain new insights about a particular phenomena
   b) Develop new concepts or theoretical perspectives about the phenomena
   c) Discover the problem that exists in the phenomena
3. Verification – to test the validity of certain assumptions, claims, theories or generalization with the real world
4. Evaluation – to evaluate the effectiveness of a particular policies, design artifacts, programs, etc
Define problem

Review literature

Collect Data

Data Analysis

Data Interpretation/Report Findings

Conceptual framework/Proposal

Build Theory Or Framework
Type of Qualitative Research

1. Case study
2. Phenomenological study
3. Ethnography
4. Grounded theory
5. Content Analysis
7. There are more than one hundred qualitative research methods.
What is a case study?

- case study is an empirical research method.
  - it is not a subset or variant of other methods, such as experiments, surveys or historical study.
- Best suited to applied problems that need to be studied in context.
  - Phenomena under study cannot be separated from context. Effects can be wide-ranging.
  - E.g study of software use
- How and why questions
- Settings where researcher has little control over variables, e.g. field sites.
- Effects take time to appear.
  - Days, weeks, months, or years rather than minutes or hours.
Why conduct a case study?

- To gain a deep understanding of a phenomenon
  - Example: To understand the capability of a new tool
  - Example: To identify factors affecting communication in code inspections
  - Example: To characterize the process of coming up to speed on a project
- Objective of Investigation
  - Exploration-To find what’s out there
  - Characterization-To more fully describe
  - Validation-To find out whether a theory/hypothesis is true
Why conduct a case study? ...

• **subject of Investigation**
  - An intervention, e.g. tool, technique, method, approach to design, implementation, or organizational structure
  - An existing thing or process, e.g. software implementation, project success, defects
# When to use case studies

<table>
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<tr>
<th>Strategy</th>
<th>Form of Research Question</th>
<th>Requires Control of Behavioral Events?</th>
<th>Focuses on contemporary events?</th>
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<tr>
<td>Experiment</td>
<td>How, why?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Survey</td>
<td>Who, what, where, how many, how much?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Archival Analysis</td>
<td>Who, what where, how many, how much?</td>
<td>No</td>
<td>Yes/No</td>
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<td>History</td>
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<td>Case Study</td>
<td>How, why?</td>
<td>No</td>
<td>Yes</td>
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Parts of a Case Study Research Design

- **A research design is a “blueprint” for a study**
  - Deals more with the logic of the study than the logistics
  - Plan for moving from questions to answers
  - Ensures that the data is collected and analyzed to produce an answer to the initial research question
  - Strong similarities between a research design and a system design

- **Five parts of a case study research design**
  - Research questions
  - Propositions (if any)
  - Unit(s) of analysis
  - Logic linking the data to the propositions
  - Criteria for interpreting the findings
Part 1: Study Questions

- Case studies are most appropriate for research questions that are of the “how” and “why” variety.
- The initial task is to clarify precisely the nature of the study questions (i.e., make sure they are actually “how” or “why” questions).
- Examples:
  - “Why do 2 organizations have a collaborative relationship?”
  - "Why do developers prefer this tool/model/notation?"
  - "How are inspections carried out in practice?"
  - "How does agile development work in practice?"
  - "Why do programmers fail to document their code?"
  - "How does software evolve over time?"
  - "Why have formal methods not been adopted widely for safety critical applications?"
  - "How does a company identify which software development projects to start?"
Types of Case Studies

**Explanatory**

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 sequence of events and underlying mechanisms

Example: How does pair programming actually work?

Example: How do software immigrants naturalize?
Types of case ...

**Causal**
Looks for causal relationship between concepts
Example: Requirements errors are more likely to cause safety-related defects than programming errors are
See study by Robyn Lutz on the Voyager and Galileo spacecraft

**Exploratory**
Criteria or parameters instead of purpose
Example: Christopher Columbus’ voyage to the new world
Example: What do CMM level 3 organizations have in common?
Part 2: Study Propositions

• Propositions are statements that help direct attention to something that should be examined in the case study, i.e. point to what should be studied
  ▫ Example: “Organizations collaborate because they derive mutual benefits”

• Propositions will tell you where to look for relevant evidence
  ▫ Example: Define and ascertain the specific benefits to each organization

• Some studies may not have propositions – this implies a topic of “exploration”
  ▫ Note: Even exploratory studies should have both clearly-stated purposes and clearly-stated criteria for success
Part 3: Unit of Analysis

- The unit of analysis defines what a “case” is in a case study
  - Example: a unit of analysis (case) may be an individual, and the case study may be the life history of that person
- Other units of analysis include decisions, social programs, processes, changes
  - Note: It is important to clarify the definition of these cases as they may be subjective, e.g. the beginning and end points of a process
- What unit of analysis to use generally depends on the primary research questions
- Once defined, the unit of analysis can still be changed if desired, e.g. as a result of discoveries based on data
- To compare results with previous studies (or allow others to compare results with yours), try to select a unit of analysis that is or can be used by others
Examples of Units of Analysis

- For a study of how software immigrants naturalize
  - Individuals
  - Development team
  - Organization
  - For a study of pair programming
  - Programming episode
  - Pairs of programmers
  - Development team
  - Organization
- For a study of software evolution
  - Modification report
  - File
  - System
  - Release
  - Stable release
Part 4: Linking Logic

- Logic or reasoning to link data to propositions
- One of the least well developed components in case studies
- Many ways to perform this, but none as precisely defined as the treatment/subject approach used in experiments
- One possibility is pattern matching
- Describe several potential patterns, then compare the case study data to the patterns and see which one is closer
Generalizing from Case Study to Theory

- “The appropriately developed theory is also at the level at which generalization of the case study results will occur”
- Theory for case studies is characterized as analytic generalization and is contrasted with another way of generalizing results known as statistical generalization
- Understanding the difference between these two types of generalization is important
Statistical Generalization

• Making an inference about a population on the basis of empirical data collected about a sample
• This method of generalization is commonly recognized because research investigators have quantitative formulas characterizing generalizations that can be made
  ▫ Examples: significance, confidence, size of the effect, correlation
• Using this as a method of generalizing the results of a case study is a “fatal flaw”, since cases are not sampling units, nor should they be chosen for this reason
  ▫ Statistical generalizations are considered a Level One Inference
Analytical Generalization

- Previously developed theory is used as a template with which to compare the empirical results of the case study.
- If 2 or more cases support the same theory, replication may be claimed.
- Results may be considered more “potent” if 2 or more cases support the same theory but don’t support the same rival theory.
- Analytical generalizations are considered a Level 2 Inference.
- Aim toward analytical generalization in doing case studies.
  - Avoid thinking in terms of samples when doing case studies.
Validity and Reliability in Case Study

• Using the same criteria for other empirical research
• Construct Validity
  ▫ Concepts being studied are operationalized and measured correctly
• Internal Validity
  ▫ Establish a causal relationship among variables in the study
• External Validity
  ▫ Establish the domain to which a study’s findings can be generalized
• Experimental Reliability
  ▫ Demonstrate that the study can be repeated with the same results
Data Analysis

- Analytic Strategies
- 3 general strategies
- 5 specific analytic techniques
- Criteria for high quality analysis
Criteria for High Quality Analysis

- Present all the evidence
- Develop rival hypotheses
- Address all major rival interpretations
- Address most significant aspect of the case study
- Use prior or expert knowledge
Three General Strategies

- Relying on Theoretical Propositions
- Thinking about Rival Explanations
- Developing a Case Description
Strategy 1 - Relying on Theoretical Propositions

• Shapes the data collection plan and gives priorities to the relevant analytic strategies
• Helps to focus attention on certain data and to ignore other useless data
• Helps to organize the entire case study and define alternative explanations to be examined
Example

• From a study of intergovernmental relationships, followed the proposition that federal funds have redistributive dollar effects but also create new organizational changes at the local level (Yin, 1980).

• The basic proposition—the creation of a “counterpart bureaucracy” in the form of local planning organizations, citizen action groups, and other new offices within a local government itself, but all attuned to specific federal programs—was traced in case studies of several cities.
Strategy 2 - Rival Explanations

- It is the contrasting perspectives of participants to the original theoretical propositions
- Attempts to collect evidence about other possible influences
- This produce may produce rival descriptive frameworks (the second strategy);
- Example
  - IT increases organizational efficiencies
  - Other rival explanation may be IT wastages organizational resource due to training, work interruption due to down time, HW and SW purchases, etc
- It is related to alternative hypothesis
Rival --- example

- In a study of IT intervention in the organization,
  - the typical hypothesis is that the observed positive outcomes were the result of the new IT system
  - The simple or direct rival explanation would be that the observed outcomes were in fact the result of some other influence besides the intervention and that the IT system may not actually have been needed
- The more rivals the analysis addresses and rejects, the more confidence can be placed in the findings
Strategy 3 - Developing a Case Description

- Serves as an alternative when theoretical proposition and rival explanation are not applicable
- Try to identify descriptive framework that organizes the case study analysis
- Should also think (at least a little) about your descriptive framework before designing your data collection instruments.
- Commonly ideas for your framework should have come from your initial review of literature, which may have revealed gaps or topics of interest to you
Example - in a study of IT integration in the organization

• Your descriptive framework can include
  1. Driving problems for initiating IT system
  2. Process of IT implementation
  3. Organizational Achievements as a result of IT system
  4. Challenges encountered
  5. Lessons learned for future practice

• You can also use decisions events as descriptive framework as in the case of project implantation
  ▫ Such as project proposal approval, contracting, monitoring, evaluation, project close down
Five Specific Analytic Techniques

- Pattern Matching
- Explanation Building
- Time-Series Analysis
- Logic Models
- Cross-Case Synthesis

Note: They are intended to deal with problems of developing internal and external validity in doing case studies
AT 1 - Pattern Matching

- Pattern matching compares an empirically based pattern with a predicted one.
- If the patterns coincide, the results can strengthen the internal validity of the case study.
- If the study is explanatory, the pattern matches either the dependent or independent variables or both.
- If it is descriptive one, pattern matching is still relevant, as long as the predicted pattern of specific variables is defined prior to data collection.
Types of pattern matching:

1. Nonequivalent dependent variables as a pattern. When one independent variable has many outcomes
   - You need to assess each outcome with different measures
2. Rival explanations as patterns
Example non-equivalent D. variables

• Effects of newly decentralized office computer system (IV)
• Outcomes (DV)
  1. employees will create new applications for the office system, and these applications will be idiosyncratic to each employee;
  2. traditional supervisory links will be threatened, as management control over work tasks and the use of central sources of information will be diminished;
  3. organizational conflicts will increase, due to the need to coordinate resources and services across the decentralized units; but nevertheless,
  4. productivity will increase over the levels prior to the installation of the new system
PM 2 - Rival Explanations

- Besides its use as analytic strategy, it is also used as pattern matching technique for independent variables.
- The presence of certain independent variables (predicted by one explanation) precludes the presence of other independent variables (predicted by a rival explanation).
- This is because the designated independent variables may involve several or many different types of characteristics or events, each assessed with different measures and instruments.
- The concern of the case study analysis is with the overall pattern of results and the degree to which the observed pattern matches the predicted one.
AT 2 - Explanation Building

- Analyzes the case study data by building an explanation about the case
- Stipulates a presumed set of causal links, why or how something happened
- Mostly occurred in narrative form
- Good narrative is a narrative that lead to theoretically significant propositions that contribute for theory
- Example - *The public policy propositions, if correct, can lead to recommendations for future policy actions*
The objective of time series analysis is to examine relevant “how” and “why” questions about the relationship of events over time.

Three types of Time Series Analyses:
- Simple Time Series
- Complex Time Series
- Chronologies
TA 1 -Simple Time Series

- Trace changes over time
- Match between a trend of data points compared to
  - Significant trend specified before investigation
  - Rival trend specified earlier
- Yin (2003) recommended two identify two patterns from the data and compare with theoretical proposition use “effects” and “no effect” pattern
- One fits best than the other
- Campbell’s (1969) Connecticut’s speed limit law that reduces the limit to 55 miles per hour in 1955 mentioned as good example for time series analysis.
a priori propositions:

an "effects" pattern

\[ \text{number of fatalities} \]

years

1 2 3 4 5 6 7

a "no effects" pattern

years

1 2 3 4 5 6 7

actual observations:
(Campbell, 1969)

\[ \text{number of fatalities} \]

'51 '52 '53 '54 '55 '56 '57 '58 '59

years

200 225 250 275 300 325

... a "no effects" pattern

Figure 2.1 An Example of Pattern Matching
SOURCE: COSMOS Corporation.
TA 2 - Complex Time Series

- Contain multiple set of variables (mixed patterns) which are relevant to the case study
- The pattern may rising and declining trend over the course of time
- Each variable is predicted to have different pattern over time
- This implies that a variable has different state at different times that gives rich descriptions for theory
- Any match of a predicted with an actual time series will produce strong evidence for an initial theoretical proposition
TA 3 - Chronologies

- It is a special form of time series analysis
- Trace events over time
- Sequence of a cause and effect cannot be inverted
- Some events must be followed by other events on a contingency basis after an interval of time
- Cover many different types of variables
- Goal is to compare chronology with that predicted by the explanatory theory
  - Example – Internet Introduced -> computer use increases -> Results efficient communication -> Results organizational performance
AT 4 - Logic Models

- Stipulate a complex chain of events over time
- Events are staged in repeated cause-effect-cause-effect patterns whereby a dependent variable (event) at an earlier stage becomes the independent variable (causal event) for the next stage
- Match empirically observed events to theoretically predicted events
- Becomes popular tools in doing case study evaluations
- It compares observed events with theoretically predicted events
Logic Model -- School intervention aimed at improving students’ academic performance

- Extra hour
- Classroom activities
- Joint exercises
  - Creates forum
  - Increases participation
  - Understanding and satisfaction about educational process
  - Achieves higher test of score
  - Increased learning of certain key concepts
Four types of logic models

1. Individual-Level Logic Model
2. Firm or Organizational-Level Logic Model
3. An alternative configuration for an Organizational-Level Logic Model
4. Program-Level Logic Model
Logic Models

• **A) Individual-level logic model**
  ▫ Assumes the case study is about an individual person

• **B) Firm or organizational-level logic model**
  ▫ Traces events taking place in an individual organization

• **C) An alternative configuration for an organizational-level logic model**
  ▫ Encounters dynamic events that are not progressing linearly
  ▫ Changes may reverse course and not just progress in one direction (Transformation and reforming)

• **D) Program-level logic model**
  ▫ Analyzes data from different case studies by collecting data on rival explanations
Further Notes on Data analysis

- Thematic analysis is common in qualitative research
- The intention is to generate more abstract concept that can chunk larger bits of data
- It is known as open coding process
- Concepts can be created from words, sentences or paragraph, even from pages
- Then establish relationship between concepts to create the narrative descriptions
R: How long have you been a teacher in this school?
T: For about 10 years.
R: Your principle, how would you describe him?
T: Quite a hot-tempered guy.
R: What do you mean hot-tempered?
T: Well, in the last staff meeting, I objected to his idea of cutting down the number of fieldtrips for students. He argued that it was too much of a responsibility for the school. Also, it was getting more and more expensive for the school.
R: What happened then?
T: Before I could say anything, he lost his cool and came for me. He refused to listen to what I had to say... he just went on and on.
R: What do you think?
T: Personally, I think it was not fair of him to scold me. After all this is a democracy and he should at least listen to what I had to say. It was very unpleasant and many of my colleagues were very disturbed over the incident.
Example

- You have uncovered eight descriptions of the principal’s behaviour in staff meetings and the following codes are assigned.
  
- B1 – hot tempered;
- B2 – lost his cool
- B3 – refused to listen
- B4 – just went on and on
- B6 – scolds
- B7 – ridiculed for questioning
- B8 – one man show
Qualitative research and computer science

- Used to **understand user problems** for design such as diagnosing user problems and needs
- Used in **artifact evaluation**- researchers qualitatively evaluate a product by interviewing and observation
- Used to **uncover non-technical factors** affecting the adoption and evolution of a new software product and other IT systems
- Used to **develop theories** such as HCI theory
Application of Qualitative - Example

  1. construct a conceptual framework,
  2. develop a system architecture,
  3. analyze and design the system,
  4. build the (prototype) system, and
  5. observe and evaluate the system.
- The last stage explicitly includes “Develop new theories/models based on the observation and experimentation of the system’s usage”
Review Questions

• What is the nature of qualitative research
• What are the different types of qualitative research methods
• When do you case study research method
• What are the different type of case study research? Explain them?
• What data analysis technique you use for case study research? Explain them?
• What the procedures you follow to do case study research?
• When do you qualitative methods in computer science research?