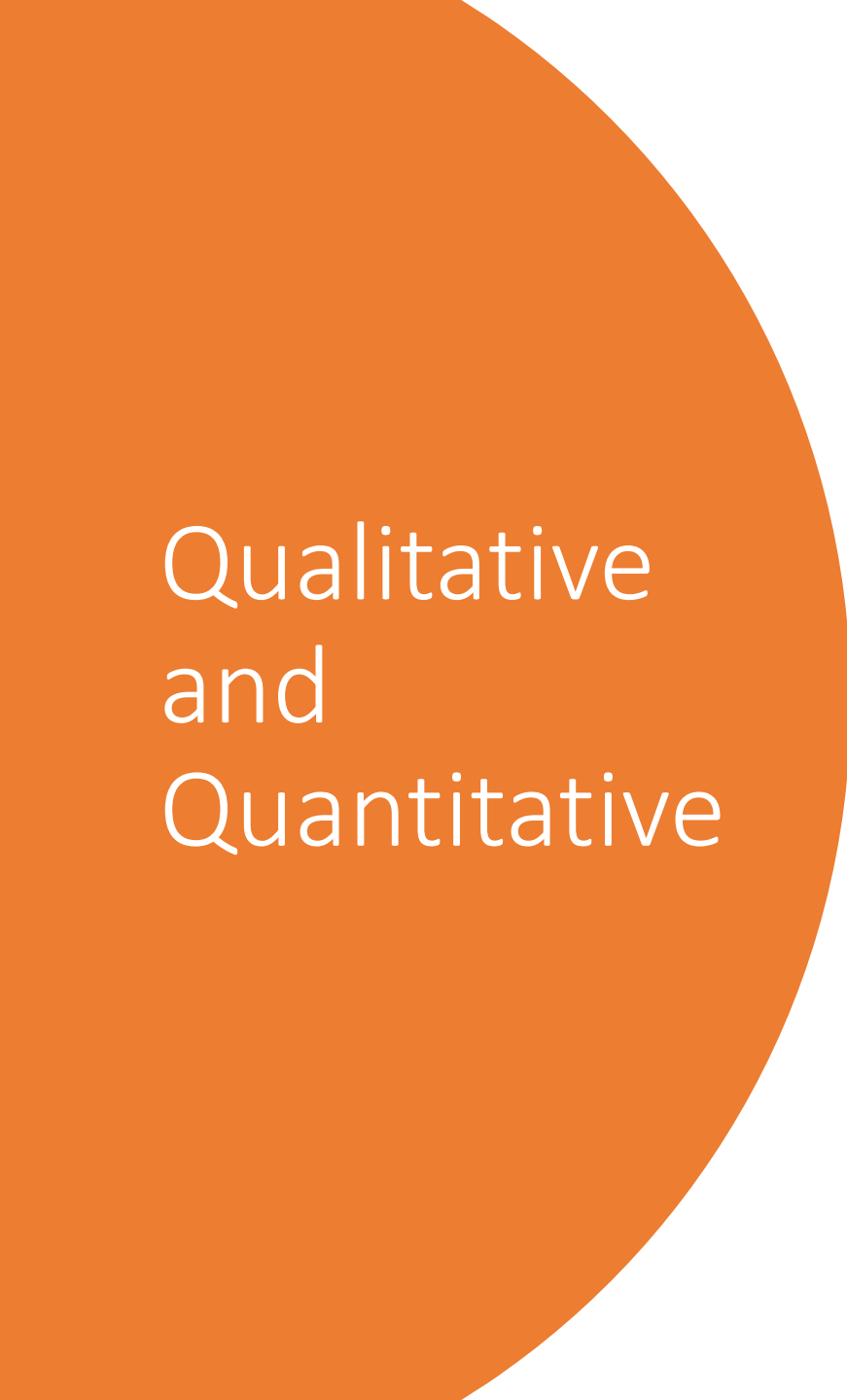


Research Methods

Qualitative and Quantitative



Qualitative and Quantitative

- **Qualitative Research**

- Used to explore and understand the complex phenomena in-depth by subjective experiences and perspectives.
- Focus on the non-numerical data such as textual and visual material collected through interviews, observations etc.



Qualitative Research

Characteristics

- **Exploratory and descriptive** :Focus on to explore and describe phenomena in-depth and often generating insights and hypotheses rather than testing pre-existing theories.
- **Subjective and interpretive** : different individuals perceive and interpret the same phenomena differently.
- **Naturalistic settings** : allows researchers to observe and interact with participants in their everyday environments.
- **Flexible and iterative**: Allow research to adapt to their approaches based on emerging findings. Data collection and analysis concurrently with researchers refining their research questions and data collection strategies as the study progress.



Qualitative research

- **Data collection Techniques**

- Interviews
- Focus groups
- Observation
- Document analysis

Allow the researchers to gather data that capture the perspectives and experience of the participants





Qualitative Research

- Data analysis
 - Thematic analysis
 - Content analysis
 - Narrative analysis

Commonly used to identify, themes, patterns and meaning withing the data.



Qualitative research

- **Thematic analysis**

- Used to systematically analyze textual, visual, or audiovisual content to identify patterns, themes, and relationships within the data.

- **Example**

- Research study : exploring the experience of students transition to online learning during COVID-19 pandemic
- Identified Themes (after conducting the interview with several students)

1. **Challenges with Technology**

- Challenges in accessing online platform, network connectivity issues, lack of experience with new online teaching tools
- Example quote : *"I struggled to keep up with classes because my internet kept disconnecting during lectures."*

2. **Feeling of Isolation**

- Loneliness and disconnection from peers and teachers
- Example quote : *"I miss the face-to-face interactions with my classmates. It feels lonely studying alone all the time."*

3. **Adapting study habits**

- Describes how students have had to adapt their study habits and routines to accommodate online learning
- Example quote : *"I've had to find new ways to stay focused at home. It's been challenging, but I'm slowly getting used to it."*

These themes offer a rich understanding of the challenges, emotions, and adaptations associated with this phenomenon.

Qualitative research

- **Content analysis**

- **Example**

- 1. Define research objectives and questions**

- Objective: to identify common topics and trends in online discussion about programming languages.
 - Research questions :
 - What are the most frequently discussed programming languages?
 - What are the common issues or challenges users encounter with specific programming languages?

- 2. Sampling and data collection**

- Select several popular online discussion forums related to programming, such as Stack Overflow, Reddit's programming communities, or specialized forums for specific programming languages.
 - Collect a representative sample of discussion threads or posts from each forum, ensuring diversity in topics and participants.

- 3. Develop coding scheme**

- Develop a coding scheme that includes categories for analyzing the content of the discussion threads, such as:
 - 1. Programming language discussed
 - 2. Discussion topic (trouble shooting; learning resources; best practices)
 - 3. Issues or challenges raised
 - 4. Solutions or recommendation provided

Qualitative research

- Example continues

4. Coding the content

- Systematically analyze the content of each discussion thread by applying the coding scheme.
- Code each post or thread according to the predefined categories, recording relevant information for each code.

5. Data analysis

- Analyze the coded data to identify patterns, themes, and trends in the discussions.
- Calculate frequencies and percentages for each category to determine the most discussed programming languages, common topics of discussion, and prevalent issues or challenges.
- Use qualitative techniques to explore the context of the coded content, such as examining the language used in discussions or the sentiments expressed by participants.

6. Interpretation and reporting

- Interpret the findings of the content analysis in relation to the research objectives and questions.
- Provide explanations, insights, and implications based on the identified patterns and trends in the discussions
- Report the findings using clear and concise language, supported by illustrative examples or quotations from the discussion threads.

- **Example findings**

- *Most Discussed Programming Languages: Python, JavaScript, Java, and C++ are the most frequently discussed programming languages across the analyzed forums.*
- *Common Topics of Discussion: Troubleshooting issues, sharing learning resources and tutorials, discussing best practices and coding techniques, and seeking advice on specific programming tasks.*
- *Prevalent Issues or Challenges: Common challenges include debugging errors, understanding complex concepts, choosing the right tools or libraries, and optimizing code performance.*

Qualitative research

- Qualitative data analysis Tools
 - Nvivo
 - MAXQDA
 - ATLAS.ti
 - ...



Quantitative Research

- **Quantitative Research**
 - Systematic empirical investigation in which data are quantified and analysed to answer research questions or test hypotheses.
 - Collection and analysis of numerical data to identify patterns, relationships and association within a population or sample.
 - Aims to measure and quantify phenomena, allowing for objective and statistically reliable conclusions.

Quantitative Research

Characteristics

- **Objective and empirical:** Relies on observable and measurable data; aims to uncover pattern and relationships that exists independently of researcher's subjective interpretation.
- **Hypothesis testing:** Test hypothesis using statistical methods; It seeks to determine whether a significant relationship between variables or whether difference exists among groups.
- **Structured data collection:** surveys, experiments, observational studies. Involve collection of data from a large number of participants.
- **Numerical representation :** Data are represented numerically facilitating mathematical calculations and statistics.

Quantitative research

- **Data collection Techniques**
 - Survey (based on questionnaire)
 - Experiments
 - Observational studies
 - Secondary data (analyzing datasets that were collected by other researchers or organizations)
 - Survey data, experimental data



Quantitative research

- **Data analysis**

Statistical analysis techniques to analyse and interpret the data

Statistical methods:

- Descriptive statistics (Mean, median, mode, standard deviation)
- Inferential statistics (t-test, analysis of variance (ANOVA))



Quantitative research

- **Data analysis**

- **Correlation** (*to measure the strength and direction of linear relationship between two continuous variables*)
 - *+1 indicates a perfect positive correlation, meaning that as one variable increases, the other variable also increases.*
 - *-1 indicates a perfect negative correlation, meaning that as one variable increases, the other variable decreases.*
 - *0 indicates no linear correlation between the variables.*
- **Regression analysis** (*Regression analysis is used to predict the value of one variable based on the value(s) of one or more independent variable*)

Quantitative research

- **Data analysis**
 - Correlation Example:
 - A researcher wants to investigate the relationship between the popularity of programming languages and the availability of job opportunities in the software development industry.
 - **Variable 1 : Popularity of Programming Languages** (This variable represents the relative popularity or usage of different programming languages among developers)
 - How do we measure this variable ?
 - **Variable 2 : Job opportunities** (This variable represents the availability of job openings or job postings that require proficiency in specific programming languages)
 - How do we measure this variable?
 - Which are the common correlation coefficients?

Quantitative research

- **Data analysis**

- Regression Example:
 - A software development team wants to predict the effort required to complete a software project based on various factors such as the size of the project, the experience level of the developers, and the complexity of the requirements.
 - Dependent variable ?
 - Independent variables ?
 - Regression equation ?
- By understanding the relationship between independent variables (project size, developer experience, requirements complexity) and the dependent variable (effort), teams can better plan and manage software projects.

Quantitative research

- Quantitative data analysis Software/Tools
 - STATA
 - SPSS
 -



Class activity

1. Construct the Gantt chart for the proposal
2. Hypotheses or objectives ?
3. Understand the concepts of independent and dependent variables.
Is there any dependent and independent variable in your study ?