University of Ioannina

School of Education

Department of Early Childhood Education

Department of Early Childhood Education

DOCTORAL STUDIES
UNIVERSITY OF IOANNINA

INTERNATIONAL PHD PROGRAM

ICT in Education: Applications in Natural, Social and Health Sciences

Research Methodology

ICT IN EDUCATION

Klaipėda University

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UNIVERSITÀ DEGLI STUDI DI FOGGIA

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Research Methodology

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Research as a journey

Imagine you are about to travel. You need to decide on two things first: where to go and which way to go?

When you are about to embark on a "research journey", you need to decide on two things in particular: what do you want to find out with your research and how can you find out?

Only then should you start the journey.

Finally, you assess whether the goal has been achieved.

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Stages of the research

Stage 1 - Decide what to research

Stage 2 - Plan how to research

Stage 3 - Conduct the research

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More detailed steps of the research

Source: https://generic.wordpress.soton.ac.uk/researchmethods/research-toic/strategies-and-models/

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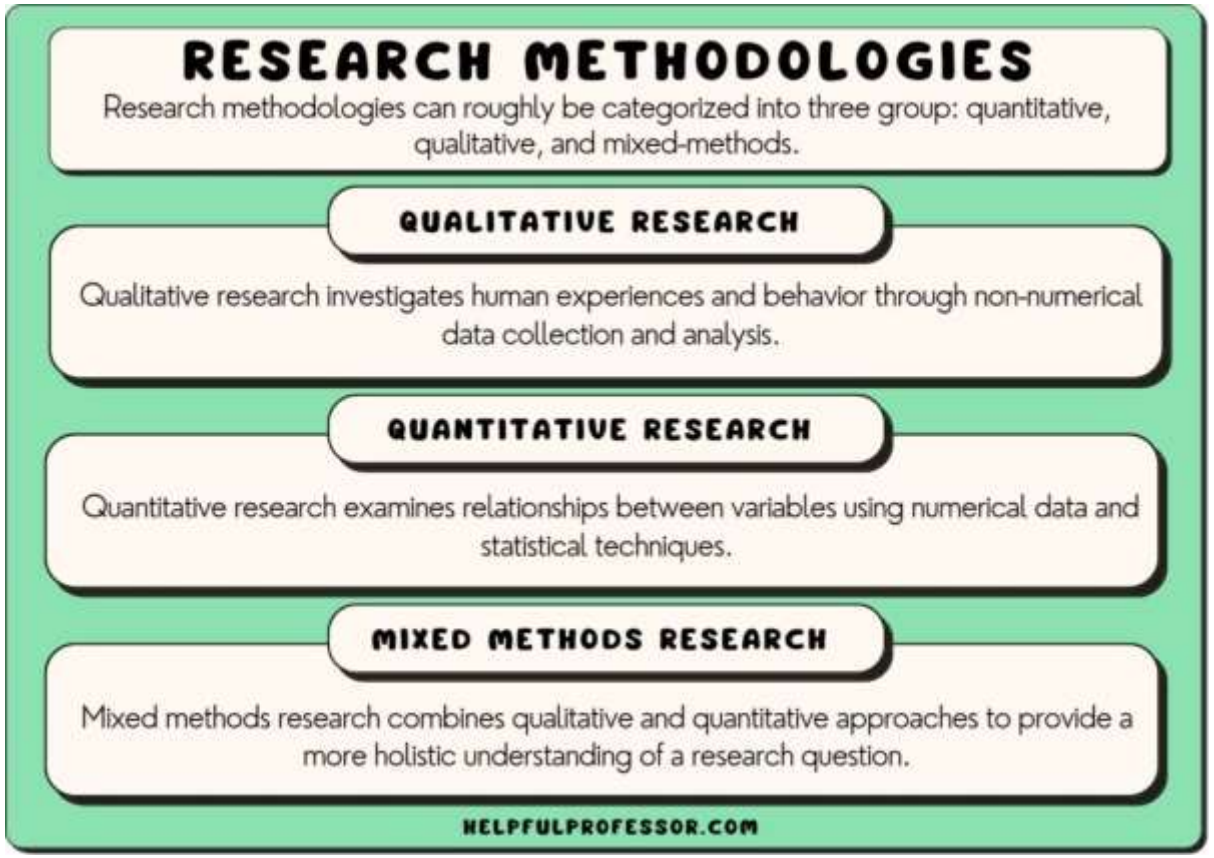
Types of research methodologies

Source: https://helpfulprofessor.com/research-methodology-examples/



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Research strategy

A research strategy is a kind of logical direction in which the researcher intends to find an answer to the research question.

The choice of a research strategy requires a good understanding of what strategies are available and what are the characteristics of their application.

It is crucial that the chosen strategy is relevant to the research question. Each research strategy has its own requirements in terms of research questions (e.g. phenomenological research cannot reveal public attitudes - it requires quantitative research, a survey approach).

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Types of research strategies

Source https://www.researchgate.net/figure/Types-of-Research-Strategy-Adopted-from-Saunders-et-al-2009_fig5_342314751

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Definition of research design

- *'Research design refers to the overall strategy utilized to carry out research that defines a succinct and logical plan to tackle established research question(s) through the collection, interpretation, analysis, and discussion of data'* (Wikipedia)

Source:

- https://en.wikipedia.org/wiki/Research_design

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Research Design types

- *Descriptive (e.g. case-study)*
- *Correlational (e.g. observational study)*
- *Experimental (e.g. field experiment)*
- *Review (e.g. literature review)*
- *Meta-analytic (meta-analysis)*

Source:

- https://en.wikipedia.org/wiki/Research_design

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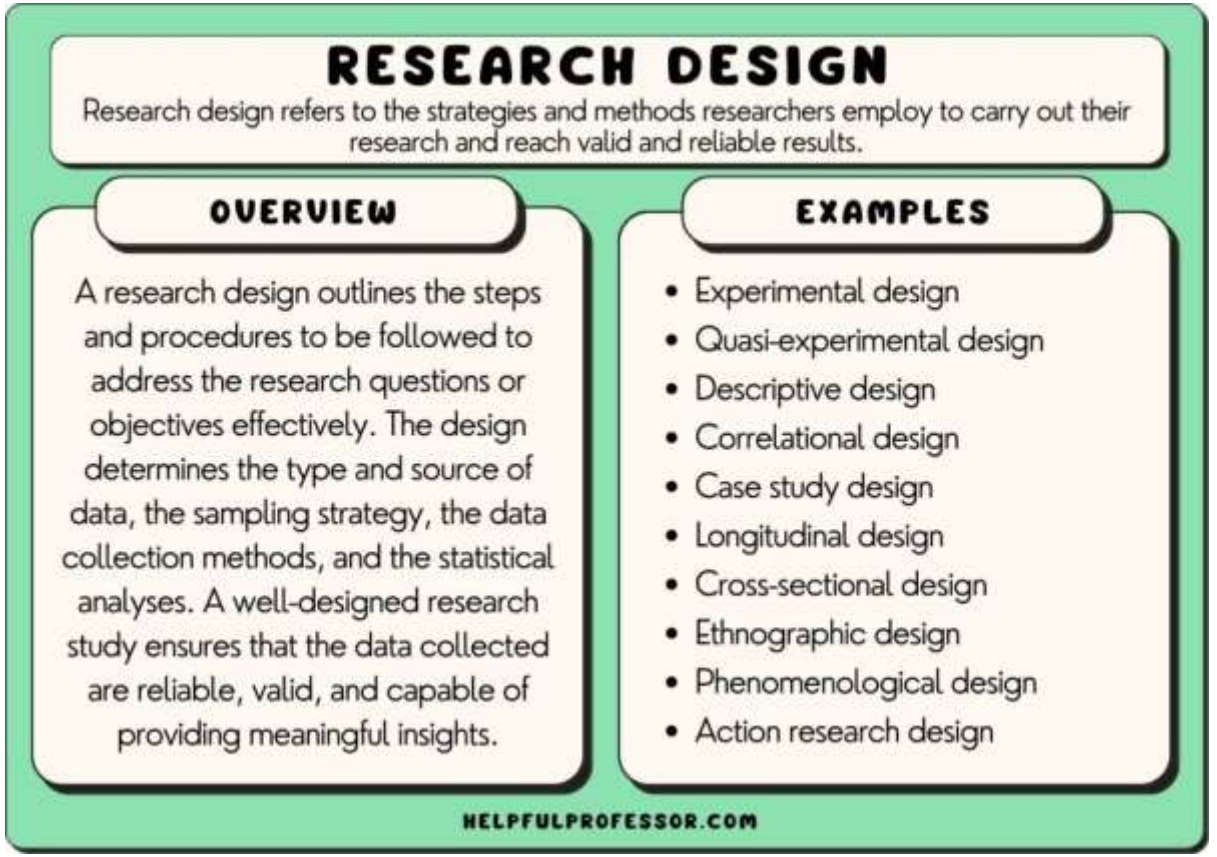
Research design types (2)

Source: https://helpfulprofessor.com/types-of-research-design/



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Definitions of data collection

- *'the activity of collecting information that can be used to find out about a particular subject'* (Cambridge Business English Dictionary)
- *'the process of gathering and measuring information on targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes'* (Wikipedia)

Sources:

- https://dictionary.cambridge.org/us/dictionary/english/data-collection
- https://en.wikipedia.org/wiki/Data_collection

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Data collection applies to

fields of knowledge:

- formal sciences (mathematics, statistics, computer sciences, etc.)
- natural sciences (physics, biology, chemistry, etc.)
- social sciences (sociology, economics, geography, etc.)
- humanities (philosophy, religion, arts, etc.)
- business & professions (law, medicine, public administration, etc.)

Source:

- https://en.wikipedia.org/wiki/List_of_academic_fields

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The process of research

- The following should be determined:
- purpose,
- type of data,
- methods,
- procedures

Source:

- https://www.scribbr.com/methodology/data-collection/

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Purpose of the research

1. problem statement ('What is the issue (practical or scientific) and why does it matter?)

2. research questions

depending on the research questions: *quantitative* or *qualitative* data

Source: Bhandari, P. (2020). A step-by-step guide to data collection. Retrieved from https://www.scribbr.com/methodology/data-collection/

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Definitions of quantitative & qualitative data

- Quantitative data is *'expressed in numbers and graphs and is analyzed through statistical methods'*
- Qualitative data is *'expressed in words and analyzed through interpretations and categorizations'*

Source:

- https://www.scribbr.com/methodology/data-collection/

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Examples of data

Quantitative data	Qualitative data
✓ Amount / number of something (e.g. money / people)	✓ Name
✓ Height	✓ Citizenship
✓ Weight	✓ Employment status

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Choice of quantitative or qualitative data

- *If the purpose is to test a hypothesis, measure something, or gain large-scale statistical insights* → **collect quantitative data**
- *If the purpose is to explore ideas, understand experiences, or gain detailed insights into a specific context* → **collect qualitative data**
- Several purposes = mixed methods approach

Source:

- https://www.scribbr.com/methodology/data-collection/

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Advantages & disadvantages of quantitative data

advantages	disadvantages
✓ it is compatible with most statistical analysis methods	✓ it may miss important info because of the scope
✓ it summarises data and streamlines into relevant info	✓ results do not describe human feelings
✓ researchers are able to eliminate personal data	✓ standard answers reflect the point of view of the researcher, not the respondent

Source:

- https://www.formpl.us/blog/quantitative-data#:~:text=Quantitative%20data%20is%20the%20type,numeric%20variables%20(e.g.%20How%20many%3F

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Advantages & disadvantages of qualitative data

advantages	disadvantages
✓ in-depth analysis	✓ time-consuming process
✓ understanding what customers think	✓ difficult to generalize
✓ rich data	✓ it requires advanced research skills

Source:

- https://www.questionpro.com/blog/qualitative-data/

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Data collection methods

Method	*Usage*	*How to collect data*
Experiment	To check the causation	Manage variables & measure their impact
Survey (questionnaire)	To understand general characteristics or opinions	Spread the list of questions to the sample (online, face-to-face…)
Interview / focus group	To get a deeper understanding of perceptions or opinions	Open-ended questions in face-to-face interviews or focus group discussions
Observation	To understand something in a natural setting	Measure or survey a sample without trying to affect them
Ethnography	To learn the culture firsthand	Join and participate in the community and record observations
Archival research	To understand current or historical events / conditions / practice	Access to manuscripts, docs or records from different sources
Secondary data collection	To analyze data that you can't access firsthand	Find existing datasets that have already been collected

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Personal Interview

- Personal Interview is a face to face two way communication between the interviewer and the respondents.
- Generally the personal interview is carried out in a planned manner and is referred to as 'structured interview'.
- This can be done in many forms e.g. door to door or as a planned formal executive meeting.

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Stages in an interview process

Source: https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/2041-210x.12828

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Types of interviews

Source: https://www.questionpro.com/blog/types-of-interviews/

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Types of interviews in research

Source: https://www.questionpro.com/blog/types-of-interviews/

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Definition of a Focus Group

- Focus Group Discussions (FGDs) are defined as semi structured group discussions, which yield qualitative data on the community level by facilitating interaction between participants.
  - The aim of the FGD is to facilitate interaction and thereby produce, via snowballing of thoughts, deeper insights.
  - FGDs provide information on a group/community level. Perspectives of individuals or households are not part of the focus. The strength of an FGD is the forum it creates for discussion between participants, thus eliciting new ideas and explanations, which would not have come up during an individual or a household interview.

Source: https://www.slideshare.net/RupaGupta20/focus-group-discussion-249581066

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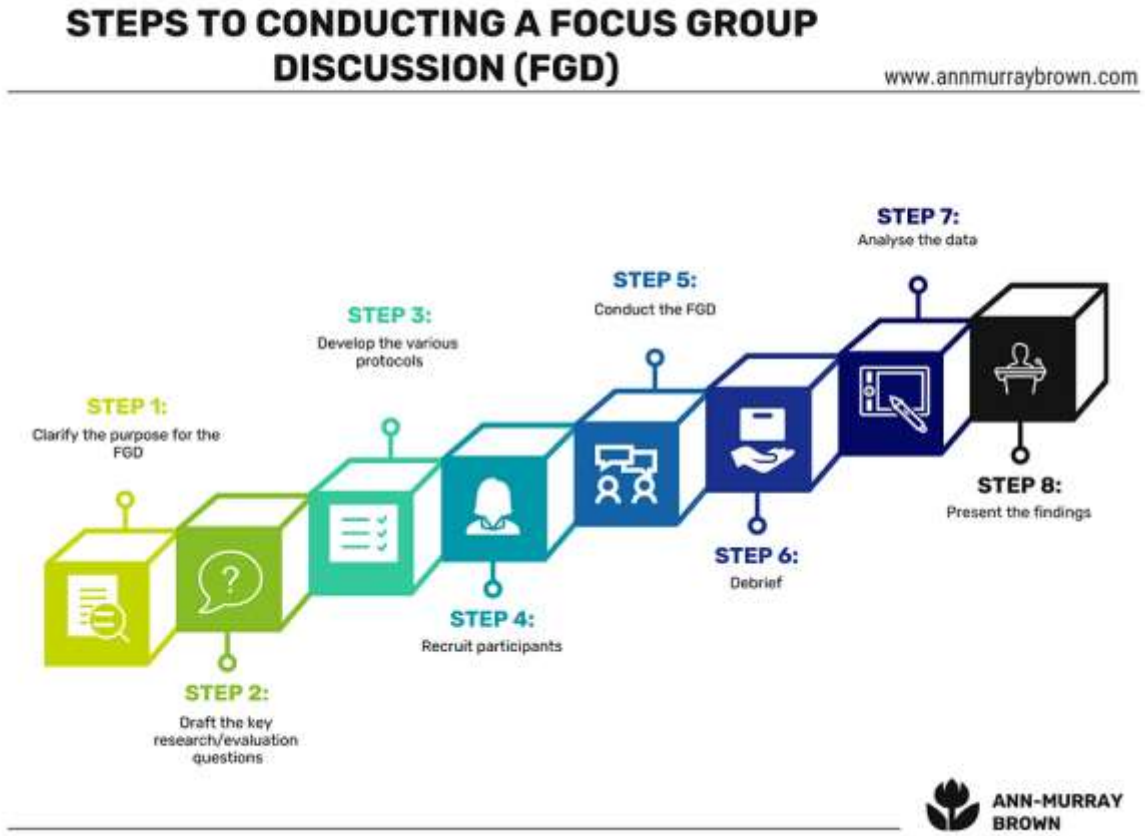

Source: https://www.annmurraybrown.com/single-post/steps-to-conducting-a-focus-group-discussion-fgd

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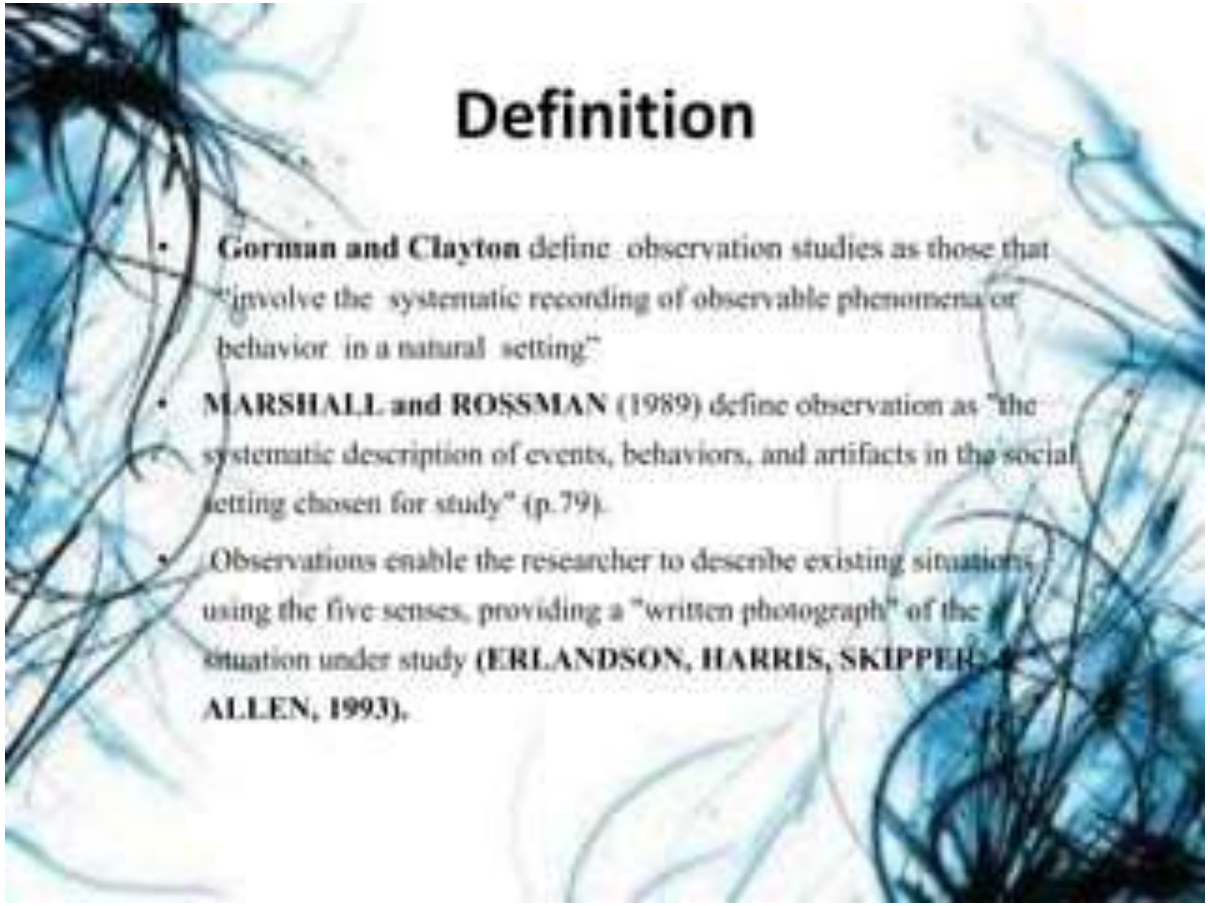
Observation definition

Source: https://www.slideshare.net/HinaKaynat/observation-70875814



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Observational Research Methods

Type of observation	Description	Advantages	Disadvantages
Overt	Participant knows they are being observed.	• No ethical issues.	• Behaviour may not be natural/normal
Covert	Participants unaware they are being observed.	• High ecological validity.	• Ethical issues.
Participants	The observer becomes actively involved in the activities of the people being studied.	• Easier to understand the observer's behaviour • High ecological validity	• Hard to record observations retrospectively (therefore low reliability) • Observer can become involved with the participants and the data subjective
Non-participant	Researcher observing from a distance.	• Observations made as they happen = more reliable • Lack of contact so the observer can maintain objectivity	• Behaviour may be recorded by the meaning behind it unknown

Source: https://www.simplypsychology.org/observation.html

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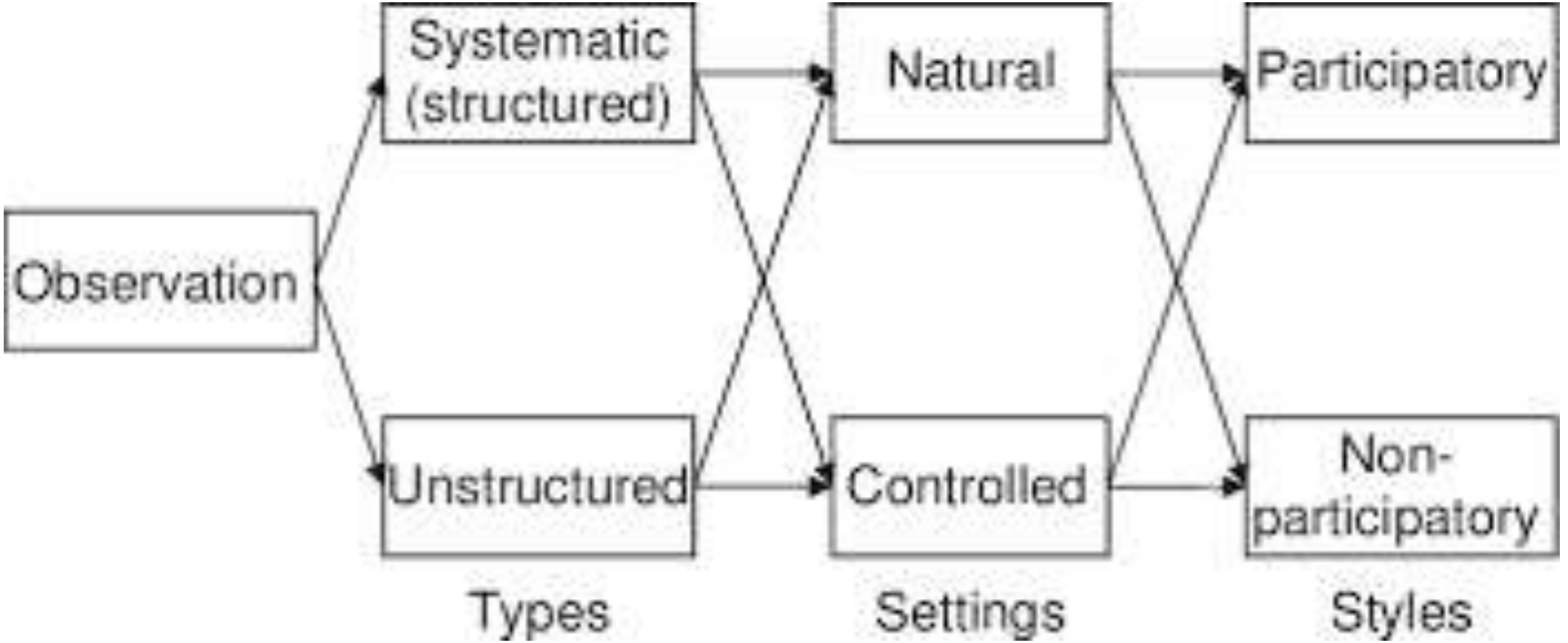
Observation categories

Source: https://www.researchgate.net/figure/Categories-of-observation_fig1_235309066



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Qualitative vs quantitative observation

Source: https://slideplayer.com/slide/14614063/

What's The Difference?

- Observation:
  - Using one of the five senses to make understand the world around you.
  - Ways to observe:
    - 1). Sight
    - 2). Touch
    - 3). Hearing
    - 4). Smell
    - 5). Taste

- Types of Observations:
  - Qualitative: Describing an object using your five senses.
  - Quantitative: Describing an object numerically.
    - Mass
    - Volume
    - Area
    - Density

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Source: https://www.youtube.com/watch?v=cvo8k3dYJXg

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What is Archival Research?

- Use previously existing records for data
- NOT the same thing as a literature review!
- Researcher does not have control over method
- Records may be unrepresentative

Source: https://slideplayer.com/slide/5123961/

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Primary vs secondary data

Source: https://libguides.coa.edu/c.php?g=366402&p=2476152

Primary Sources	Secondary Sources
These are original documents or original research.	These are works that synthesize, summarize, and/or interpret primary sources.
Examples • Diaries • Interviews • Speeches • Academic research – often printed in scholarly journals • Fiction (novels, poetry, short stories)	Examples • Encyclopedias • Histories • Reviews • Textbooks • Magazine articles • Biographies

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Types of secondary research sources

Source: https://www.qualtrics.com/experience-management/research/secondary-research/

- There are two types of secondary research sources: internal and external.
- Internal data refers to in-house data that can be gathered from the researcher's organization.
- External data refers to data published outside of and not owned by the researcher's organizatic

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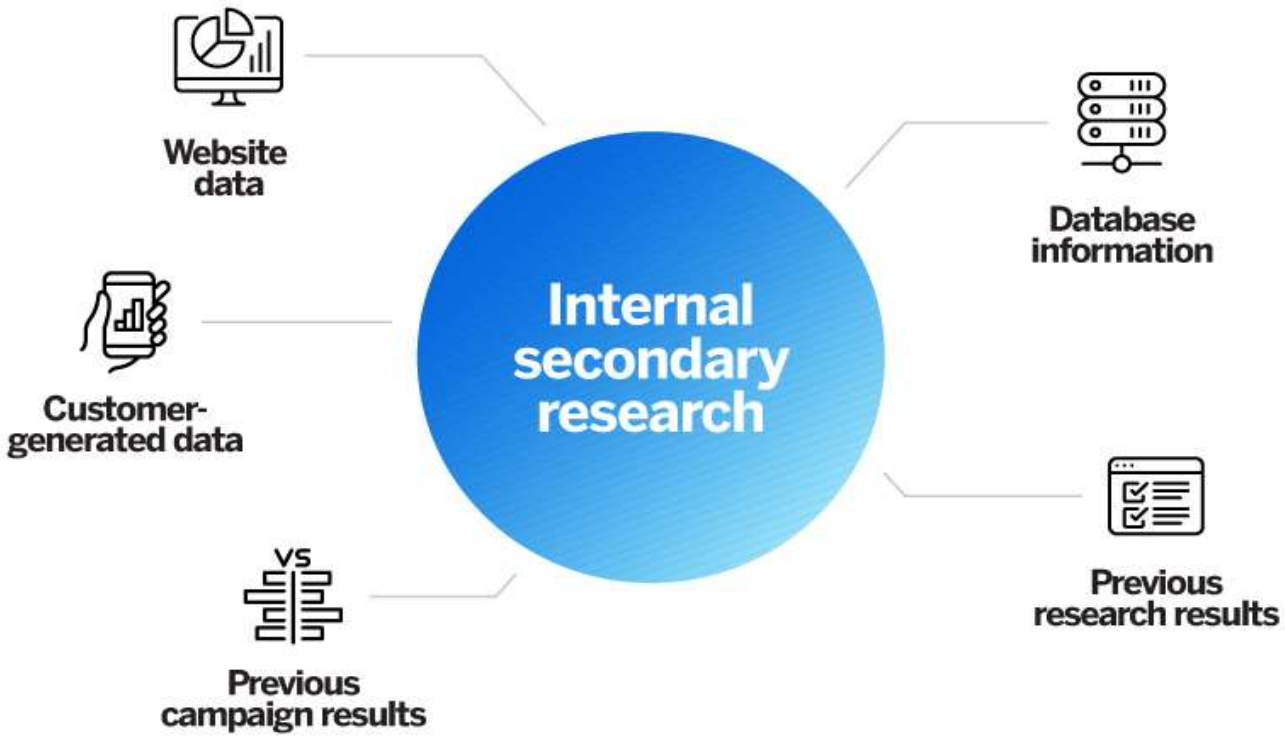

Source: https://www.qualtrics.com/experience-management/research/secondary-research/

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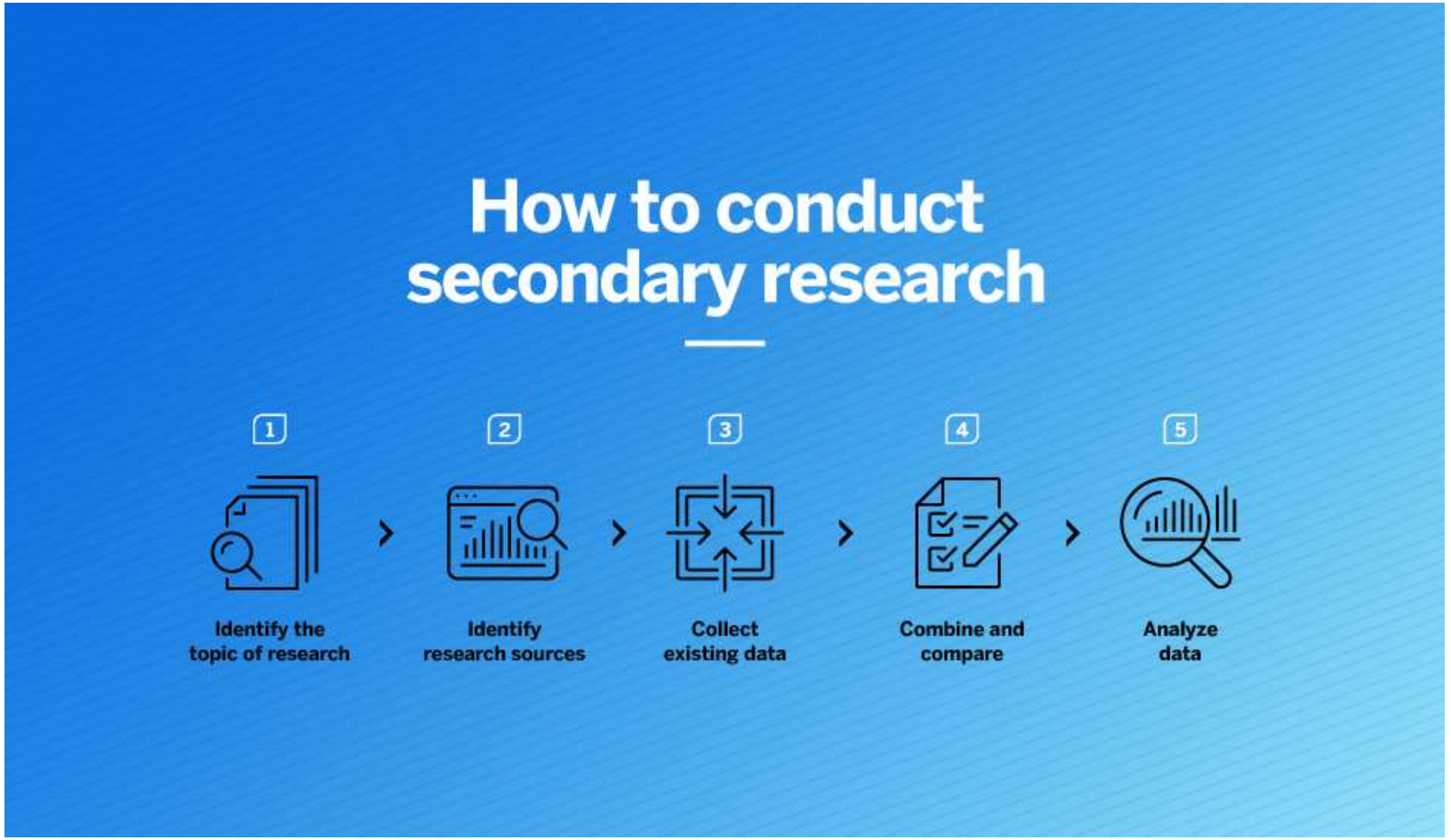

Source: https://www.qualtrics.com/experience-management/research/secondary-research/

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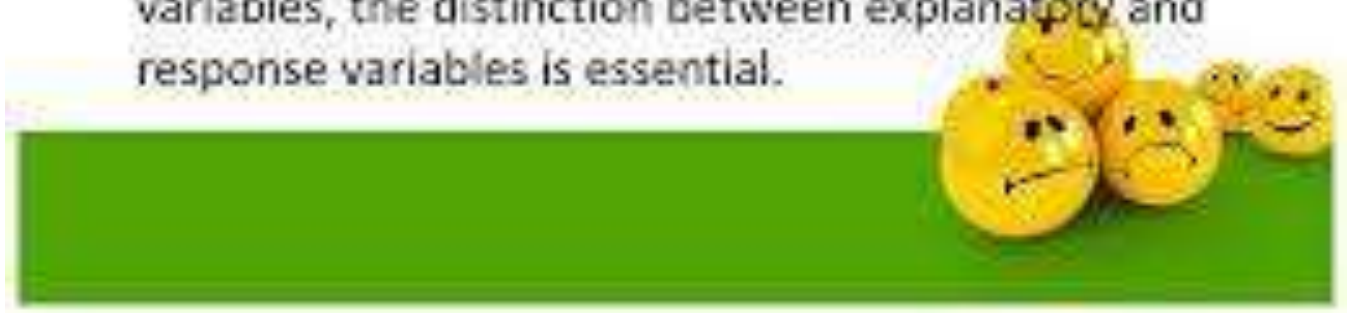
Experiment

- Definition: Experiment – deliberately imposes some treatment on individuals in order to observe their responses.
- Basic Experimental Design
  - Subject → Treatment → Observation
- The purpose of an experiment is to reveal the response of one variable to changes in other variables, the distinction between explanatory and response variables is essential.



Source: https://slideplayer.com/slide/13316391/

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Source: https://www.iedunote.com/experimental-research-designs

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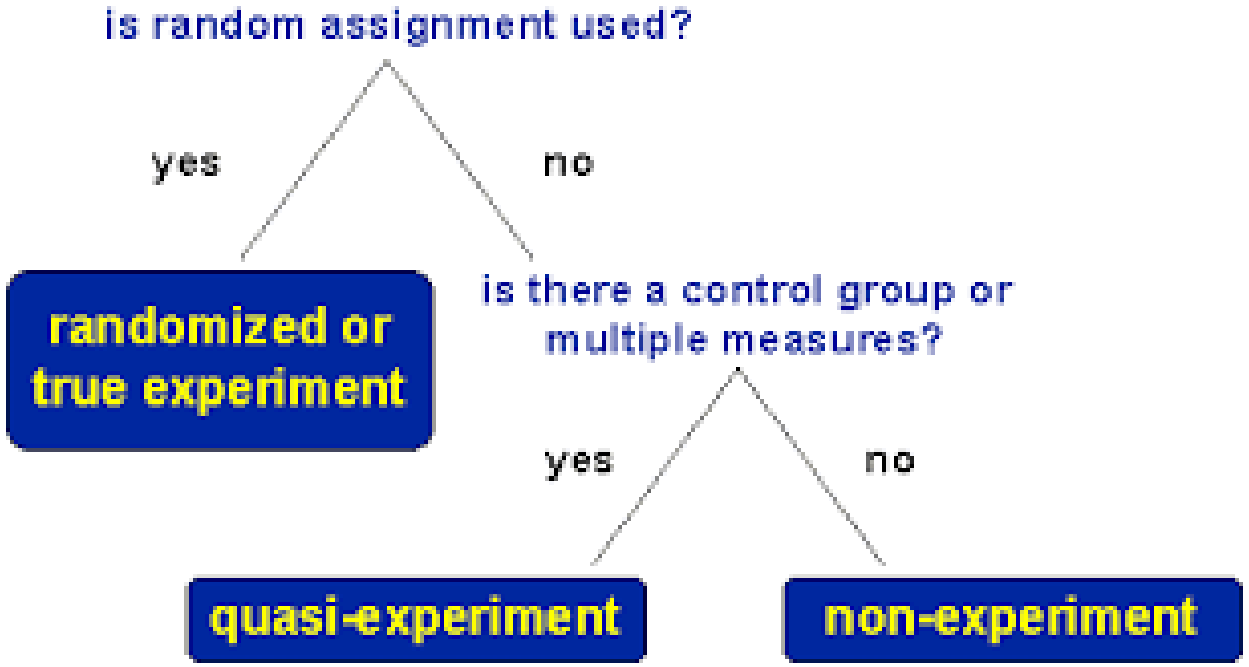
Differencies amoung various types of experiments

Source: https://conjointly.com/kb/research-design-types/



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Definitions of a questionnaire

- *'a list of questions that number of people are asked so that information can be collected about something'* (Cambridge Advanced Learner's Dictionary & Thesaurus)
- *'a research instrument consisting of a series of questions [or other types of prompts] for the purpose of gathering information from respondents'* (Wikipedia)

Sources:

- https://dictionary.cambridge.org/us/dictionary/english/questionnaire
- https://en.wikipedia.org/wiki/Questionnaire

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Types

Questionnaires are designed to identify:

- *preferences*
- *behaviors*
- *facts, including demographic*
- *latent traits*
- *attitudes*
- *an index*

Source:

- https://en.wikipedia.org/wiki/Questionnaire

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Examples of online questionnaires

- Kahoot!
- Google forms
- Socrative
- Quizizz
- Quizlet
- Padlet
- Survey Monkey, etc.

Source: Bell, 2018 https://shakeuplearning.com/blog/20-formative-assessment-tools-for-your-classroom/

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Analysing data from questionnaires

1) Data preparation:

✓correct formatting – database or spreadsheet (using ICT tools like MS Excel and others)

✓data cleansing – removal of errors such as duplicate data

2) Statistics selection:

✓e.g. descriptive statistics, inferential statistics

Source:

- https://knowhow.ncvo.org.uk/how-to/how-to-analyse-quantitative-data-for-evaluation#:~:text=Quantitative%20data%20is%20numerical%20%E2%80%93%20for,and%20who%20has%20experienced%20change

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Definition of descriptive statistics

- *'A descriptive statistic is a summary statistic that quantitatively describes or summarizes features from a collection of information, while descriptive statistics is the process of using and analysing those statistics'* (Wikipedia)

Source:

- https://en.wikipedia.org/wiki/Descriptive_statistics

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Use of descriptive statistics in analysis

- Descriptive statistics provide simple summaries about the sample and observations
- These summaries may be

✓ *quantitative*, i.e. *summary statistics*

✓ or *visual*, i.e. *simple-to-understand graphs*

Source:

- https://en.wikipedia.org/wiki/Descriptive_statistics

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Descriptive statistical methods

- *Mean – 'the average of a set of numbers'*
- *Median – 'the middle number of a set of numbers'*
- *Mode – 'most occuring number from a set of numbers'*
- *Range – 'the difference between the highest and lowest numbers from a set of numbers'*

Source:

- https://www.formpl.us/blog/quantitative-data#:~:text=Quantitative%20data%20is%20the%20type,numeric%20variables%20(e.g.%20How%20many%3F

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Definition of inferential statistics

- *'This method measures the relationship (similarities and differences) between multiple variables to generate results and infer conclusions'* (Formplus)

Source:

- https://www.formpl.us/blog/quantitative-data#:~:text=Quantitative%20data%20is%20the%20type,numeric%20variables%20(e.g.%20How%20many%3F

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Examples of inferential statistics

- Correlation,
- Regression,
- ANOVA, etc.

Source:

- https://www.formpl.us/blog/quantitative-data#:~:text=Quantitative%20data%20is%20the%20type,numeric%20variables%20(e.g.%20How%20many%3F

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Approaches to inferential statistics

- *Cross-tabulation,*
- *MaxDiff analysis,*
- *TURF analysis,*
- *Gap analysis,*
- *Text analysis*

Source:

- https://www.formpl.us/blog/quantitative-data#:~:text=Quantitative%20data%20is%20the%20type,numeric%20variables%20(e.g.%20How%20many%3F

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General process of analysing qualitative data

1) data preparation and organization
2) data viewing and exploring
3) creation of initial codes
4) review codes and combine them into themes
5) data presentation in a cohesive manner

Source:

- https://baselinesupport.campuslabs.com/hc/en-us/articles/204305675-How-to-analyze-qualitative-data

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Systems of analysis of qualitative data

- *Content analysis*
- *Grounded analysis*
- *Social Network analysis*
- *Discourse analysis*
- *Narrative analysis*
- *Conversation analysis*

Source:

- https://www.skillsyouneed.com/learn/analysing-qualitative-data.html

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Content analysis

- *'Content analysis is the study of documents and communication artifacts, which might be texts of various formats, pictures, audio or video'* *(Wikipedia)*
- Content analysis practice varies by fields of knowledge
- *'They all involve systematic reading or observation of artifacts which are assigned codes to indicate the presence of interesting pieces of content'*

Source:

- https://en.wikipedia.org/wiki/Content_analysis

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Grounded analysis

- It is similar to content analysis in connection with techniques for coding
- In this system:

✓*do not start from a defined point →*

✓*allow data to 'speak for itself' with themes from the discussions*

Source:

- https://www.skillsyouneed.com/learn/analysing-qualitative-data.html

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Social network analysis

- *'Social network analysis is the process of investigating social structures through the use of networks and graph theory. It characterizes networked structures in terms of nodes (individual actors, people, or things within the network) and the ties, edges, or links (relationships or interactions) that connect them' (Wikipedia)*

Source:

- https://en.wikipedia.org/wiki/Social_network_analysis#:~:text=Social%20network%20analysis%20(SNA)%20is,or%20interactions)%20that%20connect%20them.

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Discourse analysis

- *'Discourse analysis is an approach to the analysis of written, vocal, or sign language use, or any significant semiotic event'* *(Wikipedia)*
- It takes place in social sciences and humanities

Source:

- https://en.wikipedia.org/wiki/Discourse_analysis

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Narrative analysis

- *'Narrative analysis uses field texts, such as stories, autobiography, journals, field notes, letters, conversations, interviews, family stories, photos (and other artifacts), and life experience, as the units of analysis to research and understand the way people create meaning in their lives as narratives'* *(Wikipedia)*

Source:

- https://en.wikipedia.org/wiki/Narrative_inquiry

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Conversation analysis

- *'Conversation analysis is an approach to the study of social interaction, embracing both verbal and non-verbal conduct, in situations of everyday life. Conversation analysis originated as a sociological method, but has since spread to other fields'* *(Wikipedia)*

Source:

- https://en.wikipedia.org/wiki/Conversation_analysis#:~:text=Conversation%20analysis%20(CA)%20is%20an,since%20spread%20to%20other%20fields.

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Computer-Aided analysis

- There are many computer packages designed to support and assist with the analysis of qualitative data
- Examples:
- *NVivo*
- *Atlas.ti*

Source:

- https://www.skillsyouneed.com/learn/analysing-qualitative-data.html

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This program is co-financed by Greece and the European Union (European Social Fund- ESF) through the Operational Programme «Human Resources Development, Education and Lifelong Learning 2014-2020» in the context of the project “ICT in Education: Applications in Natural, Social and Health Sciences” (MIS 5162213).