Research Methods

Types of research

Qualitative research

-Tries to understand the **nature** or **quality** of the phenomenon.
-Based on language and descriptors.
-It tends to answer questions like: **What, Why, When, How, Who.**
-More subjective
-Its primary approach is inductive.

Mixed research

Uses the combination of the two methods

Quantitative research

-Based on numbers and statistics
-Tends to answer the question of:
How much
-More objective

Example

When studying thermal comfort assessment within a room, we proceed by choosing three households. -One researcher tracks temperatures, humidity and air speed.

-Another researcher interviews household members to determine how thermal comfort is felt.

The 1st researcher measures numerical data by using calibrated instrument.

Quantitative research

The 2nd researcher is collecting more subjective data to determine how they feel.

Qualitative research


What is research method?

Difference between

Methodology

Methodology comprises the principles, techniques, and procedures guiding research, encompassing a broader array of strategies. It extends beyond research methods to include the rationale behind their selection within our study's framework, elucidating the reasons for choosing specific approaches.

Method

Research method specifically denotes the particular approach or process adopted to collect and analyze data within a specific study

Types of Research Methods

Qualitative RM (QLRM)

- Interviews: One-on-one interviews provide in-depth insights into respondents' personal experiences.
- Focus Groups: Gathering a targeted group of people to discuss and comment on the topic of interest.
- Observations: Active watching of behavior and activities in the participant's natural setting.
- Document analysis: Reviews of documents to gather data on the entity being studied.

Mixed RM (MRM)

Uses the combination of the two methods into a single study to provide a comprehensive analysis.

-the sequential explanatory strategy, where qualitative data helps to explain the quantitative findings,

-the concurrent triangulation strategy, where both qualitative and quantitative data are collected simultaneously to corroborate results.

Quantitative RM (QRM)

They are much more structured than QLRM. They include:

-various forms of surveys (online surveys, paper surveys)

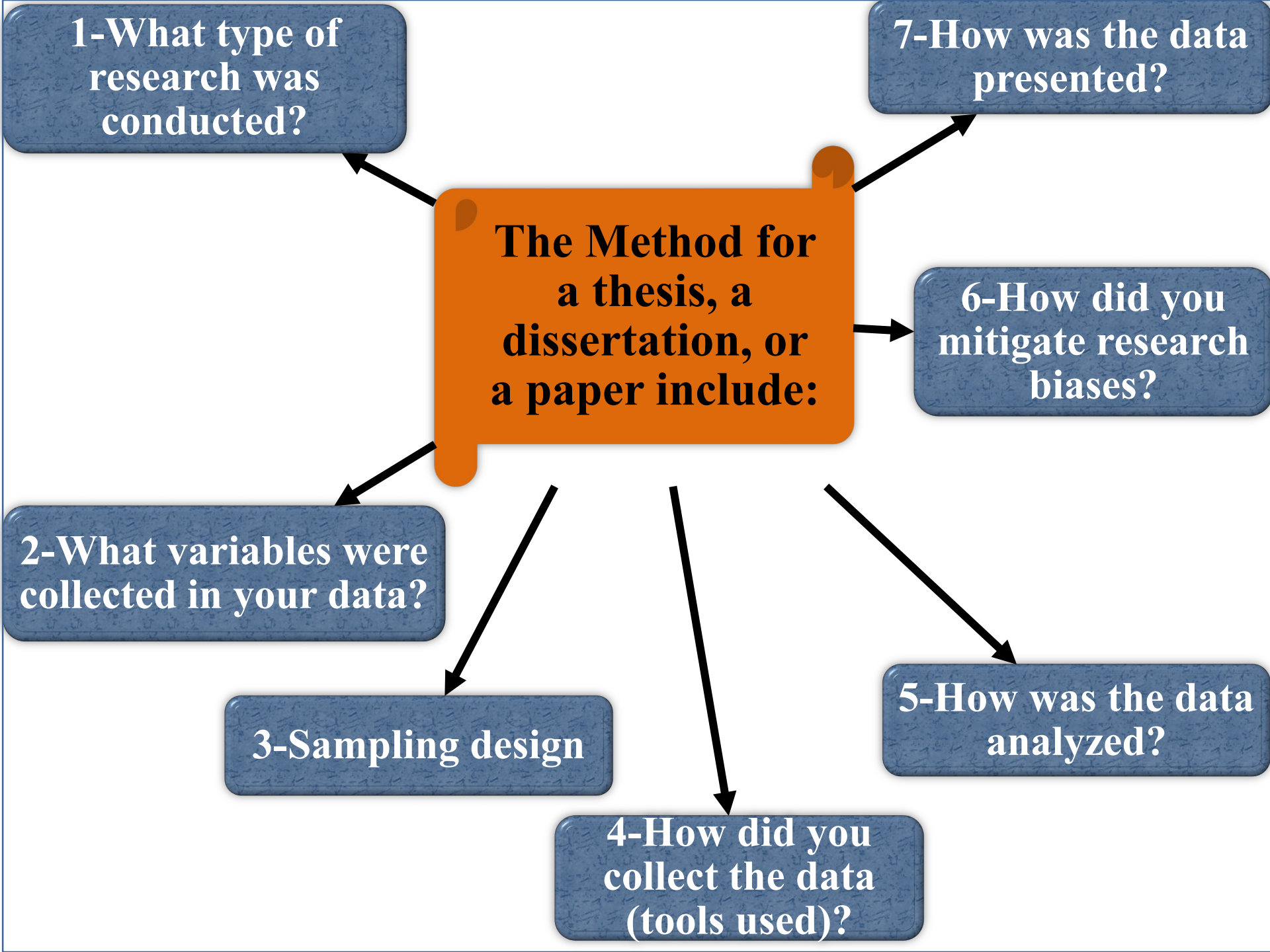
-face-to-face interviews,

-longitudinal studies,

-website interceptors,

-online polls,

-systematic observations and measurements.


The Method for a thesis, a dissertation, or a paper include:
1-What type of research was conducted?
2-What variables were collected in your data?
3-Sampling design
4-How did you collect the data (tools used)?
5-How was the data analyzed?
6-How did you mitigate research biases?
7-How was the data presented?

Writing the method section

The research method chapter or section describes data collection and analysis techniques. This chapter in a thesis or dissertation explains the research process and its evaluation. It provides legitimacy to your research within the field and serves as a reference point for readers with questions or critiques in other sections.

The method chapter should be written in past tense for clarity.

The drafting of a method includes:

Section 1: Type of research (or Methodological approach)

In this section, you introduce your predominant research approach: quantitative, qualitative, or mixed-methods. Each approach has distinct purposes and advantages depending on the research problem.

Firstly, clarify the aim of employing the chosen approach. Is it to understand the phenomenon comprehensively or address a specific research problem? This initial consideration aligns the approach with the research objectives.

Next, identify the specific aims associated with the selected approach. Are you describing the characteristics of a phenomenon, exploring an under-researched topic, or establishing causal relationships between variables?

Finally, determine if the data used is primary or secondary. Primary data is collected firsthand, while secondary data is pre-existing. Understanding the data's origin and nature is crucial for ensuring its reliability and relevance to the research objectives.

Section 2: Variables collected

In a methodological chapter of a research study, the description of variables collected typically includes details about the key elements being measured or observed during the research process. This section is crucial for understanding the scope of the data collection efforts and the factors considered in the study.

The description outlines:

-The **justification** behind the selection of variables, emphasizing their relevance to the research questions and objectives,

-the **specific data points** or variables that were gathered during the research process,

-The comprehensive **list of the variables** collected, categorized according to their respective domains or themes.

-**Identification:** Each variable is clearly identified and named to ensure clarity and consistency throughout the study. This includes both independent and dependent variables, as well as any control, moderating, or mediating variables that may be relevant to the research.

-**Definition:** A clear definition of each variable is provided to ensure a common understanding among researchers and readers. This definition includes the conceptual meaning of the variable and how it is operationalized or measured in the study.

Type of variables

In Quantitative Research (QR)

Quantitative researchers and statisticians use variables to describe and measure the items, places, temperature, pressure, people, or ideas that they are studying. Researchers carefully select variables for measurement when designing studies, choosing tests, and interpreting outcomes. The terms **independent variable (IV)** and **dependent variable (DV)** are commonly used to describe the variables under investigation. QR also involves other types of variables, including **control, moderating, mediating, and confounding** variables.

In Qualitative Research (QLR)

QLR normally avoids using variables as it focuses on collecting non-numerical data, such as the lived experiences of individuals affected by Corona19. It does not aim to measure relationships between variables in the study. QLR focuses on **concepts, themes, or phenomena** instead of IV and DV. The focus is on exploring and interpreting rather than categorizing as independent or dependent. Understanding human experiences, perceptions, and behaviors is the goal of QLR. Emphasis is on relationships and patterns, not direct cause-and-effect relationships as in QR.

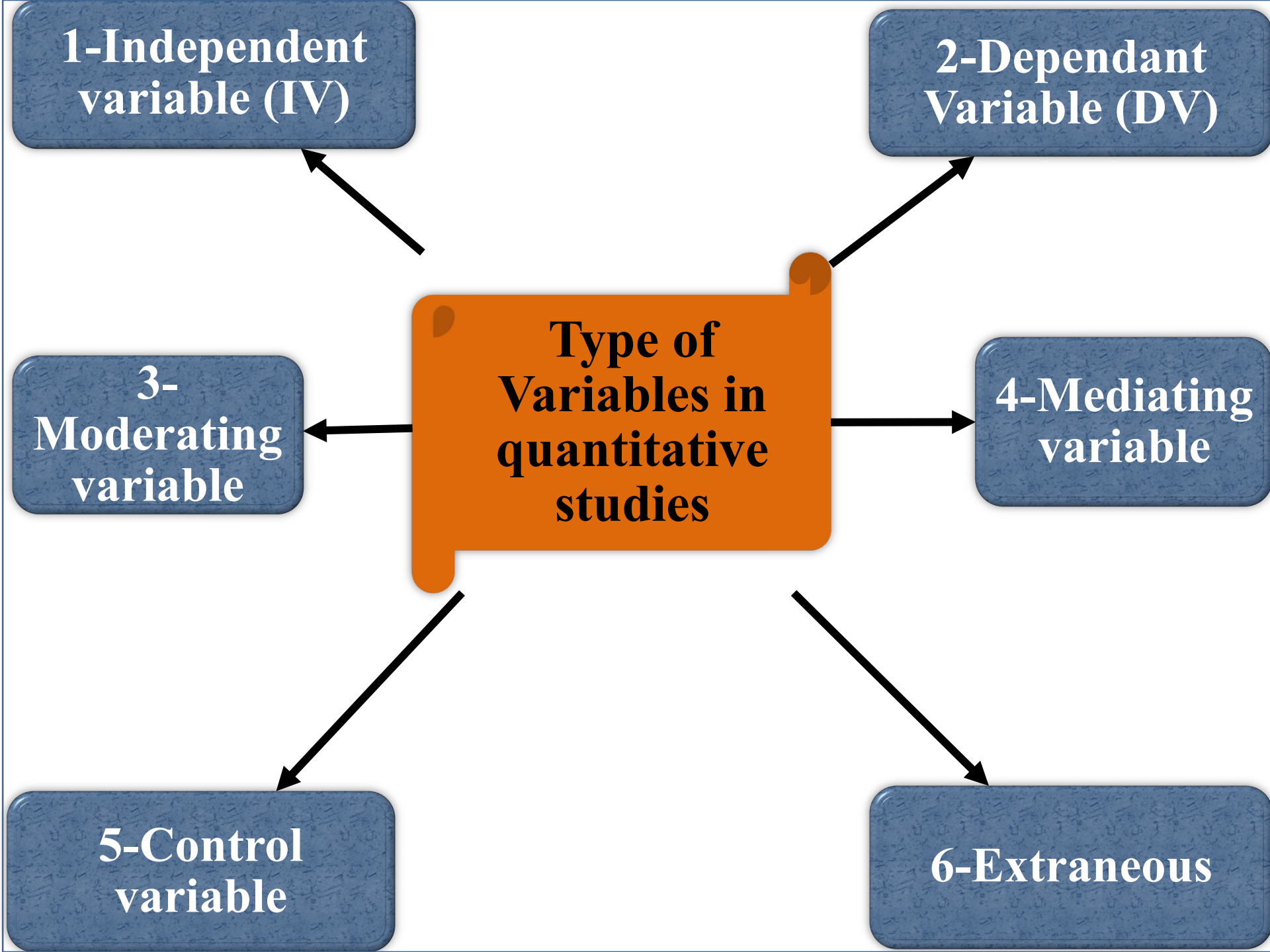
Examples for Quantitative Research

In a research on the impact of **study time** on **exam scores**, study time is the independent variable manipulated by researchers, while exam scores are the dependent variable measured.
In a dissertation on residential energy efficiency, collected variables include:

-Building Characteristics: Size, Number of floors, Age, Building materials, Architectural style.
-Energy Consumption: Electricity, Gas, Water.
-Energy Efficiency Measures: Envelope insulation, Window type, HVAC system efficiency, Energy-efficient appliances.
-Indoor Environmental Quality: Indoor air quality (CO2, VOCs), Temperature, Humidity, Natural ventilation.
-Occupant Behavior: Occupancy patterns, Thermostat settings, Lighting usage.

Examples for Qualitative Research

In the housing sector, researchers explore:
-Housing Preferences: Analyzing individuals' housing preferences, including architectural styles and neighborhood characteristics, to understand factors influencing housing choices.
-Community Engagement: Examining residents' involvement in community activities and their perceptions of social cohesion within their neighborhood.
-Accessibility and Mobility: Assessing the accessibility of housing units and neighborhoods for individuals with disabilities, focusing on inclusive design and transportation options.
-Environmental Sustainability: Studying residents' attitudes toward eco-friendly practices in housing, such as recycling and energy conservation, to understand the impact of sustainable housing on the environment.


1-Independent variable (IV)
2-Dependant Variable (DV)
Type of Variables in quantitative studies
3-Moderating variable
4-Mediating variable
5-Control variable
6-Extraneous

1-Independent variables (Cause)

They are manipulated by researchers in studies, and are factors whose values aren't influenced by other variables. They're hypothesized (assumed) to affect the dependent variable.

They are also known as explanatory variable and may have an impact on the dependent variable.

Examples:

-The **teaching method** used in a classroom study can be an independent variable. Researchers may compare the effects of traditional teaching methods to those of a new experimental method on student performance.

-In a clinical trial **testing a new drug**; the dosage or administration method of the drug is an independent variable. Researchers may vary the dosage levels to observe their effects on patients' health outcomes.

Y=f(X), Y dependent, X independant. Change in the value of X will cause changes in the value of Y.

2-Dependent Variables (Effect, Result)

A dependent variable's value is influenced by other factors, known as independent variables. Researchers manipulate independent variables in experiments to observe their effect on the dependent variable. It's what researchers measure to assess the impact of changes in the independent variable.

Dependent variables represent the outcome researchers aim to understand or predict based on changes in the independent variable.

Examples:

-In a study investigating the effectiveness of a new teaching method on student performance, the dependent variable would be the **students' test scores**.

-In a clinical trial evaluating the efficacy of a new drug, the dependent variable would be the **patients' symptom improvement** or **recovery rates**.

3-Moderating (or moderator) variables

They influence the relationship between independent and dependent variables in a study but do not directly affect the dependent variable. They can strengthen or alter this relationship based on their level or presence. They provide additional context to the relationship between the variables by indicating under what conditions or for whom the relationship may be stronger or weaker. Moderating variables help researchers understand the boundary conditions of the relationship and identify when the relationship may vary depending on certain factors.

Examples:

Gender: In a study on stress levels (independent variable) and job performance (dependent variable), gender may moderate the relationship. For instance, stress might affect job performance differently for males and females.

Experience: In research on training programs (independent variable) and job satisfaction (dependent variable), participants' experience level may moderate the impact. The effect of training programs on job satisfaction could vary based on participants' experience.

Age: In a study looking at the relationship between *economic status* that is independent variable and *how frequently people get physical exams* from a doctor that is dependent variable, age is a moderating variable as we can observe that relationship might be weaker in younger individuals and stronger in older individuals.

4-Mediating (or intervening) variables

A mediating variable is a conceptual factor that lies between an independent variable and a dependent variable. It is not directly observable in an experiment but is utilized to explain the mechanism through which the independent variable affects the dependent variable. It helps researchers understand the underlying mechanisms or processes through which the IV influences the DV. Essentially, mediating variables provide insight into the "how" or "why" behind the observed relationship between the variables of interest.

Examples :

-Self-efficacy: In a study investigating the relationship between job training (independent variable) and job performance (dependent variable), self-efficacy could act as a mediating variable. Self-efficacy influences how individuals perceive their ability to perform tasks, which in turn affects their job performance.

-Motivation: In research examining the effect of financial incentives (independent variable) on employee productivity (dependent variable), motivation could serve as a mediating variable. Financial incentives (*incitations*) may increase employees' motivation, leading to improved productivity.

-Perceived stress: In a study on the relationship between work environment (independent variable) and employee well-being (dependent variable), perceived stress could mediate this relationship. A negative work environment may lead to increased stress levels among employees, which then negatively impacts their well-being.

5-Control variables

Control or controlling variables are characteristics that are constant and do not change during a study. They do not have effect on other variables. Control variables are factors that researchers hold constant or account for in a study to prevent them from influencing the relationship between the independent and dependent variables. These variables are important to ensure that any observed effects can be attributed to the independent variable rather than to external factors. Control variables are crucial for enhancing the internal validity of a study by minimizing the influence of extraneous factors on the relationship between the variables of interest. Hence researchers might intentionally keep a control variable the same throughout an experiment to prevent bias

Examples:

-Age: In a study investigating the impact of a new teaching method (independent variable) on student performance (dependent variable), age could be a control variable. To ensure consistency and prevent age from influencing the study's outcomes, we maintained uniform age levels throughout the experiment.

-Socioeconomic Status: In research examining the relationship between access to healthcare (independent variable) and health outcomes (dependent variable), socioeconomic status could be a control variable. Controlling for socioeconomic status helps ensure that any observed effects on health outcomes are not influenced by differences in socioeconomic backgrounds.

-Environmental Conditions: In a study investigating the effect of noise levels (independent variable) on productivity (dependent variable), environmental conditions such as temperature and lighting could be control variables. By controlling for these variables, researchers can isolate the specific impact of noise on productivity.

6-Extraneous variables

Extraneous variables are factors that affect the dependent variable but that the researcher did not originally consider when designing the experiment. If left uncontrolled, these variables may introduce errors or biases into the results.

For instance, in a study evaluating a new teaching method's impact on student performance, variables like students' prior knowledge, socioeconomic status, or motivation level may serve as extraneous variables if not accounted for. These factors could influence the dependent variable (student performance) and distort the true relationship between the independent variable (teaching method) and the dependent variable. Hence, researchers must identify and manage extraneous variables to ensure the accuracy and credibility of their findings.

Section 3: Sampling design

Sampling methods ensure representative samples selection. Practical constraints like budget and time are considered, ensuring accurate results. For example, a study on residential energy efficiency may use stratified random sampling to represent various building types and sizes.

-The number of samples and the sample size: This refers to the total number of units or individuals included in the sample and the size of each individual sample. For example, a study might involve 100 residential buildings as the sample, with each building representing one unit of analysis. The sample could consist of 300 adolescents aged 13 to 17 years recruited from local schools in the urban area of Jijel. Participants were selected using stratified random sampling to ensure representation across different age groups and socio-economic backgrounds.

-Any available characteristics : Characteristics such as gender, age, building size, energy consumption, geographical location, and construction material composition are examples of variables that may be considered when selecting samples. These characteristics provide insights into the diversity and representativeness of the sample.

-Sampling procedure: Various sampling techniques can be employed, including:

Simple random sampling: Every unit or individual in the population has an equal chance of being selected.

Systematic sampling: Units are selected at regular intervals from a list or sequence after a random start point.

Stratified random sampling: The population is divided into homogeneous subgroups (strata), and then samples are randomly selected from each stratum.

Cluster sampling: The population is divided into clusters, and then clusters are randomly selected for inclusion in the sample. All individuals within the selected clusters are included in the sample.

Convenience sampling: Units are selected based on their accessibility and convenience, rather than through random selection. While this method may lack representativeness, it can be practical in certain situations.

Section 4: Data collection methods

The description of data collection methods should include information on :

Measurement or acquisition of variables: This section outlines how each variable was obtained, including measurement units and data sources. For instance, in an energy efficiency study, energy consumption variables could be sourced from utility bills or smart meter data, measured in kilowatt-hours (kWh). Data sources may include government databases, building management systems, or direct sensor measurements.

Considerations and challenges during data collection: Discuss encountered challenges like missing or inconsistent data, affecting data reliability. For instance, incomplete utility bills or sensor discrepancies may impact energy consumption data accuracy. Overcoming these issues may involve data cleaning, imputation, or validation techniques for data integrity assurance

Description of data collection tools: Briefly overview the tools used, including materials, software, or questionnaires. For instance, specify if electronic or paper-based questionnaire surveys were administered, along with software for data entry and analysis. Describe the questionnaire format (e.g., closed or open-ended) and the number of items included.

List of indicators and parameters: If used, list the indicators or objectives in questionnaires or observation grids. For example, a questionnaire on energy-related occupant behavior may include indicators like heating preferences, lighting habits, and appliance usage. An observation grid for building audits may cover parameters such as insulation levels, window types, and HVAC efficiency.

-Measurement or Observation Methods: Information about how each variable was measured, observed, or assessed is included. This may involve describing the instruments, tools, or procedures used to collect data related to each variable. For quantitative research, this may include specific scales, questionnaires, or measurement techniques, while qualitative research may involve methods such as interviews, observations, or document analysis.
Units of Measurement: For quantitative variables, the units of measurement are specified to provide context and facilitate interpretation of the data. This could include units such as time (e.g., hours, minutes), distance (e.g., meters, kilometers), frequency (e.g., occurrences per month), or other relevant units depending on the nature of the variable.

Data Sources: Information about the sources of data for each variable is provided. This may include whether the data were collected directly by the researchers (primary data) or obtained from existing sources such as databases, literature, or archival records (secondary data).

Considerations or Challenges: Any practical constraints, challenges, or limitations encountered during the data collection process are discussed. This may include issues such as missing data, data quality issues, or constraints related to resources, time, or access to participants.

Documentation: Complete documentation of variables, including their definitions, measurement methods, units, and data sources, is provided to ensure transparency and reproducibility of the research findings.

Section 5: Data analysis

You should indicate how you processed and analyzed your data. Avoid going into too much detail: you should not start introducing or discussing any of your results at this stage.

1-In quantitative research, analysis relies on numerical data. The methods section covers:

-Data preparation steps, such as handling missing data, outlier removal, and variable transformation.

-Mention of software utilized for analysis, such as SPSS, Stata, or R.

-Description of statistical tests employed, like two-tailed t-tests or simple linear regression.

Example 1: Before conducting the analysis, the collected data underwent preprocessing steps. Missing data and outliers were identified and addressed using appropriate methods. For outlier detection, the "Tukey's method" was applied, where any data points outside 1.5 times the interquartile range from the quartiles were flagged as outliers (Tukey, 1977). Following data cleaning, statistical analysis was performed using the software package R, employing techniques like multiple regression analysis to explore the relationships between variables.

Example 2: Descriptive statistics were used to summarize the demographic characteristics of the sample and the frequency of social media use. Inferential statistics, including correlation analysis and regression analysis, were employed to examine the relationship between social media usage patterns and mental health outcomes.

2-In qualitative research, analysis revolves around language, images, and observations. Qualitative research in architecture and building design employs diverse methods to explore human experiences, perceptions, and social contexts. Common methods include:

Content analysis: Sorting and interpreting words, phrases, and sentences to discern their significance.

Example: Analyzing architectural critiques to identify recurring themes in reviews of sustainable building designs.

Thematic analysis: Coding and closely studying data to uncover overarching themes and patterns.

Example: Examining interviews with construction workers to identify recurring concerns about workplace safety practices.

Discourse analysis: Investigating communication and its social context to understand underlying meanings.

Example: Studying public debates on urban development projects to analyze how different stakeholders frame their arguments and viewpoints.

-Architect Interviews: Semi-structured interviews delve into architects' design philosophies, creative processes, and influences, revealing underlying motivations and decision-making factors.

-Observational Studies: Observing user interactions with built environments uncovers how design elements impact behavior, social interactions, and usability, providing practical insights into architectural choices.

-Ethnographic Studies: Immersing researchers in specific architectural settings or communities enables observation of daily routines, cultural practices, and spatial behaviors, fostering a deep understanding of human-environment interactions.

-Content Analysis of Design Discourse: Analyzing architectural publications and online forums reveals prevailing trends, aesthetic preferences, and critical perspectives, shaping architectural practice and discourse.

-Photovoice Projects: Participatory photography engages stakeholders to document their lived experiences and perceptions of the built environment, empowering marginalized voices and influencing architectural decision-making.

Section 6: Mitigation of Research biases

In research **bias** refers to any systematic error or deviation from the truth that occurs during the data collection, analysis, or interpretation processes.

Biases can occur due to many factors such as the sampling methods, the researcher's subjective judgment or preconceptions, the study design or the data analysis techniques used.

There are several types of biases that can occur in research. Some of the most common types include:

-*Selection bias:* this occurs when the selection of study participants is not random and is influenced by some factor that is related to the outcome being studied.

For example, if a study only includes participants who are willing to participate this may bias the results.

-*Measurement bias:* this occurs when the measurement of the outcome or exposure is not accurate or consistent.

For example if a scale used to measure weight is not calibrated correctly this could lead to inaccurate results.

-*Recall bias:* this occurs when participants in a study do not accurately recall information about past events or exposures.

For example if a study asks participants to recall their dietary intake over the past year their responses may be influenced by their current dietary habits or biases.

-*Reporting bias:* this occurs when participants in a study do not accurately report information about their experiences or exposures.

For example, if participants in a study are asked about their drug use they may underreport their use due to fear of judgment or legal consequences.

-*Observer Bias:* this occurs when the researchers beliefs or expectations influence their interpretation of the results.

For example if a researcher believes that a particular treatment is effective they may unconsciously interpret the results in a way that supports the belief.

-*Sampling bias:* this occurs when the sample of participants studied is not representative of the population being studied.

For example, if a study only includes participants from a certain age group. This may not accurately represent the experiences of the broader population.

It is important for researchers to be aware of and minimize biases in their work in order to ensure that their results are accurate reliable and valid.

Reducing research biases involves implementing strategies to minimize the influence of subjective factors that could distort study results. This includes biases in study design, data collection methods, analysis techniques, and interpretation of results.

Triangulation: Combine various methods, data sources, or researchers to validate Examples of triangulation in research validity include:

1. Methodological Triangulation: Using multiple data collection methods, such as surveys, interviews, and observations, to gather data on the same phenomenon. For instance, in a study on workplace satisfaction, researchers might combine survey responses with observations of employee behavior to validate findings.

2. Investigator Triangulation: Involving multiple researchers or investigators in data collection, analysis, and interpretation. Different researchers may bring diverse perspectives and expertise to the study, reducing bias and increasing the reliability of the results.

3. Data Triangulation: Collecting data from various sources or respondents to corroborate findings. For example, in a study on consumer preferences, researchers might collect data from both customers and retailers to validate patterns and trends.

4. Theory Triangulation: Drawing on multiple theoretical frameworks or perspectives to interpret research findings. By considering different theoretical lenses, researchers can offer richer insights into the phenomenon under study and strengthen the theoretical foundation of their research.

5. Time Triangulation: Conducting data collection at different points in time to capture changes or trends over time. Longitudinal studies, for instance, track participants' responses or behaviors over an extended period, allowing researchers to observe patterns and fluctuations in the phenomenon.

Peer Review: Peer review is a vital process in mitigating biases in research. Have experts in the field review research designs, data collection methods, analysis techniques, and interpretation of results to ensure rigor.

Blinding: Conceal participant or researcher identities to minimize bias. In architectural studies, use blind peer reviews to prevent evaluator influence. Blinding helps reduce biases by minimizing the influence of subjective factors on study outcomes. It enhances the objectivity and reliability of research findings by ensuring that treatment effects are assessed in a fair and impartial manner. However, blinding may not always be feasible or appropriate in certain study designs or contexts, and researchers must carefully consider its implementation based on the specific requirements of their study.

Randomization: Randomly assign participants or samples to groups to reduce selection bias. For instance, in a green building study, randomly allocate buildings to treatment and control groups.

Transparency: Document research procedures and limitations clearly for accountability. Provide detailed descriptions of data collection and analysis methods in building performance evaluations.

Section 7: Presentation of the data

This section should provide a clear and comprehensive overview of the strategies and techniques employed to represent the research findings accurately and effectively. It encompasses various aspects, including:

-Data Visualization Techniques: Describe the visual tools employed to represent the results, such as graphs, charts, tables, and diagrams. Explain why these visualizations were chosen and how they effectively communicate the key findings.

-Statistical Analysis Methods: If statistical analysis was conducted, specify the techniques used to analyze the data. This may include descriptive statistics, inferential statistics, regression analysis, or other advanced statistical methods.

-Presentation Formats: Discuss the format in which the results are presented, whether it's through written descriptions, numerical summaries, visual representations, or a combination of these formats. Highlight any conventions followed for presenting data in your field of study.

-Software Utilization: If specialized software was employed for data analysis or visualization, mention the tools used and how they facilitated the representation of results. Provide details on any software settings or parameters configured for analysis.

Writing the method section: Example

A-Research Design:
The study used a mixed-methods approach to investigate the impact of social media usage on adolescent mental health. This approach combined quantitative surveys with qualitative interviews to provide a comprehensive understanding of the phenomenon.

B-Participants or sample:
The sample consisted of 300 adolescents aged 13 to 17 years recruited from local schools in the urban area of Jijel. Participants were selected using stratified random sampling to ensure representation across different age groups and socio-economic backgrounds.

C-Data Collection:
Quantitative Data: A self-administered questionnaire was distributed to participants to assess their frequency of social media use, types of platforms used, and perceived impact on mental health. The questionnaire included validated scales such as the Social Media Impact Scale (SMIS) and the Depression Anxiety Stress Scales (DASS-21).
Qualitative Data: Semi-structured interviews were conducted with a subset of participants (n=30) to explore their subjective experiences and perceptions regarding social media use and its effects on mental well-being. Interviews were audio-recorded and transcribed verbatim for analysis.

D-Data Analysis:

Quantitative Analysis: Descriptive statistics were used to summarize the demographic characteristics of the sample and the frequency of social media use. Inferential statistics, including correlation analysis and regression analysis, were employed to examine the relationship between social media usage patterns and mental health outcomes.

Qualitative Analysis: Thematic analysis was conducted on the interview transcripts to identify recurring themes and patterns related to participants' experiences with social media and mental health. Codes were generated iteratively, and themes were developed through constant comparison.

E-Ethical Considerations:

The study received ethical approval from the Institutional Review Board (IRB) prior to data collection. Informed consent was obtained from all participants and their legal guardians, and confidentiality and anonymity were ensured throughout the research process.

F-Limitations:

While efforts were made to obtain a diverse sample, the study may be limited by its reliance on self-report measures and the exclusion of adolescents who are not enrolled in school. Additionally, the cross-sectional nature of the study limits the ability to establish causality between social media use and mental health outcomes.