Mohamed Khider University- Biskra,
Faculty of Architecture, Civil Engineering, and Hydraulics
Department of Architecture

Course Handout:

DATA ANALYSIS COURSE

3rd Semester

Intended for 2nd year Master's Students
Specialization: Construction Project Management

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Academic Year: 2025–2026

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COURSE INFORMATION

Course Identification

Title: DATA ANALYSIS

Teaching Unit: UED

Number of Credits: 1 **Coefficient:** 1

Total Weekly Hours: 1h30

- **Lecture (hours per week):** 1h30
- **Tutorials (hours per week):** 0h00
- **Practical Work (hours per week):** 0h00

Course Description

Prerequisites:

Students are expected to have knowledge in:

- Mathematics
- Statistics
- Word processing (Word, Excel, etc.)
- Language proficiency

General Objective of the Course :

At the end of the semester, the student will be able to carry out research work and master the entire process covering the different stages, from data collection and analysis to report writing and decision-making.

Specific Objectives of the course:

This course aims to :

- Provide students with an understanding of key concepts related to data collection, types of data, and their role in research.
- Equip students with the skills to design and administer questionnaires and other data collection instruments.
- Introduce students to basic software tools (e.g., Excel, SPSS, NVivo) for data entry and analysis..
- Strengthen students' ability to prepare structured reports that present findings clearly and logically.

Intended Competencies:

At the end of the course, the learner will be able to:

- Conduct the data collection process

- Design and structure a questionnaire.
- Analyze and interpret information.
- Write a clear and structured report.
- Make informed decisions based on data.

Course Content

The syllabus of this course is structured around the following points:

- Introduction to the course
- Data collection:
  - Definition
  - Objectives of data collection
  - Data collection tools
  - Selection of tools
  - Development of data collection tools
  - Data collection process
- Fieldwork
- Data analysis: use of the collected data (quantitative and qualitative)
  - SPSS software (quantitative data)
  - NVivo software (qualitative data)

Assessment Methods

Type of Assessment	Weighting (%)
Exam	100
Total	100

References & Bibliography

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Course Plan

This course is structured into five chapters, each covering a key aspect of data analysis, as follows:

Chapter 01: Introduction to Data Analysis

Chapter 02: Data collection

Chapter 03 : Fieldwork

Chapter 04: Data Analysis: Exploitation of the Data Collected

Chapter 05: Data interpretation and reporting

Introduction

The present course handout introduces students to the fundamental principles and practices of data analysis as an essential component of scientific inquiry and professional research. Its primary aim is to develop both a conceptual and methodological understanding of how data are systematically collected, organized, processed, and interpreted in order to generate meaningful knowledge and support evidence-based decision-making.

This course (DATA ANALYSIS) is intended for second-year Master's students specializing in Construction Project Management during the third semester. In this field, data analysis plays a crucial role in enhancing planning, coordination, and performance evaluation across all stages of a project. The systematic examination of project-related data; ranging from cost estimates and scheduling information to resource allocation metrics and risk indicators, supports more accurate forecasting, strengthens decision-making, and enables more effective control over time, quality, and budget parameters. Furthermore, data-driven analysis facilitates the identification of bottlenecks, the evaluation of contractor performance, and the development of strategies to reduce uncertainty and optimize project outcomes. As construction projects become increasingly complex and data-intensive, the ability to analyze and interpret information has emerged as a key professional competency for future project managers and industry practitioners.

This course places particular emphasis on the entire analytical process, beginning with the selection of appropriate data collection strategies, followed by the preparation and management of datasets, and culminating in the application of both quantitative and qualitative analytical techniques. Throughout this process, students are encouraged to critically engage with data, assess the reliability and validity of findings, and reflect on the ethical and methodological implications of their analytical choices.

Through this handout, students are provided with a structured reference designed to support both conceptual understanding and practical application. The overarching objective is to foster critical thinking, methodological rigor, and analytical autonomy, enabling learners to apply data analysis techniques confidently in academic research as well as in professional environments.

Mental map of the course

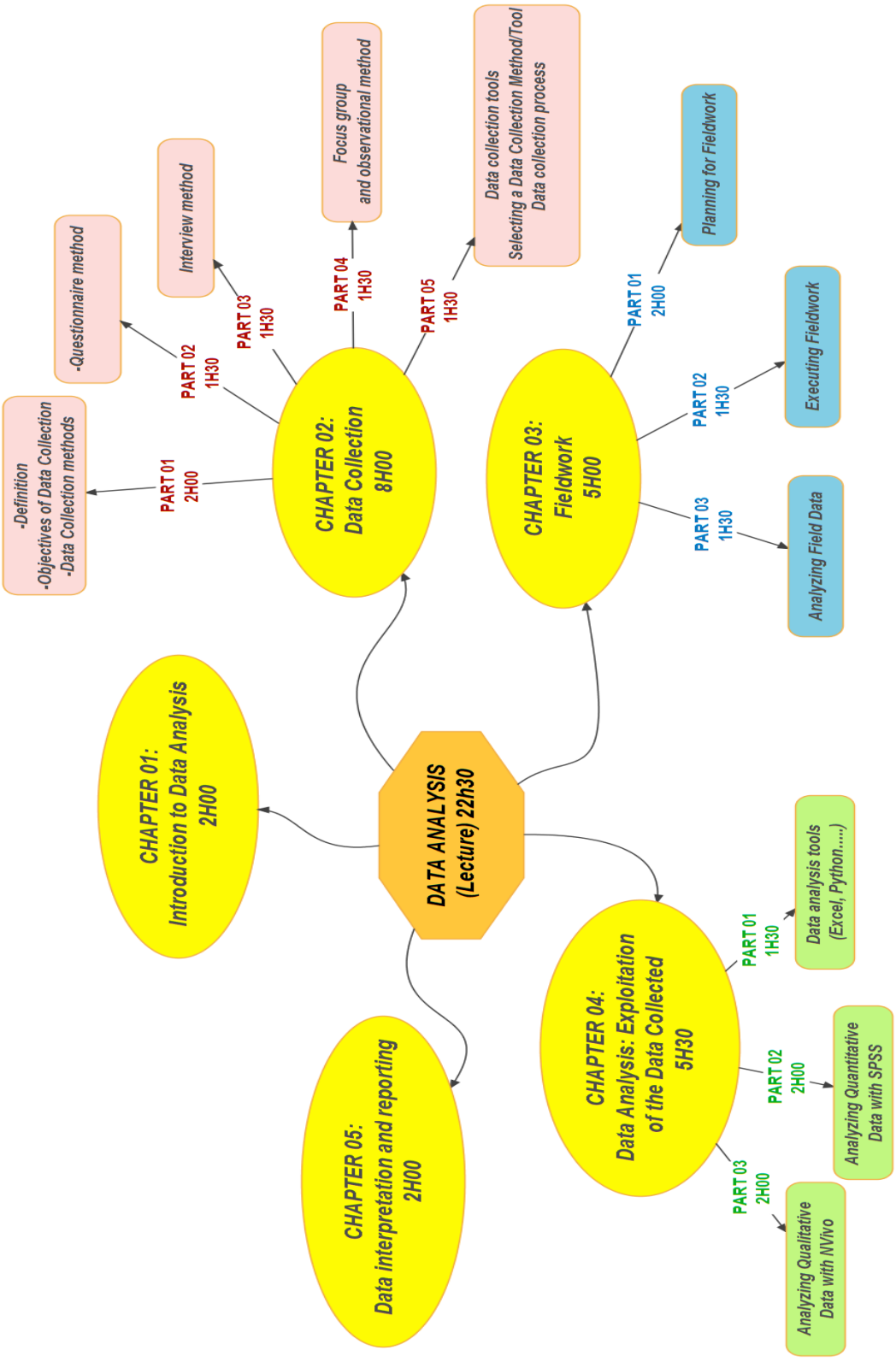


Figure 01 : Mental map of the course DATA ANALYSIS

Chapter 01:
Introduction to Data Analysis

I.1 What is data and data analysis?

DATA refers to **factual information** that needs to be recorded and analyzed in a form which can be assessed to make a determination or decision about a specific action. It consists of facts, numbers, text, letters, symbols, images, sounds, and measurements.

Data is gathered from a variety of sources, such as scientific research, government records, commercial transactions, social media, etc. (Richmond. B, 2006)

DATA ANALYSIS is a range of specific procedures, specialized techniques and methods that convert the collected data to meaningful information in order to draw conclusion about that information, thus supporting the mechanism of decision-making process. (Manpreet. K. B, 2017)

In other words, Data analysis includes ways of working with information (data) to support the work, goals and plans of your program or agency. (Richmond. B, 2006)

I.2 Importance of Data Analysis

Data analysis is the most crucial part of any research. It allows researchers to understand the information gathered, test hypotheses, and draw conclusions. It ensures that research findings are accurate, reliable, and actionable, enabling researchers to draw meaningful conclusions, « data analysis is the crucial part of research which makes the result of the study more effective ». (Dawit, 2020, p25).

I.3 Types of Data

Data are organized into two broad categories: **qualitative and quantitative**.

I.3.1.Qualitative Data: Qualitative data are primarily non-numerical and are often descriptive or nominal in nature. This means they are collected in the form of words or sentences, capturing feelings, emotions, opinions, and subjective perceptions about a particular phenomenon. (Kabir, 2016).

Examples :

- The supervisor observed that workers were '**well-coordinated**' during the concrete pour.
- Workers reported that the new safety protocols were '**easy to follow**' but '**time-consuming**.'

- The project team identified potential weather disruptions as a '**significant risk**' to the schedule

I.3.2.Quantitative Data: Quantitative data refers to numerical data that can be measured and quantified. It is data that represents quantities and is typically used for statistical analysis, often collected through surveys, measurements, and experiments (Kabir, 2016).

Examples :

- The project is scheduled to be completed in **12 months.**
- Material costs for the foundation amount to **200,000 DA**.
- There are **150 workers** on-site daily
- Each floor of the building will take **30 days** to construct.

What is the difference between quantitative and qualitative data ?

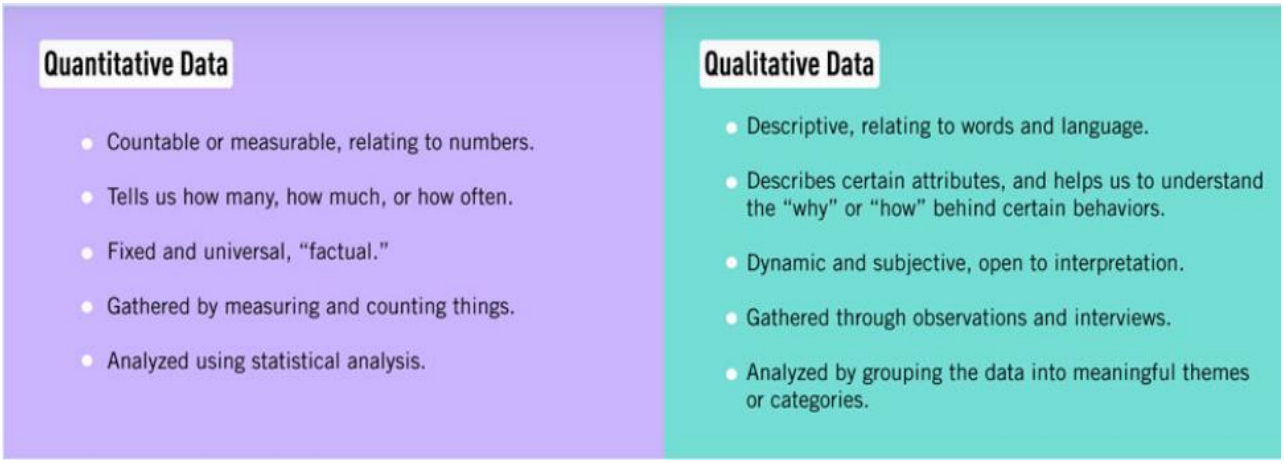


Figure 02 : the difference between quantitative and qualitative data. **source :** https://careerfoundry.com/en/blog/data-analytics/difference-between-quantitative-and-qualitative-data/

I.4 Overview of Data Analysis Process

The data analysis process is a systematic approach to collecting, cleaning, interpreting, and presenting data to extract meaningful insights and support decision-making. Here's an overview of the key steps involved in this process:

1. **Define the objectives/research problem**

The first step in the data analysis process is to clearly define the objectives or research problem. Understanding why data analysis is being conducted and what decisions or questions it aims to address is crucial. This step ensures that the analysis is focused and aligned with the goals of the study. Key questions to consider include: What are the objectives of this analysis? What

outcomes are expected? For example, in a construction project, the objective may be to identify the primary causes of cost overruns.

Clearly stating the objectives helps determine the specific questions to answer and guides the selection of appropriate data collection and analysis methods.

2. **Data Collection**

Data collection involves gathering relevant information from all sources necessary to address the research problem, test hypotheses, or evaluate outcomes. The quality and comprehensiveness of the data directly affect the validity of the analysis. Examples of data collection in a construction project include obtaining daily progress reports, budget records, and weather data. This step requires careful planning to ensure that data is accurate, relevant, and collected ethically.

3. **Data Cleaning and Preparation**

Once the data has been collected, it must be entered into a data management system such as SPSS, SAS, or Excel. During this process, errors are inevitable, whether due to incorrect coding, misread entries, missing data, or duplicates. Data cleaning is the process of detecting and correcting these errors to ensure the dataset is accurate and reliable. For example, identifying and removing duplicate rows or correcting misclassified entries helps prevent misleading results and ensures that subsequent analysis reflects true patterns in the data. **Data cleaning is the process of detecting and correcting these coding errors.**
(https://www.researchgate.net/publication/338528149_Data_Analysis_Types_Process_Methods_Techniques_and_Tools)

4. **Data Exploration and Visualization**

After cleaning, the data should be explored to understand its structure, patterns, and key characteristics. Data exploration helps detect outliers, trends, or unusual observations that may influence the analysis. Visualization tools such as graphs, charts, and dashboards are valuable in this step, making complex data more comprehensible. For example, creating a bar chart to show monthly expenses can help identify trends in cost overruns and highlight areas requiring further investigation.

5. **Data Analysis**

The analysis step involves applying appropriate analytical techniques to interpret the data and extract meaningful insights. The choice of method depends on the type of data (quantitative or qualitative) and the objectives of the study. Quantitative data may be analyzed using statistical techniques, while qualitative data may require thematic or content analysis. The goal is to uncover patterns, correlations, or insights that answer the research questions or test the hypotheses.

6. **Interpretation of Result**s

Interpreting results involves making sense of the findings within the context of the research objectives. This step answers the questions: What do the results mean? How do the findings align with the project's goals or hypotheses? For instance, in a construction project, analysis may show that delays caused by subcontractor inefficiencies are responsible for 20% of schedule overruns. Interpretation provides the rationale for conclusions and helps identify actionable steps based on the insights gained from the data.

7. **Reporting and Communication**

The final step in the data analysis process is reporting and communicating the results in a clear, actionable format. Reports may take the form of written documents, visual dashboards, or presentations tailored to different audiences. Key elements include a summary of findings, visual representations such as graphs and charts, and recommendations based on the analysis. For example, a report may present charts illustrating the main causes of cost and schedule delays and suggest strategies to mitigate these issues in future projects.

Effective communication ensures that the insights from data analysis are understood and can inform decision-making.

Figure 03 : steps of data analysis process. **Source:** Author

I.5 Application of data analysis in construction project management research (example)

A simpler example of data analysis in a construction project context, focusing on understanding the impact of weather delays on project completion times.

1-Research objective:

To determine how weather delays impact the total duration of construction projects.

2- Data collection

Hypothetical dataset:

Project ID	Weather Delays (days)	Total Duration (days)
001	3	150
002	0	120
003	5	180
004	2	140
005	7	200

3- Data preparation

Data cleaning: Ensure all data entries are correct and consistent. In this case, verify that weather delays and total duration are recorded in days.

4- Data exploration and visualization

1. **Scatter plot :** To visualize the relationship between weather delays and total project duration.
    - **X-axis**: Weather Delays (days)
    - **Y-axis**: Total Duration (days)
    - **Plot**: Each project is represented as a point. The scatter plot will show if there's a visible trend or pattern.
2. **Bar Chart**: To compare the total duration of projects with different weather delays.
    - **X-axis**: Project ID
    - **Y-axis**: Total Duration (days)
    - **Bars**: Each bar represents the total duration for a specific project, which can be compared visually to the weather delays.

4- Data Analysis

Using analytical techniques: to determine if there is a relationship between weather delays and total project duration

5- Results interpretation

-Findings:

The analysis revealed a strong positive correlation between weather-related delays and the total duration of construction projects. In other words, projects that experience more frequent or severe weather delays tend to have longer overall durations. This relationship highlights the significant impact that weather can have on project timelines and emphasizes the need to account for environmental factors during project planning.

-Recommendations:

- **Improve Planning**: Factor in potential weather delays during the planning phase to create more realistic project timelines.

- **Implement Mitigation Strategies**: Develop strategies to minimize the impact of weather on construction activities, such as scheduling critical tasks during favorable weather periods.

5. Reporting and communication

Research report: Create a brief report summarizing the findings. Include the average weather delays, total durations, and correlation results. Use a scatter plot to visualize the relationship between weather delays and total duration.

Presentation: Present the findings in a simple slide or dashboard to stakeholders, highlighting the key points and recommendations.

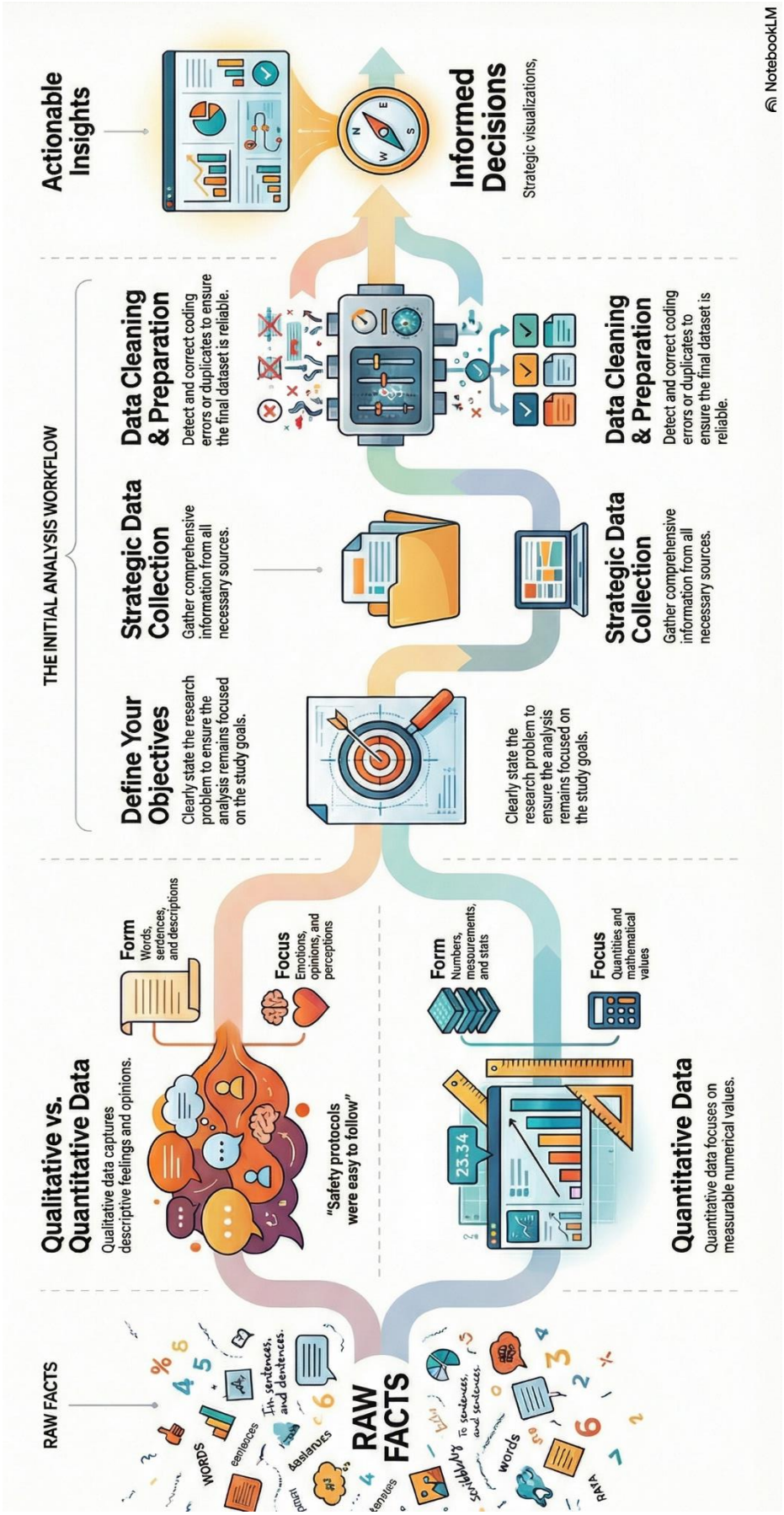


Figure 04 :The data analysis workflow: from raw data to informed decisions *(Illustration generated by Notebook AI)*

Chapter 02:
Data Collection

II.1. Definition of data collection

Data collection is the process of gathering and measuring information on variables of interest, that enables the researcher to find answers to research questions, test hypotheses, and evaluate outcomes.

Data collection is one of the most important stages in conducting a research. « You can have the best research design in the world but if you cannot collect the required data you will be not be able to complete your project» (Kabir, 2016, p202).

II.2. Objectives of Data Collection

- Provides factual information to make informed choices and strategic decisions.
- Creates a record of information that can be referenced or used in future research.
- Helps predict future scenarios and plan accordingly
- provides the necessary information to test hypotheses, validate research findings, and conduct thorough analysis.

II.3. Data Collection methods

Generally, data collection methods are divided to two main categories of Primary Data Collection Methods and Secondary Data Collection Methods.

II.3.1 Primary data collection methods

Primary data collection involves gathering information directly for the specific purpose of a study. This data remains private and inaccessible to others until it is published. Both qualitative and quantitative methods can be employed to collect such data.

Primary data refers to first-hand information that has not been published or altered by anyone else. In other words, researchers collect this data directly using various methods, tailored to the specific objectives of their study.

Common methods of collecting primary data include:

- Questionnaires
- Interviews
- Focus Group Interviews
- Observation
- Survey

- Case-studies
- Experimental Method
- Statistical Method etc.

II.3.2. Secondary data collection methods

Secondary data refers to information that has already been collected and published by someone else, often for a different purpose. Researchers can use these existing data sources for their own studies. For instance, the **literature review** section of any research paper is primarily based on secondary data.

Thus, secondary data play a crucial role in research, providing information from past studies that can serve as a foundation for conducting new research or as essential background knowledge. They can also assist in designing a study and offer a baseline for comparing primary data results. However, it is important for researchers to critically assess the validity and reliability of these sources to ensure accurate and trustworthy findings.

This collected data can come from **qualitative sources**, such as interview transcripts or reports, as well as **quantitative sources**, such as census data. In general, methods for collecting secondary data can be categorized as shown in Figure 05.

Secondary Data Collection Methods	Description and Credibility Points
Published Printed Sources	In these types, the writer, publication, and publishing time are important.
Books	The most authentic ones among the secondary sources.
Journals/Periodicals	The most important methods as they are up-to-date and provide data and information about very specific subjects.
Magazines/Newspapers	Not highly reliable but can be effective in your research as well.
Published Electronic Sources	Very fast and accessible.
E-Journals	Very available compared to the printed ones. Nowadays these types are very credible as well
General Websites	Not very reliable.
Weblogs	Commonly used methods and provide reliable diaries.
Unpublished Personal Records	Useful in some cases.
Diaries	Useful in descriptive methods, although they can be not very accessible.
Letters	Must be checked in terms of reliability before using.
Government Records	Very useful in different subjects such as human research, social sciences, etc.
Census Data/Population Statistics	Include educational and health records.
Public Sector Records	Provided by private companies and NGO surveys.

Figure 05: Types of secondary data collection methods. **Source :** Hamed Taherdoost, 2021, P33

Figure 06 presents a summary of the most frequently used methods for collecting both primary and secondary data. It offers a visual overview that helps to quickly understand the different techniques associated with each type of data collection methods.

Figure 06 : Data collection methods . **Source :** Hamed Taherdoost, 2021, P13

II.3.3 Difference between primary and secondary collection data

The key differences between primary and secondary data collection are summarized in the table below (table 01) to provide a clear and concise comparison

Table 01: Differences between primary and secondary data collection. **Source:** Author

Aspect	**Primary Data Collection**	**Secondary Data Collection**
Definition	Data collected directly from original sources by the researcher.	Data that has already been collected and recorded by others.
Source	First-hand sources such as surveys, interviews, observations, and experiments.	Existing sources such as books, articles, reports, and databases.
Purpose	To gather specific, original data tailored to the research objectives.	To use previously collected data for new analyses or comparisons.
Data Collection Methods	Surveys, interviews, focus groups, observations, experiments.	Literature reviews, archival research, reports, databases.
Time and Cost	Often time-consuming and expensive as it involves direct engagement with subjects.	Generally quicker and less costly as data is already available.
Control Over Data	High control over the design, methodology, and quality of the data collected.	Less control over how the data was collected, its quality, and its relevance.
Examples	Conducting a new survey to assess current safety practices on a construction site, performing interviews with project managers about challenges in project scheduling.	Analyzing historical project performance data from a construction management database, reviewing existing research studies on construction site safety trends, examining industry reports on project delays.

II.3.4 How primary and secondary data complement each other?

Primary and secondary data complement each other by serving different but interconnected purposes in research. Secondary data provides essential background information and helps identify gaps in existing knowledge, while primary data addresses these gaps by supplying specific, targeted information. Using secondary data can also reduce the need for extensive

primary research, saving both time and costs. Furthermore, secondary data is useful for understanding broad trends and patterns, whereas primary data delivers detailed and context-specific insights, allowing researchers to make well-informed decisions and draw accurate conclusions.

II.4. Most common primary data collection methods

The most common primary data collection methods will be explained in this section, including questionnaires, interviews, focus groups, observation, surveys, and experimental methods, all in detail, to help guide your research work.

II.4.1 Questionnaire method

II.4.1.1 Definition

A **questionnaire** is a research tool composed of a set of questions and prompts designed to collect information from respondents within a specific population.

Data obtained through questionnaires cannot be sourced from secondary resources (Pandey & Pandey, 2015). Questionnaires are suitable for collecting both **qualitative** and **quantitative** data. While they are not the most frequently used method in qualitative research, they are particularly useful when dealing with **large sample sizes**.

II.4.1.2 Types of questions used in a questionnaire:

Each type of question serves a distinct purpose and can influence the quality and depth of the information obtained from respondents.

1. Closed-Ended Questions: provide respondents with a limited set of predefined answer options. These questions can be further categorized into several subtypes:

a. Multiple-Choice Questions - Respondents select one or more options from a list of choices.

Example: "Which safety measures do you regularly follow? (Select all that apply)

b-Yes/No Questions: Simple binary choices.

Example: "Do you wear protective equipment on the construction site? (Yes/No)"

c-Rating Scale Questions: Rate a statement on a scale (e.g., 1 to 5).

Example: "How satisfied are you with the current project management process? (1 = Very Dissatisfied, 5 = Very Satisfied)

d-Likert Scale Questions: Measures agreement or disagreement with a statement.

Example: "I feel adequately trained to use the project management software. (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)"

e-Ranking Questions: Rank options in order of preference.

Example: "Rank the following project management challenges in order of importance."

2-**Open-Ended Questions:** Respondents provide their own answers without predefined options. *Example:* "What challenges have you faced in completing tasks on schedule?"

3. **Demographic Questions**: Collect personal or demographic information, for example:

- **Age**: "What is your age group? (20-30, 31-40, etc.)"
- **Gender**: "What is your gender? (Male, Female, Other)"
- **Occupation**: "What is your current role in the construction project?"

4. Matrix Questions: Multiple similar questions presented in a table format with a shared set of response options.

Example:

Statement	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Communication on the site is effective					
The safety measures are adequate					

5. Filter/Contingency Questions: These are used to guide respondents to different follow-up questions based on their previous answers. *For example:*

- Q1: "Have you been involved in a project delay? (Yes/No)"
- Q2 (if yes): "What were the main reasons for the delay?"

6. Checklist Questions: Respondents select all items that apply to them from a list. *Example:* "Which of the following equipment do you regularly use on-site? (Check all that apply)"

II.4.1.3 Types of Questionnaires

1-Structured Questionnaires: These contain closed-ended questions that provide respondents with predefined answer options, such as multiple-choice or Likert scale questions. Structured questionnaires facilitate quantitative analysis and are often used in large-scale surveys.

2-Unstructured Questionnaires: These include open-ended questions that allow respondents to provide their answers in their own words. Unstructured questionnaires are useful for exploratory research and can yield rich qualitative data.

2-Semi-Structured Questionnaires: These combine elements of both structured and unstructured formats, featuring a mix of closed and open-ended questions. This approach allows researchers to obtain specific information while also exploring respondents' perspectives in greater depth.

II.4.1.4 Questionnaire administration modes

There is different methods used to distribute and collect responses from participants. The choice of mode affects response rates, data quality, and the ease of administration

1-Face-to-face questionnaire administration, where an interviewer presents the items orally.(asking questions and recording answers.)

2- **Paper-and-pencil questionnaire administration**, Participants complete the questionnaire themselves without any direct interaction with the researcher.

(kabir,2016)

3-Telephone Surveys: The questionnaire is administered over the phone, with the interviewer asking questions and recording responses.

4- An online questionnaire is a cost-effective method for data collection. However, researchers should be aware of the potential for missing responses due to limited internet access. Various online survey platforms can be used to distribute questionnaires, and the collected data can then be easily imported into analysis software for further processing (Taherdoost, 2021).

II.4.1.5 Factors to consider when choosing an administration mode

Target Audience: Consider their access to technology and comfort with different modes (e.g., older populations may prefer phone or face-to-face, while younger people might prefer online).

Budget: Some methods (e.g., face-to-face) can be costly, while online and email surveys are generally cheaper.

Questionnaire Complexity: Complex surveys may require interviewer administration to clarify questions.

Time Sensitivity: Some modes (e.g., mobile surveys) may yield quicker responses than others.

II.4.1.6 Steps in designing a questionnaire

1. Define the Research Objectives: Clearly articulate the purpose of the questionnaire and the specific research questions it aims to address. This foundational step guides the entire design process and ensures that the questions are relevant to the research goals (Aithal & Aithal, 2020; Rowley, 2014).

2.**Identify the Target Population:** Determine the demographic characteristics of the respondents from whom data will be collected. Understanding the target population helps in tailoring the questionnaire to their specific context and ensuring that the language and content are appropriate (Rowley, 2014; Govender et al., 2014).

3.Develop the Questionnaire Items: Create questions that align with the research objectives. This involves deciding on the types of questions to include (e.g., closed-ended, open-ended, Likert scale) and ensuring that they are clear, concise, and unbiased. It is essential to avoid leading questions that may influence respondents' answers (Rowley, 2014; Pluye et al., 2014).

4.Pilot Testing: Conduct a pilot test with a small sample of the target population to identify any issues related to question clarity, format, and overall flow. Feedback from the pilot test can be used to refine the questionnaire before full-scale administration (Aithal & Aithal, 2020). This step is crucial for assessing the reliability and validity of the questionnaire items (Sukrisman, 2020).

5.Revise the Questionnaire: Based on the feedback obtained during the pilot testing, make necessary revisions to improve clarity, relevance, and comprehensiveness. This iterative process may involve rewording questions, adjusting response options, or removing ambiguous items (Rowley, 2014; Aithal & Aithal, 2020).

6.Determine the Mode of Administration: Decide how the questionnaire will be distributed (e.g., online, paper-based, face-to-face). The mode of administration can affect response rates and the quality of the data collected. Considerations such as accessibility and convenience for respondents should guide this decision (Rowley, 2014; Govender et al., 2014).

7.Administer the Questionnaire: Distribute the finalized questionnaire to the target population, ensuring that instructions for completion are clear. Monitor the response rate and follow up as necessary to encourage participation (Aithal & Aithal, 2020).

8. Analyze the Data: Once the data is collected, analyze it using appropriate statistical methods. For quantitative data, descriptive and inferential statistics may be employed, while qualitative data may be analyzed thematically (Aithal & Aithal, 2020). Ensure that the analysis aligns with the original research objectives.

9.Report the Findings: Present the results in a clear and organized manner, highlighting key findings in relation to the research objectives. Include discussions on the implications of the findings and any limitations of the study (Rowley, 2014).

II.4.1.7 Advantages and disadvantages of Questionnaires

Advantages of Questionnaires

- Enable the collection of a large amount of data from a sizable sample.
- Allow for the acquisition of highly accurate data.
- Facilitate easy analysis, as the collected data can often be quickly imported into analysis software (Frechtling, 2002; Kabir, 2016; Taherdoost, 2021).

Disadvantages of Questionnaires

- Questions may be misunderstood, which can compromise the quality of the responses.
- Low response rates can occur if participants are not sufficiently motivated to complete the questionnaire (Frechtling, 2002).
- Responses may include irrelevant or incorrect answers (Pandey & Pandey, 2015).
- Assessing the reliability of the answers is often difficult or impossible (Taherdoost, 2021).

II.4.2 Interview

Interviewing involves posing questions to participants and recording their responses for a study. Interviews can take various forms, including **individual face-to-face interviews** and **group interviews** conducted in person. Additionally, interviews can be conducted remotely using **telephone** or other **electronic devices** such as computers (Kabir, 2016).

This method is particularly useful for gaining detailed, nuanced, and personal perspectives, which may not be captured through other data collection tools like questionnaires or surveys.

II.4.2.1.Types of interviews:

There are three main types of interviews: **structured, semi-structured,** and **unstructured**, each offering different levels of guidance and flexibility for data collection.

1-Structured Interview:

In a structured interview, all participants are asked the same set of pre-prepared questions. The range of possible responses is usually limited, although a few open-ended questions may be included to allow for more detailed answers. Example: Asking a construction project manager the same set of questions regarding time management on multiple projects.

2-Semi-structured interviews

A semi-structured interview is conducted according to a prepared guide. Interviewers follow this guide when asking questions, but they have the flexibility to probe further or ask additional questions if more information is needed. Example: Interviewing a site engineer about general project issues but allowing them to explore specific challenges like materials or labor.

3-Unstructured interviews

An unstructured interview is an informal method of data collection that does not follow a predetermined set of questions. There is no interview guide, and the interaction typically takes the form of a casual conversation between the interviewer and participant. Example: Open-ended discussions with a project stakeholder about unexpected issues during a project.

II.4.2.2.Key factors in choosing the right type of interview

Choosing the appropriate interview type is crucial to effectively gathering the information you need.

- **Research Objective:** Choose structured interviews for specific, quantifiable data, and semi-structured or unstructured interviews for exploring complex, qualitative insights.
- **Nature of the Information:** Use structured interviews for factual information and semi-structured or unstructured interviews for in-depth, nuanced data on complex topics.
- **Participant Availability and Comfort:** Structured interviews are efficient for participants with limited time, while semi-structured or unstructured interviews allow for a more open, comfortable discussion, especially on sensitive topics.

II.4.2.3.Interview process steps

1. **Define Objectives**: Clearly establish the purpose of the interview and the type of information you aim to gather.

2. **Prepare Questions**: Develop a structured or semi-structured list of questions aligned with the research objectives. Ensure the questions are clear, concise, and unbiased.

3. **Select Participants**: Identify and recruit individuals who have relevant experience or knowledge related to the research topic.

4. **Schedule and Plan**: Arrange the interview at a time and place convenient for the participant, ensuring a comfortable and distraction-free environment.

5. **Prepare Materials**: Gather necessary materials like recording devices, consent forms, and interview guides. Ensure any equipment is functioning properly.

6. **Conduct the Interview**: Begin with an introduction, explain the purpose, and obtain consent. Follow the prepared questions, while being flexible for deeper probing as necessary.

7. **Active Listening**: Engage with the participant by listening attentively, asking follow-up questions, and clarifying responses where needed.

8. **Record Responses**: Take notes or record the interview (with permission) to ensure accuracy in capturing responses.

9. **Wrap-Up**: Thank the participant and provide information about the next steps, if any, such as how the data will be used or any follow-up communication.

10. **Analyze Data**: Review and analyze the collected responses, using qualitative or quantitative methods as appropriate for your research.

11. **Report Findings**: Summarize key insights, trends, and conclusions drawn from the interview data in relation to the research objectives.

Example in Construction Project Management:

An example of using interviews in construction project management is assessing how project managers handle construction delays. The participants for such a study would be project

managers from various construction sites. Key questions could include: What are the most common causes of delays in your projects? How do you address these delays when they occur? And what measures do you take to prevent delays in future projects? This approach allows researchers to gather detailed insights directly from professionals facing real-world project challenges.

II.4.2.4. Merits and Demerits

Merits:

- Collecting detailed and in-depth information directly from participants.
- Gaining insights into past experiences and future expectations of specific events or topics.
- The ability to explain and clarify questions to interviewees during the interview

Demerits

- Organizing when and where to meet can be complicated, with plans sometimes changing last minute.
- There's a risk of missing important information during interviews.
- The process of organizing and analyzing the responses (coding) can be lengthy and difficult

II.4.3 Focus Groups method (FGD)

II.4.3.1.Definition

Focus group discussion is a method that combines elements of interviewing and observation. It is used to explore human behaviors, attitudes, and perceptions regarding a particular topic. This in-depth, field-based method typically involves a group of 6–12 participants who often share common characteristics such as gender, age, or educational background. The group engages in a guided discussion on a specific research topic.

II.4.3.2. Objectives of the method

Focus groups aim to explore complex issues, generate new ideas, and understand collective attitudes within a targeted population

II.4.3.3 Key components

1. **Participants**: Typically, a focus group consists of 6-10 participants who are selected based on specific criteria relevant to the research topic.

2. **Moderator**: An experienced facilitator who guides the discussion, ensures that all participants have a chance to speak, and keeps the conversation on track.

3. **Discussion Guide**: A structured set of questions or topics prepared in advance to steer the conversation and ensure that all relevant areas are covered.

4. **Setting**: The discussion usually takes place in a comfortable, neutral environment where participants feel at ease.

5. **Data Collection**: The discussion is recorded (with participants' consent) and transcribed for analysis. Observations and notes from the session are also used to gather insights.

II.4.3.4 Advantages and Disadvantage of Focus Group

Advantages

- Provides in-depth insights into participants' thoughts and experiences.
- Facilitates dynamic discussion and idea generation through participant interaction.
- Allows researchers to observe non-verbal cues, like facial expressions and body language, adding depth to the data

Disadvantages

- Face privacy lacks;
- Coordinating schedules, securing a venue, and ensuring effective participation can be time-consuming and costly.
- Responses can be less structured and harder to analyze compared to quantitative data.

II.4.3.5.Example: Safety practices on construction sites.

An example of a qualitative study in construction project management is investigating safety practices on construction sites. The objective is to understand how workers perceive existing safety measures. Participants include workers, safety officers, and site managers. The study aims to identify the safety issues they encounter and explore ways to improve training programs. Key questions may include: What safety problems do you observe on-site? How effective is the current safety training? And what measures would make you feel safer while working? The expected outcomes are to identify common safety concerns, enhance training

programs based on worker feedback, and develop more effective safety protocols to ensure a safer working environment.

II.4.4 Observation method

II.4.4.1 Definition

In observation methods, first-hand data are collected by directly observing events, behaviors, interactions, or processes in order to gain a deeper understanding of the concepts being studied. This approach can be used to gather both qualitative and quantitative data.

II.4.4.2 Key features of the observational method

- **Natural Setting**: Observations typically occur in a real-world environment where subjects naturally engage in activities without external influences.
- **Non-Interference**: The researcher does not intervene or manipulate variables but records data as it unfolds.
- **Detailed Data Collection**: It emphasizes the collection of rich, detailed qualitative data rather than numerical or quantitative data.

II.4.4.3 Types of observational methods

Observation can be done in different ways, depending on how involved the researcher is and how structured the observation is.

1. **Participant Observation**: The researcher actively engages with the subjects while also making observations. For example, a manager joining workers on a construction site to observe their workflow.
2. **Non-Participant Observation**: The researcher observes from a distance, without becoming part of the group being studied. For instance, watching safety practices on a construction site from afar.
3. **Structured Observation**: The researcher follows a specific framework or checklist for observations. This is more systematic and is often used in more controlled settings.
4. **Unstructured Observation**: There is no predefined structure or checklist; the researcher observes freely and makes notes on various occurrences that seem relevant or interesting.

II.4.4.4 Advantages and disadvantage of obervation

Advantages:

- Gathering direct information **(**the data collected reflects real-world actions and reactions).
- Offers in-depth insights into complex behaviors and interactions, especially in dynamic environments like construction sites.

Disadvantages:

- It can take significant time to gather sufficient data.
- Observations can be influenced by the researcher's biases or interpretations.

II.4.4.5. Example: Observing safety practices on a construction site

To observe how construction workers follow safety protocols while working on a construction site.

The process began with selecting a local construction site and developing a detailed observation checklist focused on helmet use, harness usage, and adherence to safety signage.

The researcher conducted multiple site visits, systematically recording the frequency of safety gear usage, compliance with protocols, and relevant interactions among workers. Observational data were then analyzed to identify trends and recurring issues.

The findings revealed that, while most workers complied with general safety measures, harness usage was often neglected, particularly under conditions of high workload or time pressure. These results highlight specific gaps in safety compliance and support recommendations for enhanced training, regular reminders, and improved monitoring to strengthen occupational safety practices on construction sites.

II.5. Data Collection Tools

Data collection tools are **instruments or software** used to gather and record information systematically for research. They can be **manual** (like paper questionnaires, interview guides, and observation sheets) or **digital** (like Google Forms, SPSS, NVivo, ……).

Using the right tool ensures data that are **reliable, accurate, and easy to analyze**.

II.5.1 Types of data collection tools

Data collection tools can be classified into **manual (traditional) tools** and **software-based (digital) tools**, depending on whether they rely on paper and direct observation or technology-

assisted methods. Each type has its own advantages, limitations, and appropriate contexts for use.

A-Manual (traditional) tools

These are **non-digital instruments** used to collect data directly, often on paper or through in-person observation (table 02).

Table 02: Manual data collection tools. **Source:** Author.

Tool	Description / Use	Example
Questionnaire (paper-based)	Printed survey sheets filled out by hand.	Field or classroom surveys.
Interview Guide	Printed list of questions used during interviews.	Face-to-face interviews.
Observation Checklist	Paper form used to record observations manually.	On-site behavioral or spatial observation.

The advantages of manual tools include simplicity, low cost, and no need for technology. However, they can be time-consuming, difficult to store and analyze when handling large datasets, and are more prone to human errors.

B- Software-Based (digital) tools

Software-based tools leverage computers or mobile applications to collect, store, and sometimes analyze data, improving speed, accuracy, and data management.

B.1 questionnaire tools

Digital questionnaire tools are designed to collect structured survey data from large audiences efficiently. Examples include **QuestionPro**, which offers advanced survey features and analytics; **SurveyMonkey**, known for its user-friendly interface and customizable options; and **Google Forms**, a free tool ideal for simple surveys. These tools make it easier to distribute surveys, collect responses in real time, and analyze results without manual data entry.

B.2 Interview and focus group tools

Interview and focus group software tools facilitate qualitative data collection through guided conversations and group discussions. They often include features for recording, transcribing, and analyzing spoken interactions, providing deeper insights into participants' attitudes, behaviors, and experiences. Popular platforms include **Zoom** for virtual interviews, **Microsoft**

Teams for collaborative discussions and recordings, and **Google Meet**, a free and accessible option for remote sessions. These tools enhance the accuracy and efficiency of qualitative research while allowing participation from geographically dispersed individuals.

B.3 Observation and field data collection tool

Observation and field data collection tools are essential for capturing in-situ, real-world data accurately. These tools help track and record information on-site, often including multimedia elements like photos, audio, or video. Examples include **KoboToolbox**, a free and open-source platform for challenging field environments; **OpenDataKit (ODK)**, a mobile data collection tool suitable for various field settings; and **Epicollect5**, a free and easy-to-use app supporting geotagged data collection. These tools streamline data entry, enhance accuracy, and support multimedia documentation for richer datasets.

II.6. Selecting a Data Collection Method/Tool

Selecting the appropriate data collection method or tool is a critical step that depends on several factors related to your goals, the type of data you need, available resources, and the context in which the data will be collected.

It is important to recognize that no single data collection method or tool is ideal for every situation, and no single factor alone determines the most appropriate choice. Researchers must consider all relevant factors together when deciding which methods or tools to use.

Selecting a data collection method/tool involves the following key factors:

- **Research questions and objectives**: Align the method with the type of data needed (quantitative vs. qualitative) and the specific goals of the study.
- **Participant/Unit sample**: Consider the characteristics and size of the population or sample, and how accessible they are for participation.
- **Response rates, time, and cost**: Balance efficiency, expected participation, and budget constraints when choosing between methods like surveys, interviews, or fieldwork.
- **Research team's expertise**: Ensure the method matches the skillset of the research team, especially for more complex tools or data collection techniques.
- **Data quality**: Focus on methods that will yield accurate, reliable, and valid data, suited to the study's requirements.

II.7.Data collection process

In the Data Collection Process, there are 5 key steps:

II.7.1 Decide what data to collect:

Start by determining what information you need. This includes selecting the topics to focus on, the sources to gather the data from, and how much data is required. For example, in a construction project, you might decide to collect data on worker productivity and materials used.

II.7.2 Set a deadline for data collection

Next, set a timeline for gathering the data. If it's an ongoing project, like tracking construction progress, you might collect data continuously. For a specific project, like evaluating a single construction phase, you would gather data within a defined time period.

II.7.3 Choose a data collection method

Select the method that best fits your needs: surveys, direct observations, or digital tools, depending on the type of information you're gathering.

II.7.4 Start collecting data

With your plan in place, begin the data collection process. Stay organized, store the data properly, and regularly check on your progress to make any necessary adjustments to the plan.

II.7.5 Analyze and use the data

After gathering the data, analyze it to find patterns and insights. This helps you make informed decisions. For example, you might find that certain materials are being used inefficiently, prompting changes to improve cost and time management in future projects. (udhisthir Sharma,2023)

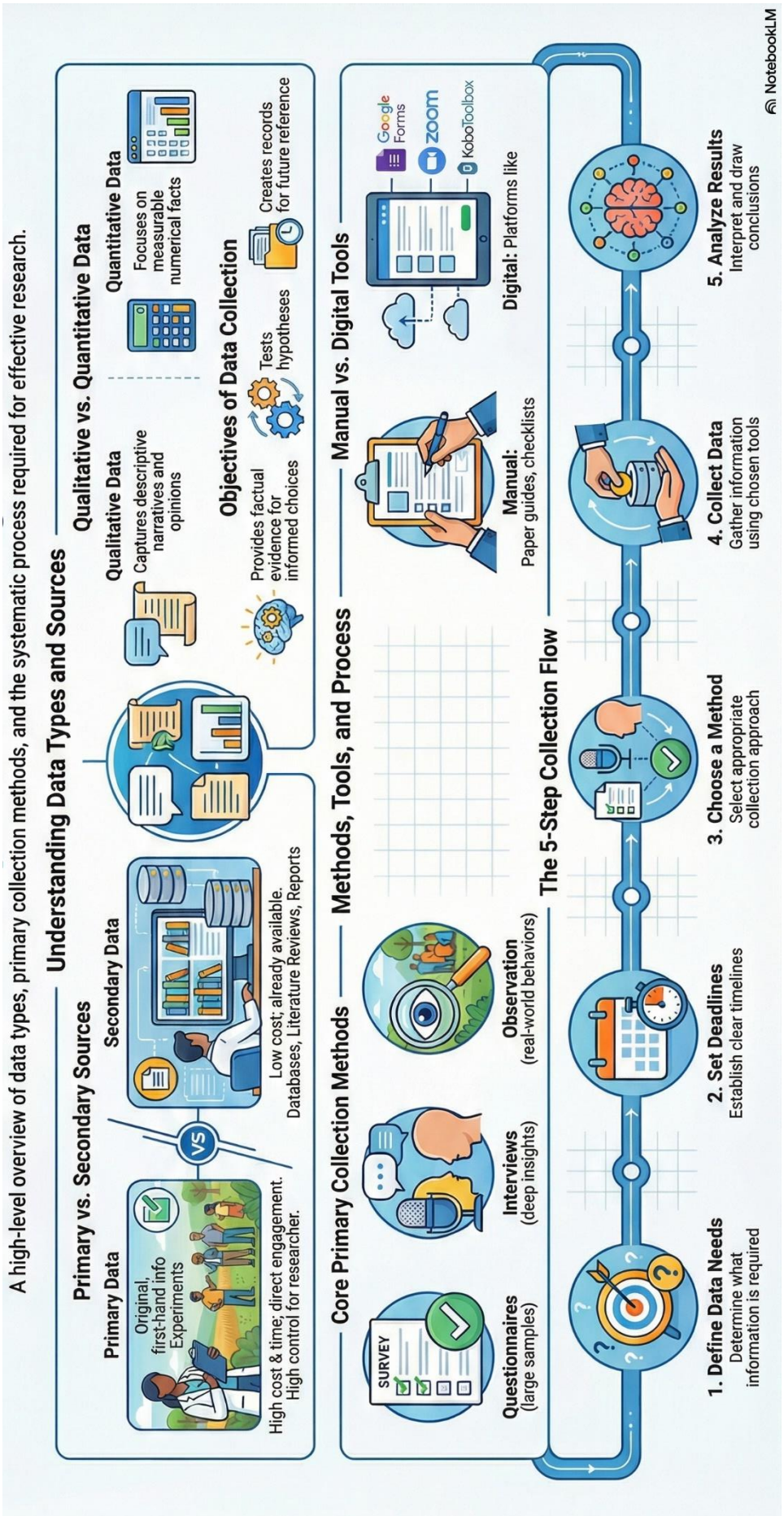


Figure 07 : Data Collection Methods and Tools: From Research Design to Analysis. *(Illustration generated by Notebook AI)*

Chapter 03
Fieldwork

III.1. WHAT is fieldwork?

Fieldwork is the process of collecting raw data or information directly from the environment or context relevant to a study, research project, or practical application. It typically involves going outside of controlled or laboratory settings to gather data through observation, measurement, interviews, surveys, or other hands-on techniques

Fieldwork allows researchers, project managers, and practitioners to directly engage with the subjects or sites they are studying, ensuring that the data collected is authentic, relevant, and reflective of actual conditions.

In the context of construction project management, fieldwork may include site visits to track project progress, surveys to understand stakeholder satisfaction, or interviews with project managers to assess decision-making processes. The data collected can be used to evaluate factors such as project delays, cost overruns, or resource management, ultimately leading to improvements in project performance.

III.2. Objectives of fieldwork

- Obtaining firsthand, **original or primary data sources** as interviews, surveys, or observations. (Zvobgo. k, et al. 2022).
- Fieldwork enables researchers to collect and access **original or primary data sources**, crucial for empirical research.
- Validating or challenging existing hypotheses through empirical data from the field.
- Fieldwork can provide rich and detailed information that cannot be obtained through other research methods.
- Establishing direct interactions with participants or stakeholders, which enriches the research process.

III.3. Phases of fieldwork: from planning to analysis

Fieldwork can be divided into three key phases: Planning, Execution, and Analysis. Each phase plays a critical role in ensuring successful data collection and accurate interpretation of results (Figure 08).

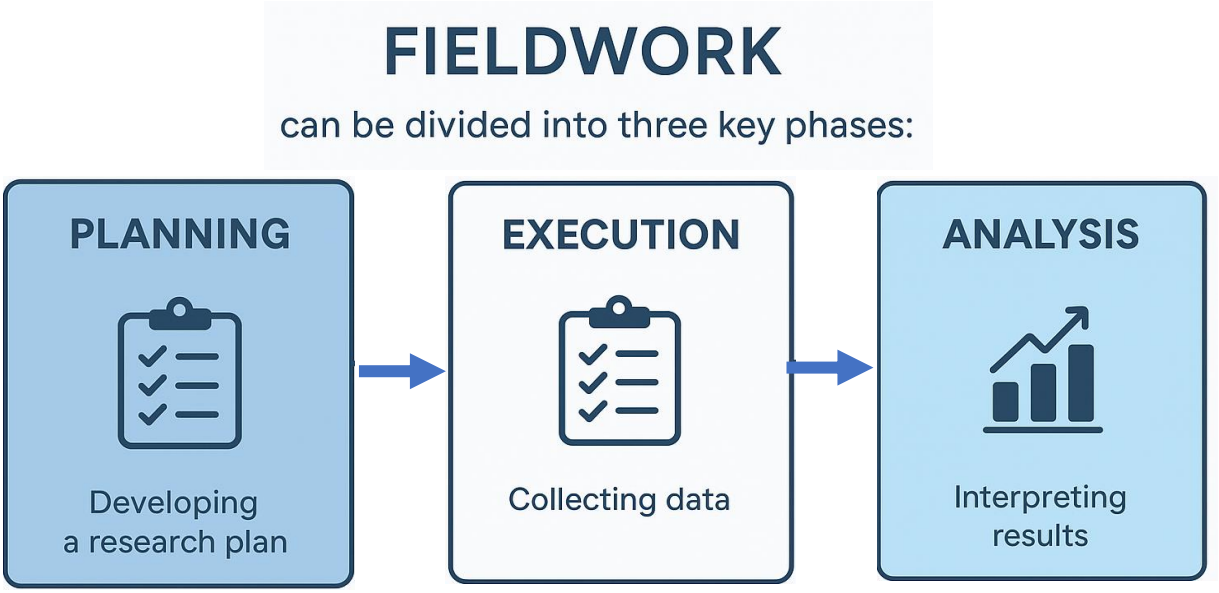


Figure 08 : Phases of Fieldwork . **Source :** Author (generated using Canva)

III.3.1 Planning for fieldwork

Planning is essential to ensure that fieldwork is well-organized, time-efficient, and produces useful data. This phase involves defining the research problem, selecting the site, designing tools, and obtaining ethical approval (Scheyvens & Storey, 2014).

III.3.1.1. Defining objectives

The first step in planning is to establish clear research goals. Defining the purpose of the fieldwork and the specific questions it seeks to address helps guide all subsequent activities. For example, a study may aim to identify the causes of frequent cost overruns in infrastructure projects. Additionally, it is important to define the type of data expected, whether quantitative (e.g., cost data, schedules) or qualitative (e.g., interviews with project managers).

III.3.1.2 Designing the fieldwork plan

Designing the fieldwork plan involves selecting appropriate methods such as interviews, surveys, or observations based on the research objectives. A sampling strategy should be developed to ensure representative and relevant data, for example, sampling projects from residential buildings to large infrastructure projects. A detailed timeline must also be created, aligning fieldwork stages with construction project phases, including design, execution, and handover.

III.3.1.3 Logistical preparation

Logistical preparation ensures that the fieldwork proceeds smoothly. This includes identifying and securing access to field sites, arranging necessary resources such as equipment, transportation, and personnel, and budgeting for travel, materials, and staffing. Risk management strategies should be put in place to address unexpected challenges such as site access issues or equipment failure. Preparation also involves building rapport with participants, training assistants, and testing data collection instruments (DeWalt & DeWalt, 2011) (Figure 09).

Figure 09 : Planning for fieldwork steps . **Source :** Author ((generated using Canva)

III.3.2 Executing fieldwork

This phase involves the actual data collection and requires close adherence to the research plan to ensure data accuracy and completeness.

III.3.2.1 Data collection

During data collection, researchers employ methods such as observation, interviews, surveys, or archival visits to gather primary data (Porter & Grossman, 2004). For example, in a study on delays, an observer might record the duration of each construction phase and compare it with the planned schedule. Researchers must also remain flexible and adapt to unforeseen conditions in the field.

III.3.2.2 Recording and documentation

Accurate documentation is critical for data integrity. Detailed notes, recordings, and logs should be maintained systematically. For example, documenting safety violations with photographs can help link these issues to project delays. Backup procedures, both digital and physical, are necessary to prevent loss of data.

III.3.3 Analyzing field data

Finally, the analysis phase integrates and interprets the collected data to build or test theoretical frameworks. Fieldwork thus contributes not only to data gathering but also to the development and testing of theory (Geddes, 2003).

III.3.3.1 Data cleaning and preparation

Raw data must be organized into categories such as time, cost, safety, and resources. For instance, interview responses can be grouped by themes like communication issues or budget constraints. Data cleaning involves removing errors or incomplete entries to ensure accuracy.

III.3.3.2 Quantitative data analysis

Quantitative data, such as costs, schedules, and resource allocations, are analyzed using statistical tools to identify patterns or correlations. For example, statistical analysis may reveal relationships between project size and delay frequency. Visualizations like charts, graphs, and tables help present these findings clearly.

III.3.3.3 Qualitative data analysis

Qualitative data analysis involves identifying themes, patterns, and narratives from interviews, observations, or textual records. Coding and categorization organize qualitative information for deeper analysis, for example, grouping interview statements about “resource shortages” or “lack of safety compliance.”

III.3.3.4 Reporting findings

Finally, findings are compiled into a comprehensive report addressing the research questions and supported by both qualitative and quantitative data. Recommendations based on the analysis are presented to provide actionable insights for stakeholders and inform future project planning.

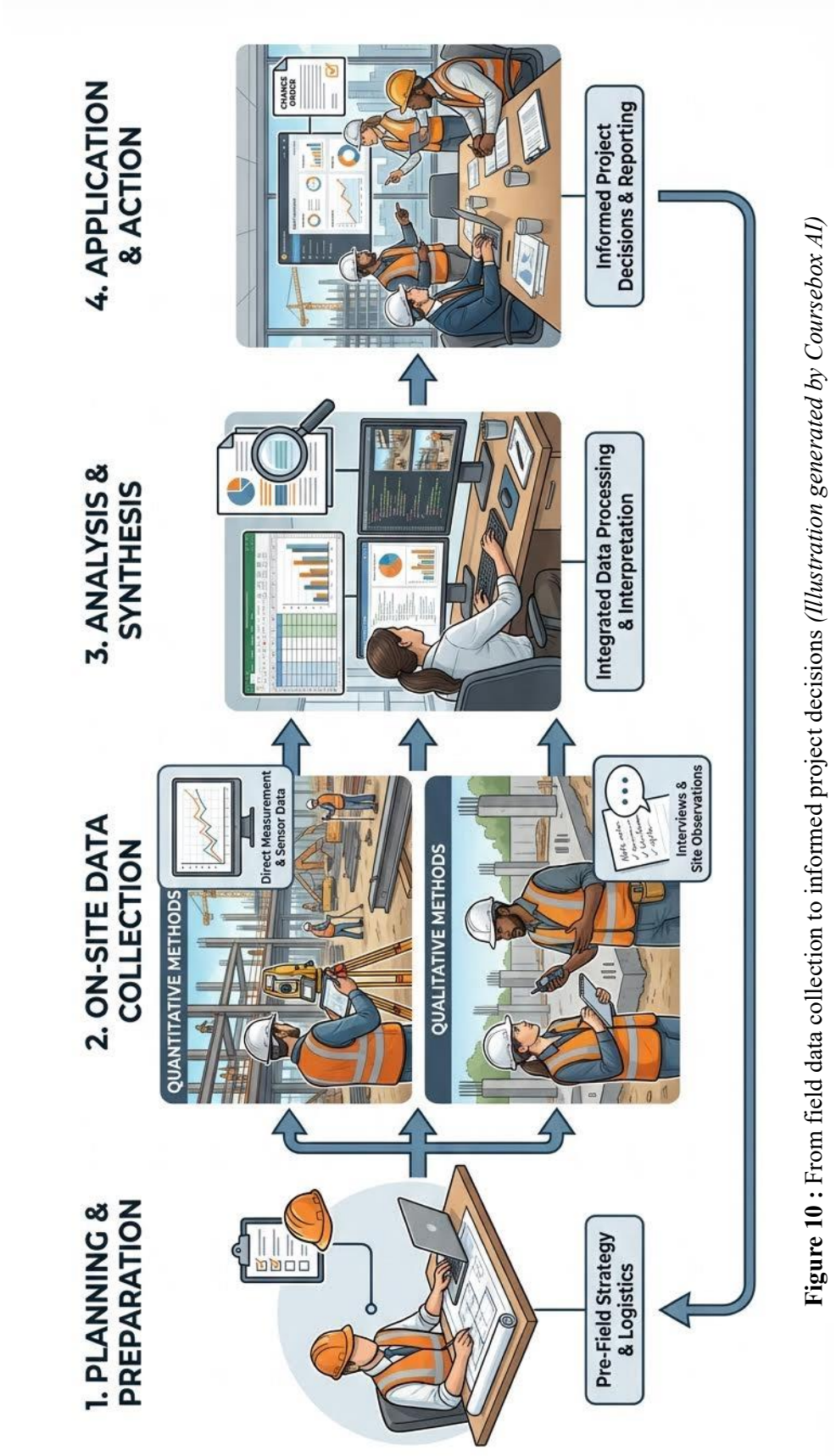


Figure 10 : From field data collection to informed project decisions *(Illustration generated by Coursebox AI)*

Chapter 04 :
Data Analysis: Exploitation of the Data Collected

IV.1.Data analysis tools

IV.1.1.What are data analysis tools?

Data analysis tools refer to the software platforms, applications, and digital resources that enable professionals to explore and interpret datasets in order to understand overall trends and generate useful insights for forecasting and informed decision-making.

These tools can be viewed as sets of visual and analytical resources; such as charts, graphs, and dashboards, used to collect, process, and present data in a wide range of contexts. Selecting an appropriate data analysis tool is therefore crucial, as it helps optimize analytical efforts and supports the achievement of research and professional objectives. (https://www.coursera.org/articles/data-analysis-tools)

IV.1.2. Data analysis tools types

These tools offer a variety of features that support tasks such as data processing, visualization, statistical evaluation, and machine learning. Below are some of the most widely used data analysis tools:Spreadsheet Software

1. Data Visualization Tools
2. Statistical Analysis Software
3. Qualitative Data and Survey Tools….ect. (Islam, 2020).

IV.1.2.1. Spreadsheet software

Spreadsheet Software is a type of application that allows users to organize, manipulate, and analyze data in tabular form, using a grid of rows and columns. Each cell in the grid can contain text, numbers, or formulas that perform calculations based on the data in other cells. Spreadsheet software is widely used for tasks such as budgeting, data tracking, statistical analysis, and creating charts and graphs for data visualization.

Common Examples:

Microsoft Excel: The most widely used spreadsheet software, known for its extensive features and capabilities. **Excel**: A popular tool for organizing data, performing calculations, and creating simple charts; often used for smaller datasets.

Google Sheets: A cloud-based spreadsheet application that enables real-time collaboration and easy sharing of documents. **Google Sheets**: Similar to Excel, but cloud-based, allowing multiple people to work on the same file in real-time.

IV.1.2.2.Data visualization tools

Data Visualization Tools are software applications designed to transform complex data sets into visual representations, such as charts, graphs, maps, and dashboards. These tools help users understand and interpret data by presenting it in a visually appealing and easily digestible format, enabling quicker insights and better decision-making.

Common Examples:

Tableau: A tool for creating visual representations of data, such as charts and dashboards, to make data easier to understand.

Power BI: A Microsoft tool for building interactive data visualizations and reports, often used for business intelligence.

IV.1.2.3.Statistical analysis software

Statistical Analysis Software is a type of program that helps users perform statistical analyses on data. These tools make it easier to understand and interpret data by providing various statistical functions and methods.

Common Examples:

SPSS (Statistical Package for the Social Sciences): Widely used in social sciences and market research, known for its ease of use and comprehensive statistical capabilities.

SAS (Statistical Analysis System): A powerful tool often used in business, healthcare, and academia for advanced analytics and data management.

IV.1.2.4. Qualitative data and survey tools

Qualitative Data and Survey Tools are software applications designed to help users collect, analyze, and interpret qualitative data and survey responses. These tools facilitate the process of gathering insights from participants, whether through structured surveys or unstructured qualitative research, enabling researchers to understand opinions, behaviors, and experiences.

Common Examples

SurveyMonkey: SurveyMonkey is an online survey tool that allows users to create, distribute, and analyze surveys. It offers a wide range of templates and customizable options to design surveys for collecting data from respondents. It offers both free and paid plans with various features depending on the user's needs. (Guerrero, 2019).

Qualtrics: Qualtrics is an online platform for creating surveys and collecting feedback. It helps businesses and researchers gather data from customers, employees, or any target group. Qualtrics offers tools to create customizable surveys, analyze the responses, and generate reports.

NVivo: NVivo is a software tool used for analyzing qualitative data, such as interviews, open-ended survey responses, articles, and audio/video content. It helps researchers organize, code, and interpret large amounts of unstructured data to uncover patterns and insights. NVivo offers tools for data visualization, reporting, and the creation of models to better understand complex data sets.

IV.1.3.Choosing the right analysis data tool

Selecting the appropriate data analysis tool depends on several factors, which should be considered carefully to ensure effective and accurate analysis.

1- Define Your Data Type and Size:

The type and size of your dataset influence which tools are suitable for analysis. For small to medium datasets, tools such as Google Sheets, Excel, or SurveyMonkey are sufficient and user-friendly. For large and complex datasets, or when dealing with big data, more robust tools like SPSS, SAS, R, or Tableau are recommended, as they can handle large volumes of data and complex structures.

2-Identify Your Analysis Needs:

Your choice of tool should also reflect the type of analysis you plan to perform. For descriptive analysis, basic statistics, or simple visualizations, Excel, Google Sheets, and Tableau are suitable. For advanced statistical analysis, predictive modeling, or hypothesis testing, SPSS, R, and SAS provide more comprehensive capabilities. If the focus is on qualitative data, such as interviews or survey responses, NVivo or Qualtrics are ideal tools.

3-Consider Ease of Use:

The user's experience level is an important factor. Beginners may prefer tools with intuitive interfaces, such as Google Sheets, Excel, or Power BI. Experienced analysts or data scientists, on the other hand, may choose advanced tools like R, SAS, or SPSS, which offer greater analytical power but require more expertise to operate effectively.

4-Cost and Budget:

The financial aspect of tool selection cannot be overlooked. Free tools like Google Sheets can be sufficient for projects with limited budgets, while more advanced projects may necessitate investment in paid tools such as SPSS, SAS, Tableau, or Power BI (Okutan, 2023).

By considering these factors, you can select the most appropriate tool that enhances your ability to analyze data effectively and make informed decisions.

IV.2.Analyzing quantitative data with spss (introduction to spss)

IV.2.1.Overview of SPSS

IV.2.1.1.What is SPSS?

SPSS (Statistical Package for the Social Sciences) is a software program used by researchers in various disciplines for quantitative analysis of complex data

It is developed by Norman H. Nie and C. Hadli Hull of IBM Corporation in the year 1968. It is compatible with Windows, Linux and Mac operation systems. SPSS is among the most widely used programs for statistical analysis

SPSS can import data from many different file types and use them to create tables, charts, and graphs that show trends and distributions. It can also calculate descriptive statistics and perform a wide range of advanced statistical analyses (Bryman, et al., 2011).

IV.2.1.2. Why use SPSS for quantitative data analysis?

SPSS is widely used for quantitative data analysis due to its combination of **user-friendliness and powerful analytical** capabilities. It offers an **intuitive interface** that requires no coding, making it accessible to users with varying levels of technical expertise. The software supports a wide range of statistical analyses and **visualizations**, allowing for comprehensive data examination. SPSS also streamlines data management, improving efficiency and saving time when handling datasets. Additionally, it provides reliable and accurate results, even for large and complex datasets (So, H. Y., et al., 2020).

IV.2.2.The SPSS interface

The primary workspace in SPSS is known as the Data Editor window. This is where you carry out most tasks in the software, such as creating variables, modifying data, and selecting the analyses you want to run.

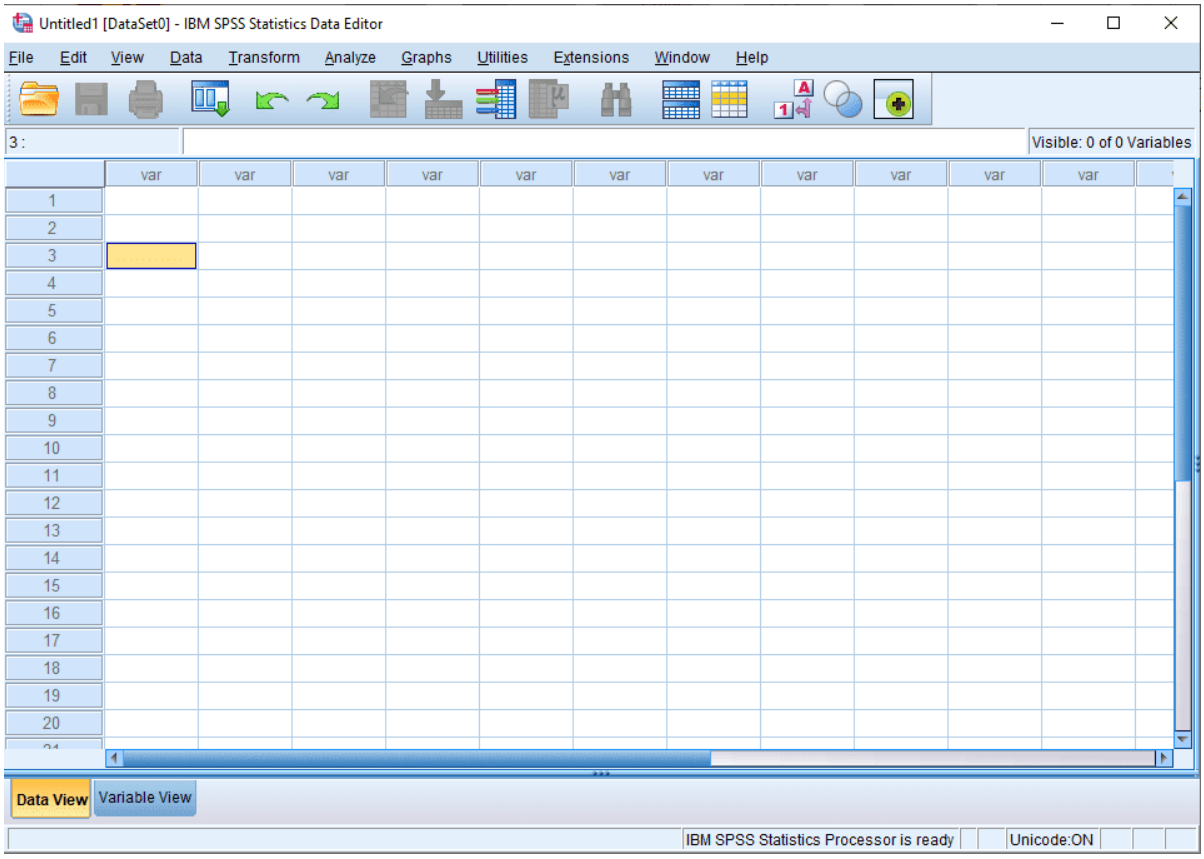


Figure 11: The SPSS Data Editor window where data entry and analysis operations are performed. **Source:** Author (SPSS screenshot).

The **Data Editor window** in SPSS looks very similar to a Microsoft Excel sheet. It is basically a large table made up of rows and columns. In SPSS, each column represents a **variable**; meaning a specific piece of information you are collecting, such as a question in a questionnaire. Each row represents a **case**, which could be one participant or unit in your study, like a household in a survey or a patient in a medical study.

The Data Editor window has two main sections: the **Data View** and the **Variable View**. You can switch between these two tabs using the buttons located at the bottom-left of the window (figure 12).

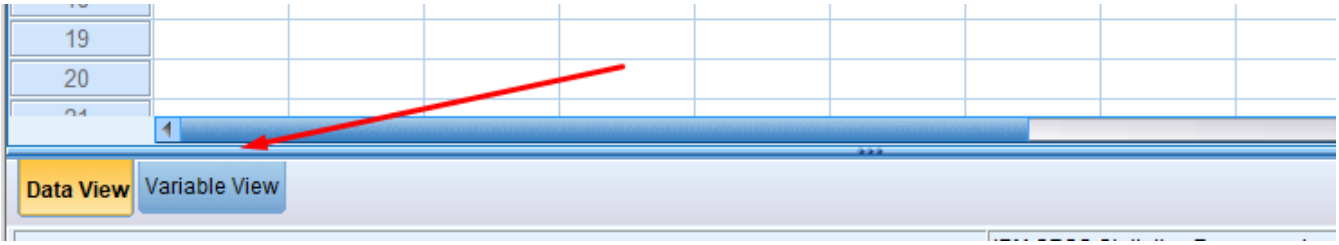


Figure 12 : The SPSS data editor window showing the data view and variable view Tabs. **Source:** Author (SPSS screenshot).

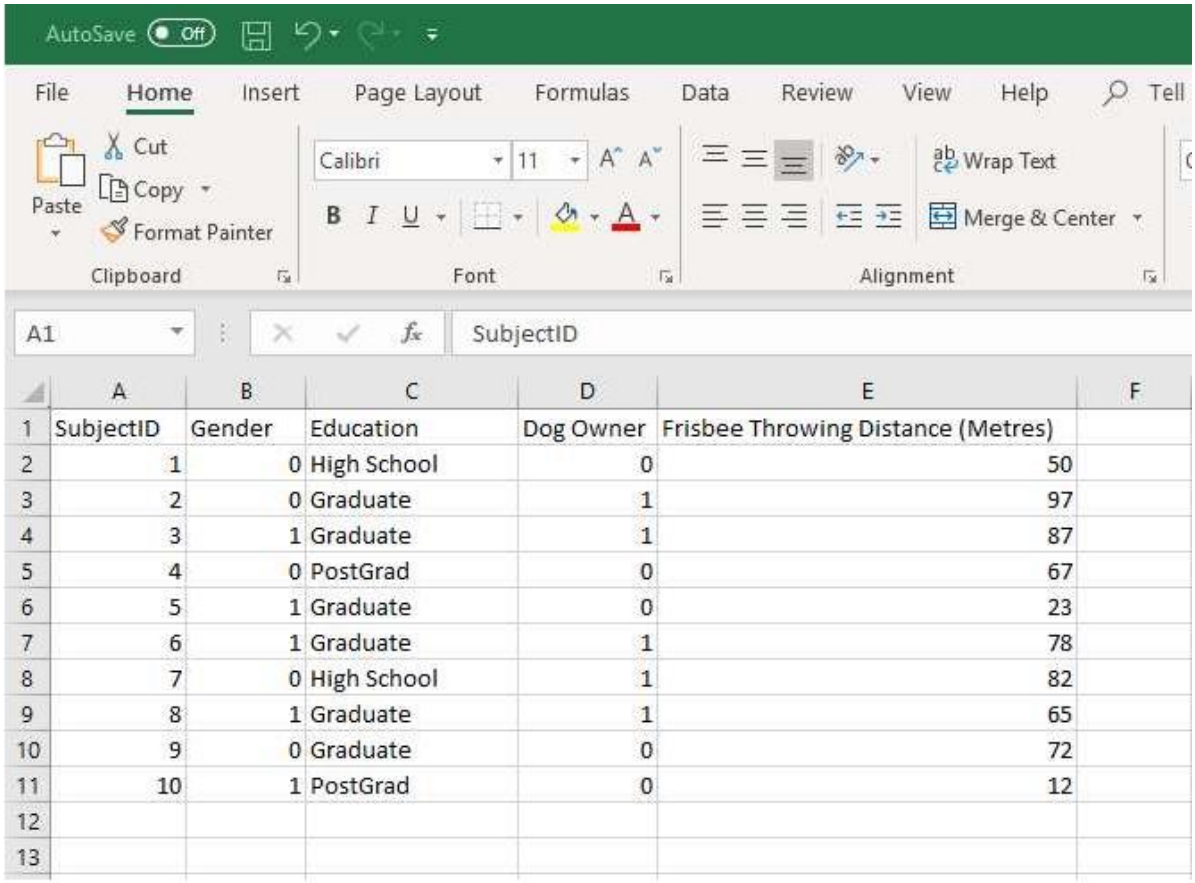
The Data View is used to display and edit the actual data values.

The Variable View is where you set up and modify the variables and their properties.

IV.2.3.Step-by-Step SPSS Data Analysis Process

Step 1: Prepare Your Data

Ensure that the data is collected and organized in a clear format, such as an Excel spreadsheet, with all necessary variables and values in tabular form.



	A	B	C	D	E	F
1	SubjectID	Gender	Education	Dog Owner	Frisbee Throwing Distance (Metres)	
2	1	0	High School	0	50	
3	2	0	Graduate	1	97	
4	3	1	Graduate	1	87	
5	4	0	PostGrad	0	67	
6	5	1	Graduate	0	23	
7	6	1	Graduate	1	78	
8	7	0	High School	1	82	
9	8	1	Graduate	1	65	
10	9	0	Graduate	0	72	
11	10	1	PostGrad	0	12	
12						
13						

Figure 13: Example of data prepared in excel prior to SPSS Analysis. **Source:** Author (SPSS screenshot).

Step 2: Getting data into SPSS

There are multiple ways to bring data into SPSS. In this lesson, I will demonstrate how to define variables, enter data manually, and import data from Excel into SPSS.

A/- Entering Data Manually

A/1- Defining Variables in SPSS

Defining variables in SPSS is an important step to ensure your data is properly organized and ready for analysis. Each column in the SPSS Data View represents a variable, and defining these variables involves specifying details about their names, types, and properties.

To define variables in SPSS, switch to the Variable View in the Data Editor. Here, you specify characteristics such as:

-Variable Name

Each variable must have a unique name. The name should begin with a letter and cannot contain spaces or special characters (e.g., "Age" or "Income").

-Variable Type

In the "Type" column, choose the type of data your variable contains. Common types include:

1. **Numeric**: For numbers (e.g., age, income).
2. **String**: For text (e.g., names, categories).

-Adding Labels:

Use the "Label" column to provide a detailed description of the variable. For example, instead of just "Age," the label might be "Respondent's Age in Years."

-Defining Value Labels (Optional):

For categorical data (e.g., gender or education level), you can assign labels to specific values using the "Values" column. For example:

1 = Male
2 = Female

-Specifying Measurement Levels:

In the "Measure" column, select the variable's level of measurement:

- Nominal: For categories without order (e.g., gender, color).
- Ordinal: For categories with a logical order (e.g., education levels).
- Scale: For numeric data with meaningful intervals (e.g., height, income).

-Adjusting Other Properties:

- Width: Specifies the number of characters or digits the variable can hold.
- Decimals: Sets the number of decimal places for numeric variables.
- Missing Values: Indicates any specific values (e.g., 999) that should be treated as missing data.

Once the variables are fully defined, return to the "Data View" tab to begin entering or analyzing your data. Properly defining variables ensures accurate analysis and better organization of your dataset.

Example:

Name	Type	Decimals	Label	Values	Measure
Name	String	0	Name		Nominal
Gender	Numeric	0	Gender	1 – Male 2 – Female	Nominal
Age	Numeric	0	Age		Scale
Rice	Numeric	0	Did you eat Rice in the past 7 days?	1 – Yes 0 – No	Nominal

The Variable view will look like this:

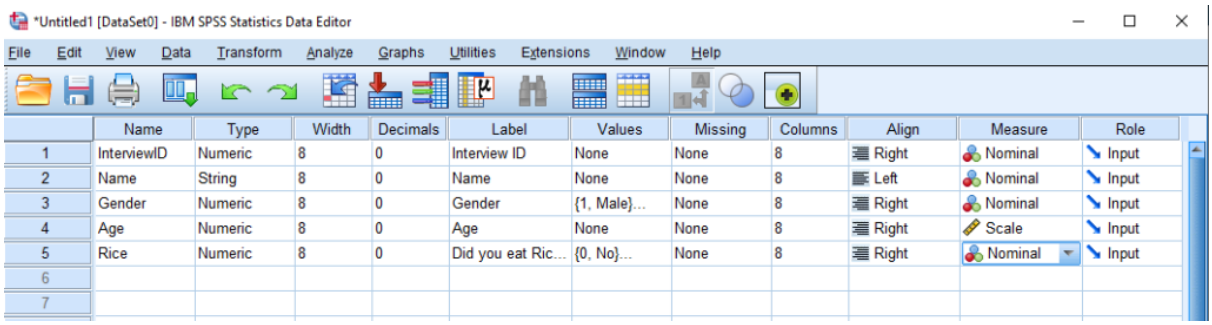


Figure 14: Example of variables fully defined in the SPSS Variable View. **Source:** Author (SPSS screenshot).

A/2- Data Entry in SPSS

Entering data in SPSS is simple and works like Excel:

1. **Go to Data View**: Click the "Data View" tab at the bottom-left of the screen.
2. **Enter Data**: Type values directly into the cells (e.g., type "1" in the Gender column).

3. **Show Labels**: Click the "Value Labels" button on the toolbar to display labels like "Male" instead of "1."

This makes data entry and viewing easier to understand.

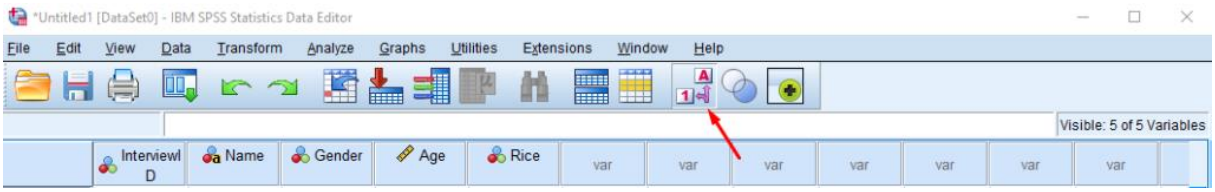
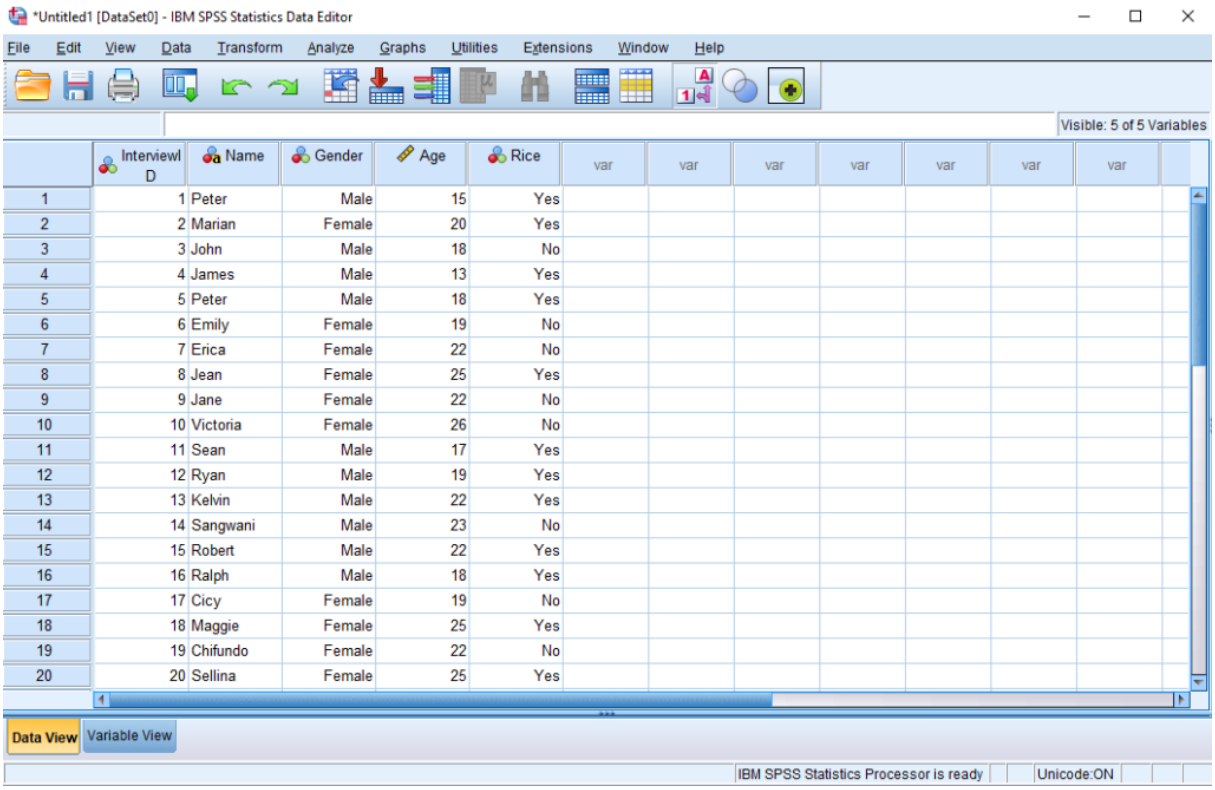


Figure 15: Activating the value labels button to show text labels instead of numeric codes in SPSS. **Source:** Author (SPSS screenshot).



	Interviewl D	Name	Gender	Age	Rice
1	1	Peter	Male	15	Yes
2	2	Marian	Female	20	Yes
3	3	John	Male	18	No
4	4	James	Male	13	Yes
5	5	Peter	Male	18	Yes
6	6	Emily	Female	19	No
7	7	Erica	Female	22	No
8	8	Jean	Female	25	Yes
9	9	Jane	Female	22	No
10	10	Victoria	Female	26	No
11	11	Sean	Male	17	Yes
12	12	Ryan	Male	19	Yes
13	13	Kelvin	Male	22	Yes
14	14	Sangwani	Male	23	No
15	15	Robert	Male	22	Yes
16	16	Ralph	Male	18	Yes
17	17	Cicy	Female	19	No
18	18	Maggie	Female	25	Yes
19	19	Chifundo	Female	22	No
20	20	Sellina	Female	25	Yes

Figure 16: Entering Data in SPSS using the data view tab. **Source:** Author (SPSS screenshot).

B/-Importing Data from Excel into SPSS

To start, click File -> Open -> Data (as below).

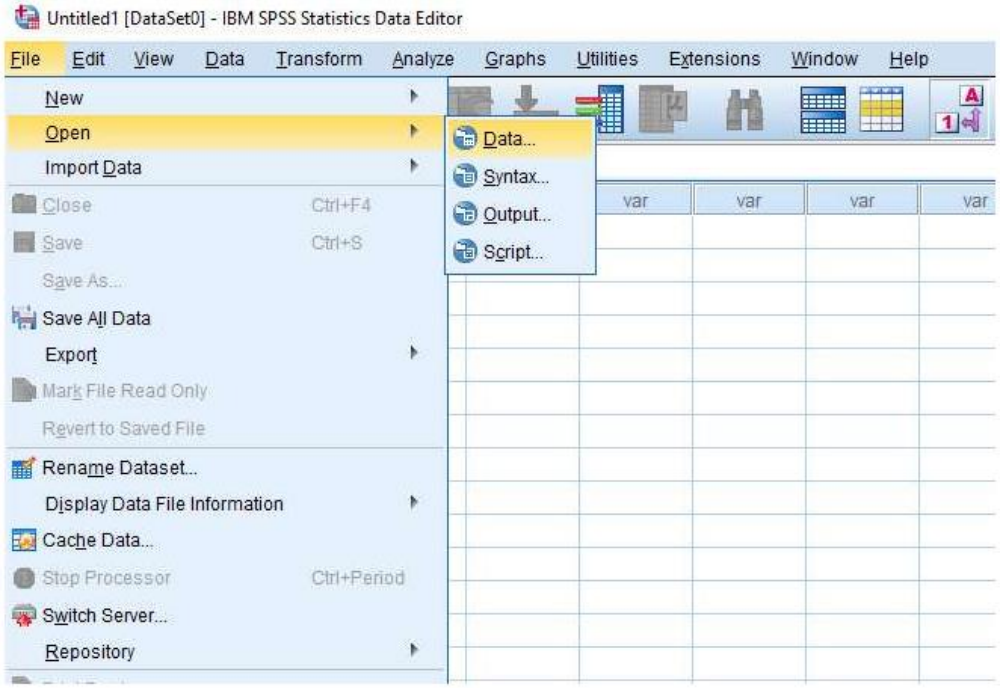


Figure 17: Importing Data from Excel into SPSS. **Source:** Author (SPSS screenshot).

Once you click Data, the Open Data box will appear.

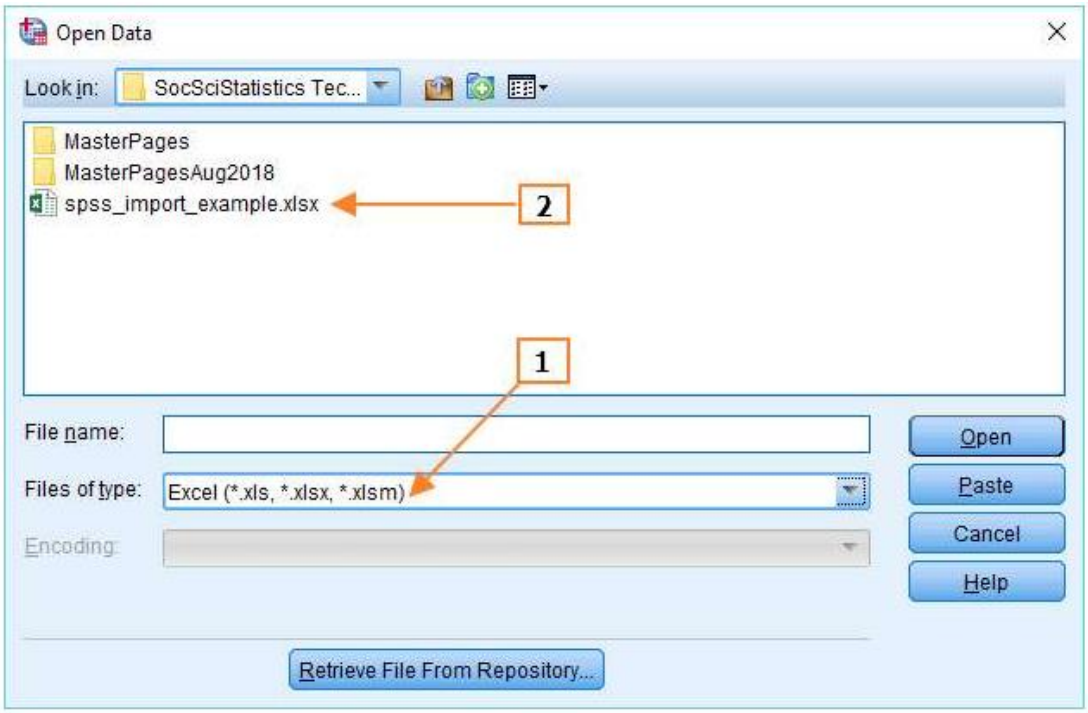


Figure 18: The "Open Data" dialog box in SPSS**. Source:** Author (SPSS screenshot).

In the “Files of type” menu, choose the Excel option. Then browse to the folder where your Excel file is saved, and it will appear in the list. Once you select and open it, the “Read Excel File” dialog box will appear.

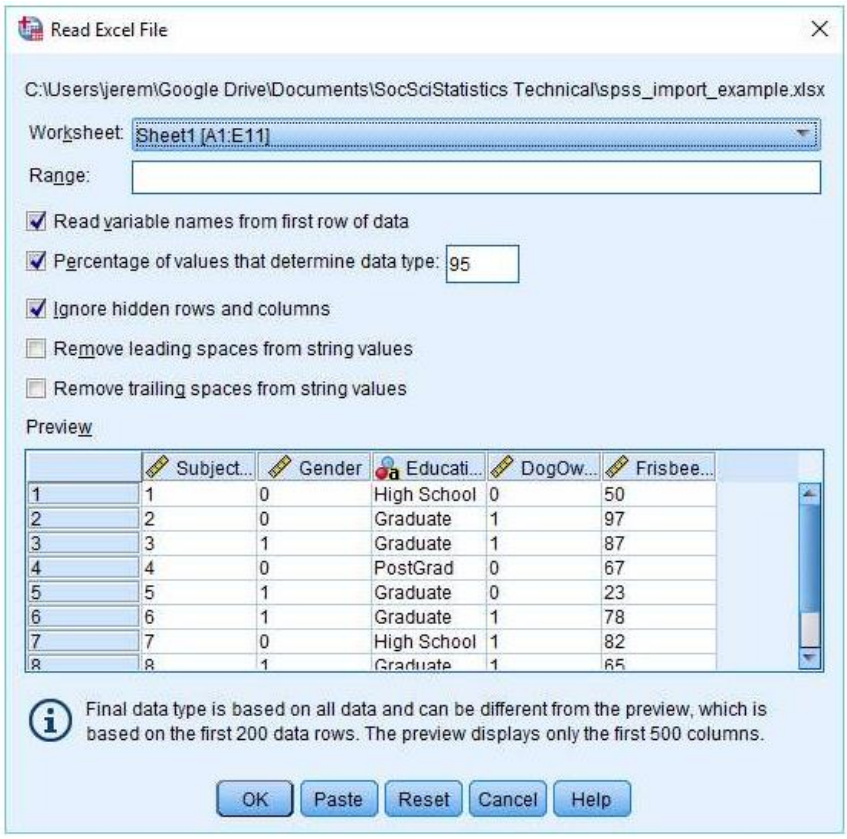


Figure 19: SPSS “read excel file” dialog box**. Source:** Author (SPSS screenshot).

This dialog box provides several options, most of which are easy to understand. One important option is the “Percentage of values that determine data type.” This setting controls how SPSS assigns a data type (e.g., numeric or string) to your variables. For example, if the percentage is set to 95%, SPSS will assign a numeric type if 95% of the values in a column are numbers. The percentage value can be set to anything higher than 50. If SPSS is unable to identify the data type, it will automatically treat the value as text. After choosing your settings and reviewing the preview, click **OK** to begin the import.

-Check Your Data in SPSS

-Your data will then appear in a new Data View sheet, with the variable names listed across the top.

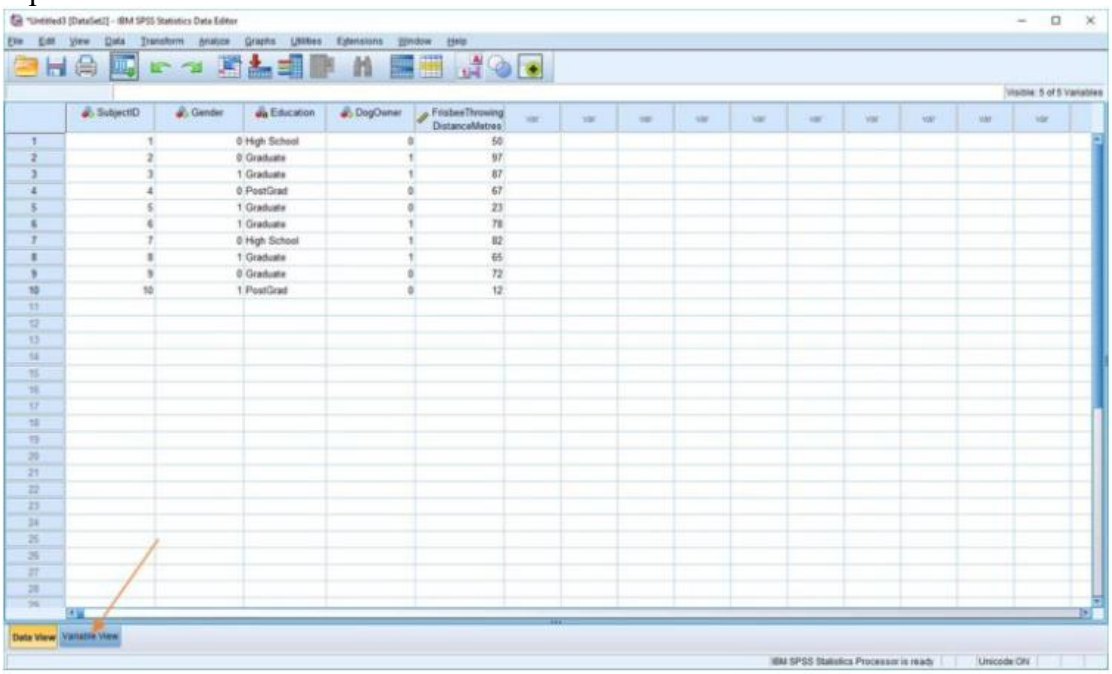


Figure 20: Imported data displayed in SPSS data view with variable names at the top. **Source:** Author (SPSS screenshot).

The first step is to verify that your data has been imported correctly. Once you confirm that everything appears as expected, the next step is to ensure that each data parameter is set properly; for example, that numerical data is recognized as numeric.

To do this, switch to the **Variable View** tab (indicated by the red arrow above). This will open the Variable View in SPSS, where you can review and adjust the settings for each variable.

When importing data, SPSS defines variables automatically, but it's still important to review and adjust the settings in the Variable View to ensure accuracy before performing any analysis

Step 3: Data Analysis

SPSS offers many different types of data analysis, and all of these options can be accessed from the **Analyze** menu.

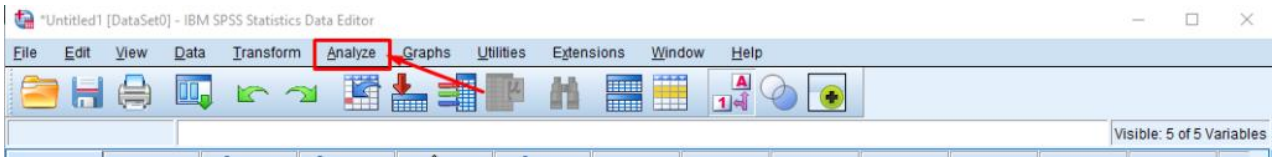


Figure 21: SPSS "Analyze" menu showing available data analysis options. **Source:** Author (SPSS screenshot).

In this lesson, we will look at basic descriptive statistics.

A/- Analyzing categorical variables

Variables that are classified as nominal or ordinal are most appropriately examined using frequency counts. A frequency represents the number of times a particular category appears in the dataset. For example, you might want to determine how many respondents are male and how many are female.

To produce these results in SPSS, go to the **Analyze** menu, choose **Descriptive Statistics**, and then select **Frequencies**.

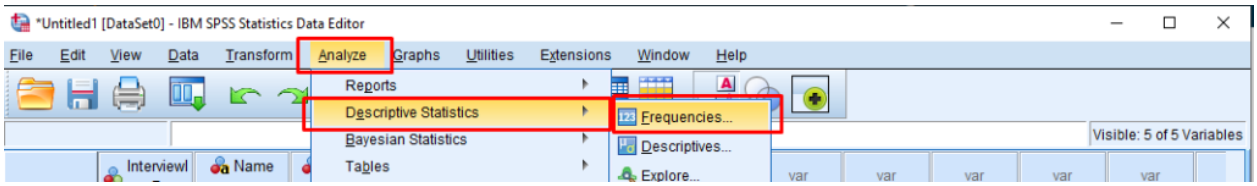


Figure 22: Selecting the frequencies option for categorical variables in SPSS. **Source:** Author (SPSS screenshot).

In the dialog window, select the variable **Gender** and move it into the analysis field on the right.

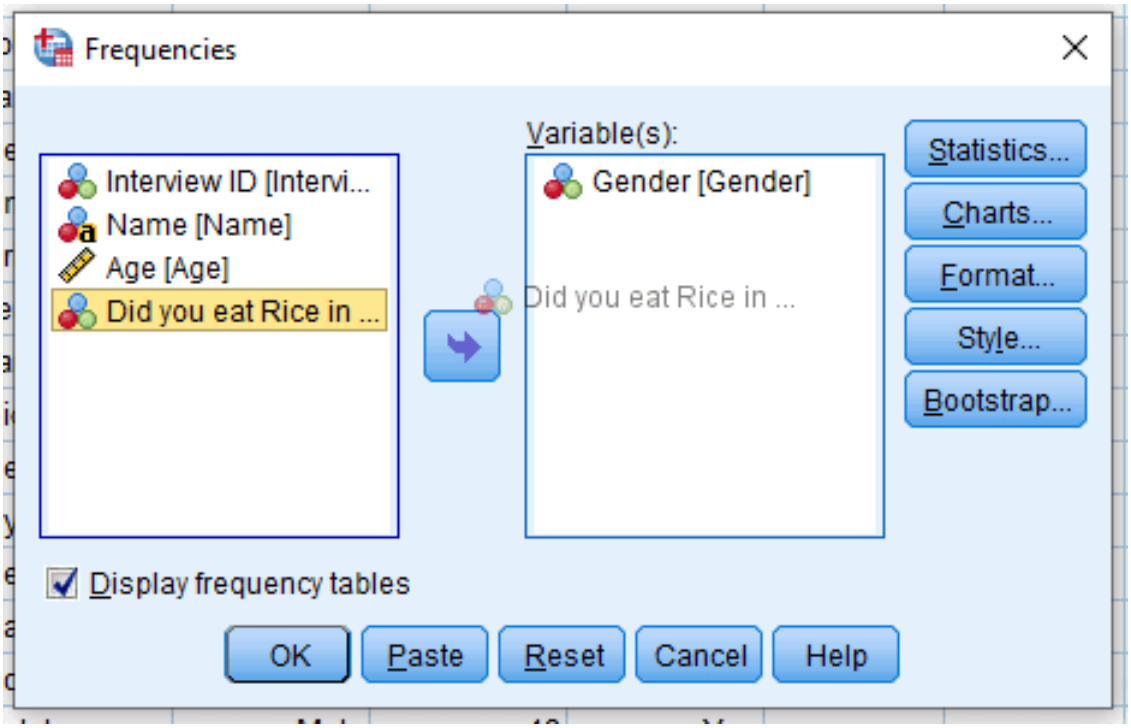


Figure 23: Dragging a categorical variable (gender) into the analysis box in the SPSS frequencies dialog. **Source:** Author (SPSS screenshot).

- Repeat the same procedure for the variable "Did you eat Rice in the past 7 days?"
- Next, click on the **Charts** button located on the right-hand side of the dialog box.
- Select **Bar charts**, then click **Continue** to confirm your choice.

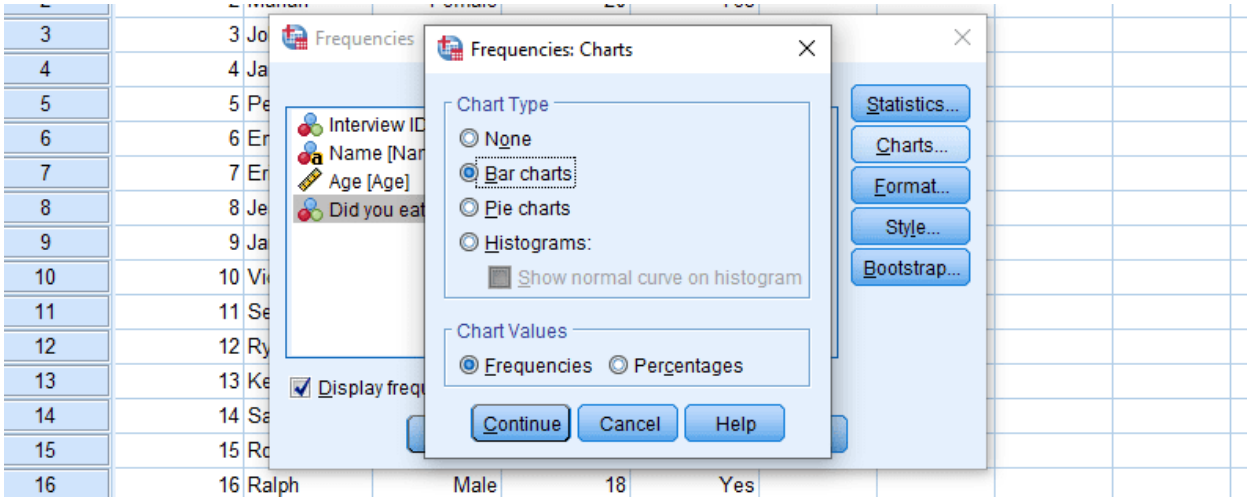


Figure 24: Selecting bar charts for frequency analysis in SPSS. **Source:** Author (SPSS screenshot).

- Click OK to run the analysis.

SPSS will open a new window called the **Viewer**, where the results of the analysis are displayed.

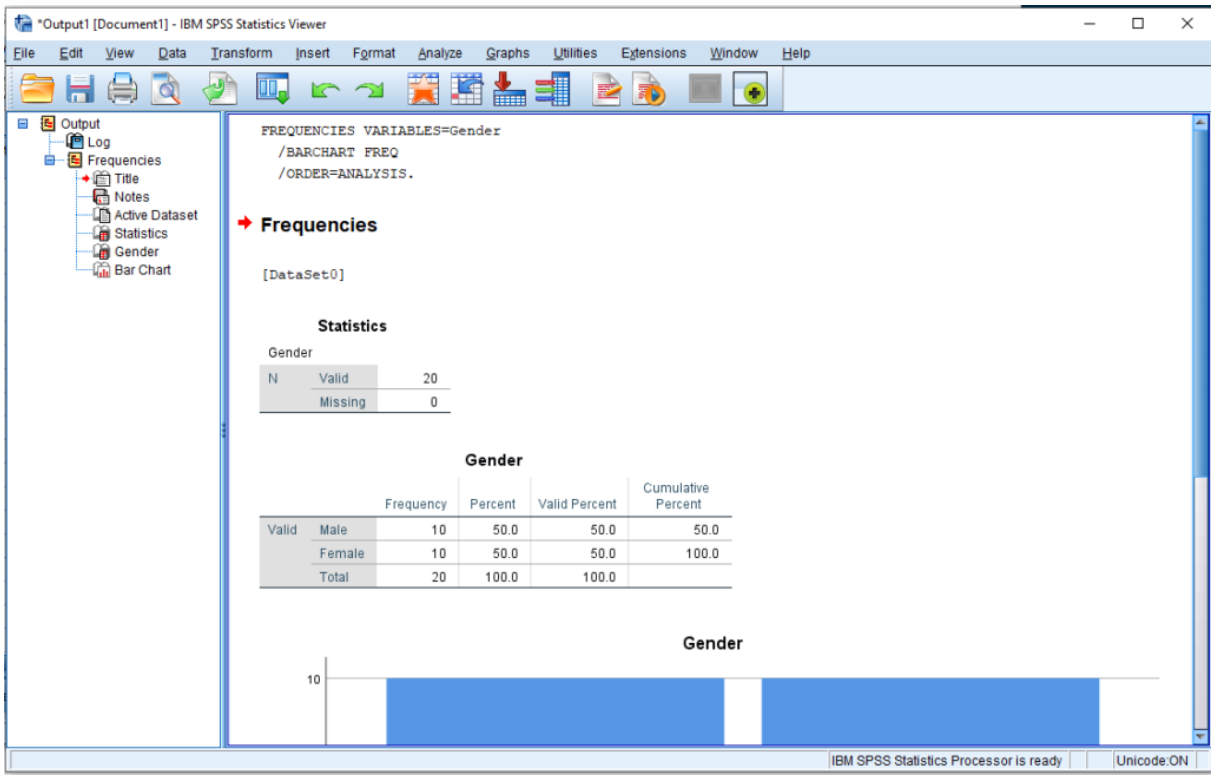


Figure 25: Frequency analysis results in SPSS Viewer. **Source:** Author (SPSS screenshot).

The first table in the output is the **Statistics** table. Because no additional statistics were requested, only two values are shown: **Valid** and **Missing**.

- **Valid** indicates the number of responses that contain usable data for the variable.
- **Missing** refers to the number of responses that are not usable; either because the value was left blank or because it was coded as missing in Variable View.

The second table displayed is the **Frequencies Table**, which contains the following columns:

- **Frequency:** The number of times each category appears in the dataset.
- **Percent:** The frequency expressed as a proportion of the total sample.
- **Valid Percent:** The percentage based only on valid responses (excluding missing data). This is the value most often reported.
- **Cumulative Percent:** The running total of the Valid Percent column across categories.

An example of how you might report the results is:

"**A total of 20 participants completed the survey. Of these, 10 were male and 10 were female, representing 50% of the sample each.**"

To include the SPSS output in a Microsoft Word document, right-click the desired table or chart in the Viewer and select **Copy**. Then open Word, right-click where you want to insert it, and choose **Paste**.

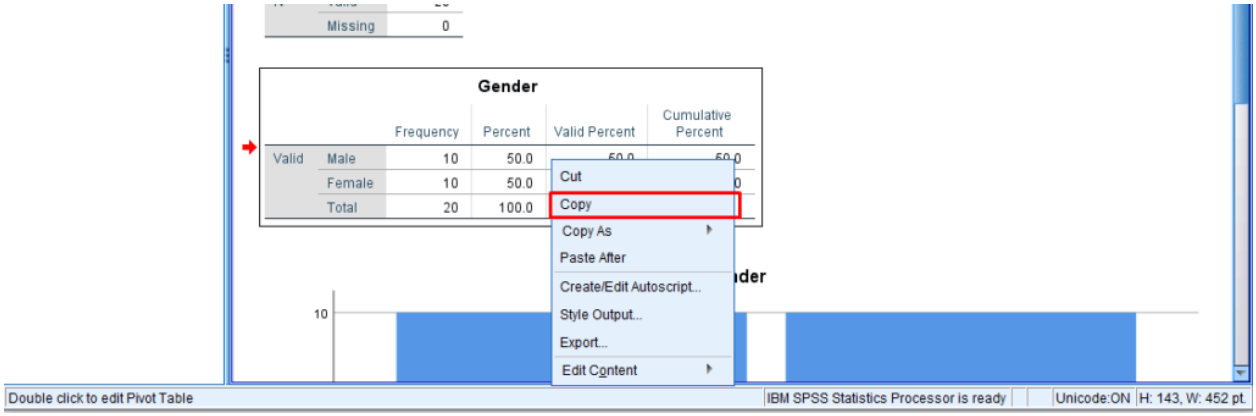


Figure 26: Copying SPSS output tables or charts for insertion into microsoft word. **Source:** Author (SPSS screenshot).

B/-Analyzing continuous (scale variables)

The frequency table we created earlier is not very useful for variables that contain many different numeric values, such as age. In these cases, the table becomes extremely long and difficult to interpret.

When the data values for a variable are arranged in ascending order; from the smallest to the largest, this is referred to as a **frequency distribution**.

To analyze scale variables, we usually begin by identifying the central or average value within this distribution. This is done using the **mean**, **median**, or **mode**, which are collectively known as **measures of central tendency**.

However, these averages alone do not fully describe the data. In addition to the central value, it is also important to understand how the data are spread out. This is done using **measures of variability (or dispersion)**, which include the **range, variance, and standard deviation**. These indicators show how much the values differ from one another.

To perform this analysis in SPSS:

- In the SPSS Data Editor, go to **Analyze → Descriptive Statistics → Frequencies**
- Click the **Reset** button at the bottom of the dialog box
- Drag the variable **Age** into the box on the right
- Click the **Statistics** button
- Select the options: **Mean, Median, Standard Deviation, Range, Minimum, Maximum, and Quartiles**

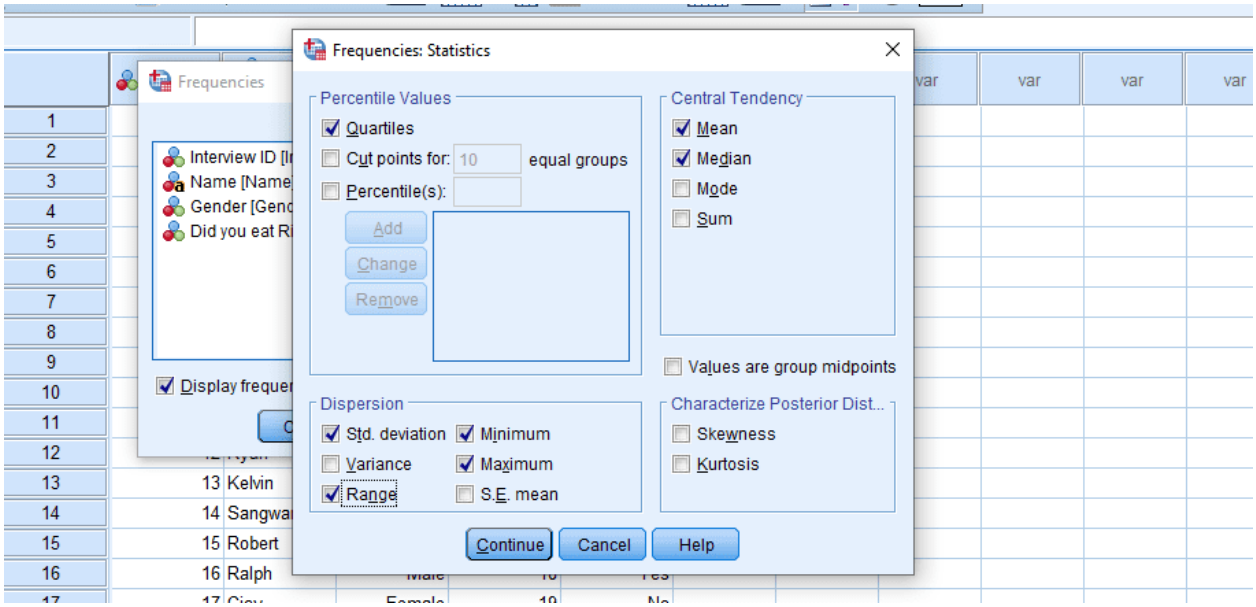


Figure 27: Configuring frequency analysis options to include key descriptive statistics in SPSS.
Source: Author (SPSS screenshot).

- Click **Continue** to return to the main dialog box.
- Then select **Charts**.
- Choose **Histogram**, and activate the option **Show normal curve on histogram**.
- Click **Continue** again.
- Finally, deselect the option **Display frequency table** located at the bottom left of the Frequencies dialog window, so that only the statistical summary and histogram are produced.

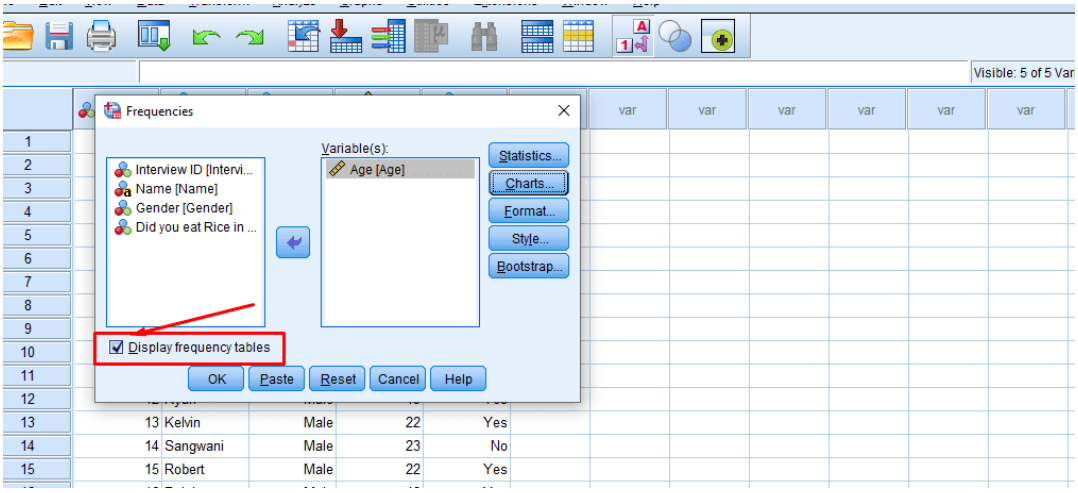


Figure 28: Deselecting the "display frequency tables" option in SPSS. **Source:** Author (SPSS screenshot).

- Click **OK**

Once again, the output will appear in the **Viewer window**.

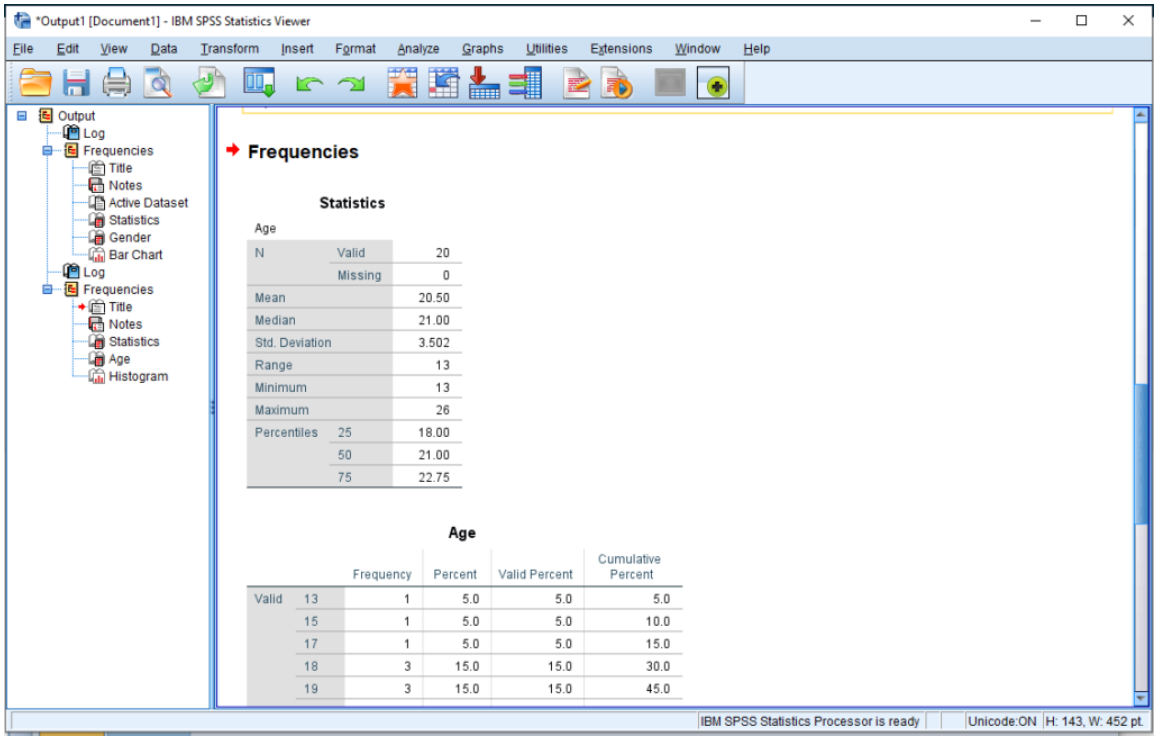


Figure 29: Descriptive statistics results in spss viewer. **Source:** Author (SPSS screenshot).

As before, SPSS produces a **Table of Descriptive Statistics**. However, this table now includes additional indicators that we selected in the *Statistics Options* dialog box:

- **Mean:** The arithmetic average, calculated by adding all values and dividing the total by the number of observations.
- **Median:** The central value in the dataset. When there is an even number of observations, it is the average of the two central values.
- **Standard Deviation:** A measure of dispersion showing how much the values deviate from the mean on average. A standard deviation of 0 indicates no variability, while larger values indicate greater spread in the data.
- **Range:** The difference between the maximum and minimum values in the dataset.
- **Percentiles:** Values that indicate the point below which a given percentage of observations fall (for example, the 25th percentile represents the value below which 25% of the data lie).

IV.3.Analyzing qualitative data with Nvivo (Introduction to Nvivo)

IV.3.1.Overview of NVivo

IV.3.1.1.What is NVivo?

NVivo is a software program designed for qualitative and mixed-methods research. It is used to analyze unstructured data such as text, audio, video, and images. Typical sources include interviews, focus groups, open-ended survey responses, social media content, and journal articles. NVivo is available for both Windows and Macintosh operating systems. (Pival, 2023).

IV.3.1.2.Why Use NVivo for Qualitative Data Analysis?

NVivo is a powerful tool for qualitative data analysis because it can handle large and diverse datasets, including text, audio, video, and survey responses. It provides advanced coding tools to identify and organize themes, while facilitating data organization through classifications and attributes. NVivo also includes visualization features such as word clouds, charts, tree maps, and concept maps, and integrates with other platforms like Excel, SurveyMonkey, social media, and EndNote. It is particularly well-suited for mixed-methods research, allowing integration of qualitative and quantitative data. Additionally, NVivo can generate reports and export findings for publications or presentations, making it a comprehensive solution for qualitative research (Dhakal, 2022).

IV.3.2.Explore the NVivo Interface

The **left-side menu (Navigation View)** allows you to move between different components of your project, such as files, codes, notes, queries, and other elements. We will explore these sections in more detail as we continue using the software.

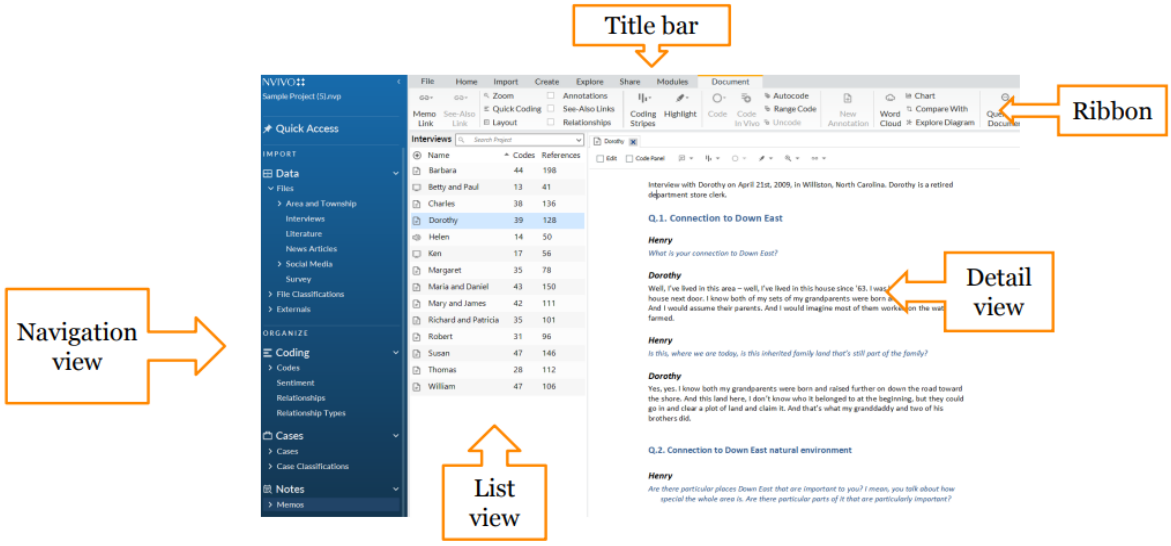


Figure 30: NVivo interface showing navigation view and ribbon menus. **Source:** Author (NVivo screenshot).

At the top of the screen, you will find a set of **ribbon menus**, similar to those in Microsoft Word or Excel. The available options in these menus will change depending on the item currently selected.

IV.3.3. Step-by-Step NVivo Data Analysis Process

Step 1: Set Up a New Project

1. Create a new project: Open NVivo and click on "New Project."
2. Provide a name and optional description for your project.
3. Save the project file to a designated folder on your computer.

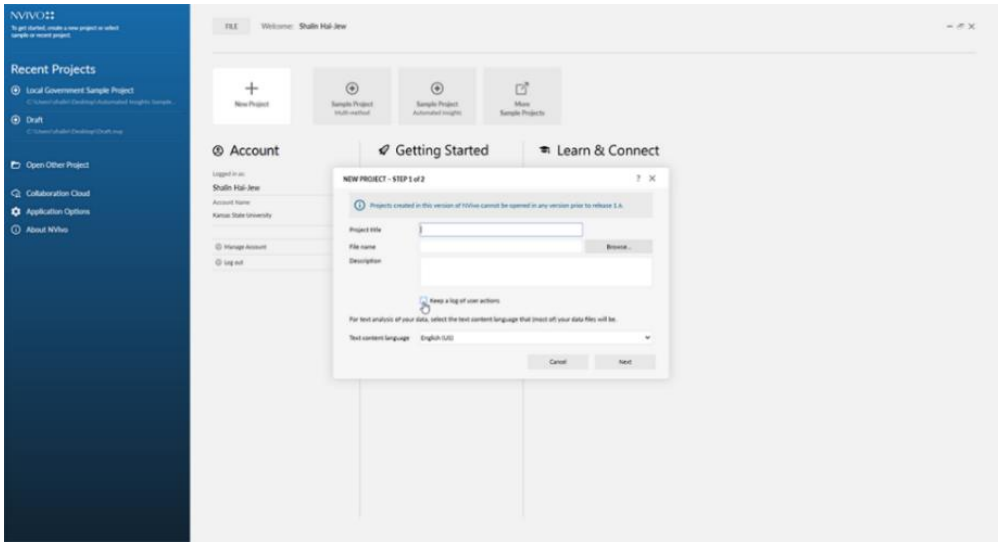


Figure 31: Creating a new project in NVivo. **Source:** Author (NVivo screenshot).

Step 2: Organize Data

1. Open NVivo and navigate to your project.
2. In the Navigation Pane (left menu), expand Data.
3. Right-click on Files and select New Folder.
4. Name the folder based on your data type (e.g., "Interviews," "Focus Groups").
5. Repeat this process for other data categories to create a structured workspace.

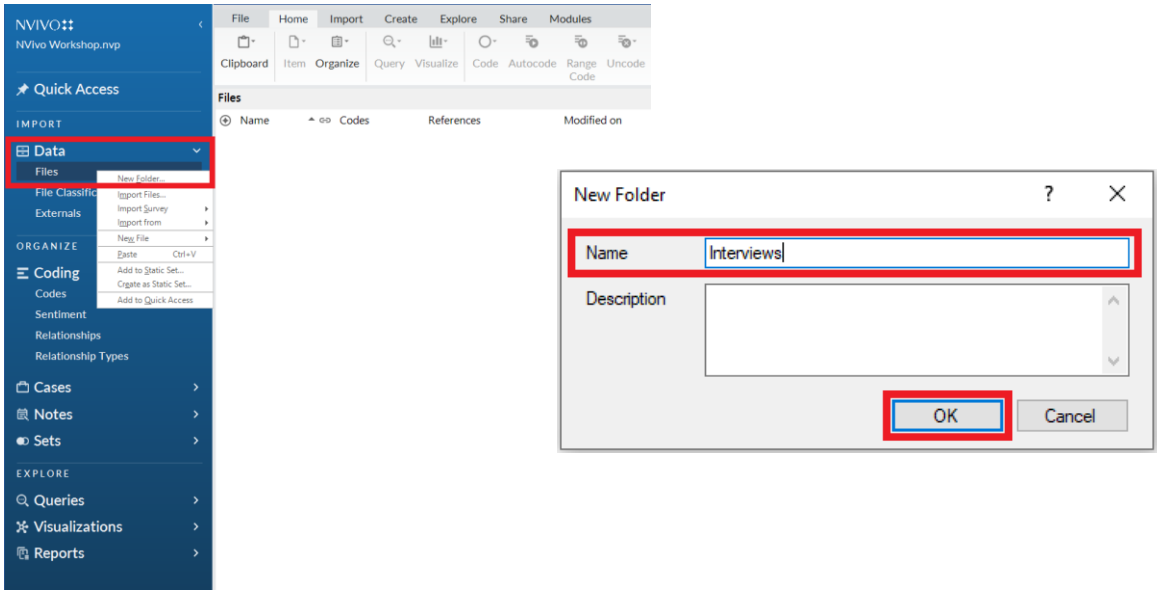


Figure 32: Organizing Data in NVivo by creating folders in the navigation pane. **Source:** Author (NVivo screenshot).

Step 3: Import Data

You can import a wide range of materials into NVivo, including word documents, PDFs, audio/video recordings, social media content, web pages, journal articles and survey data.

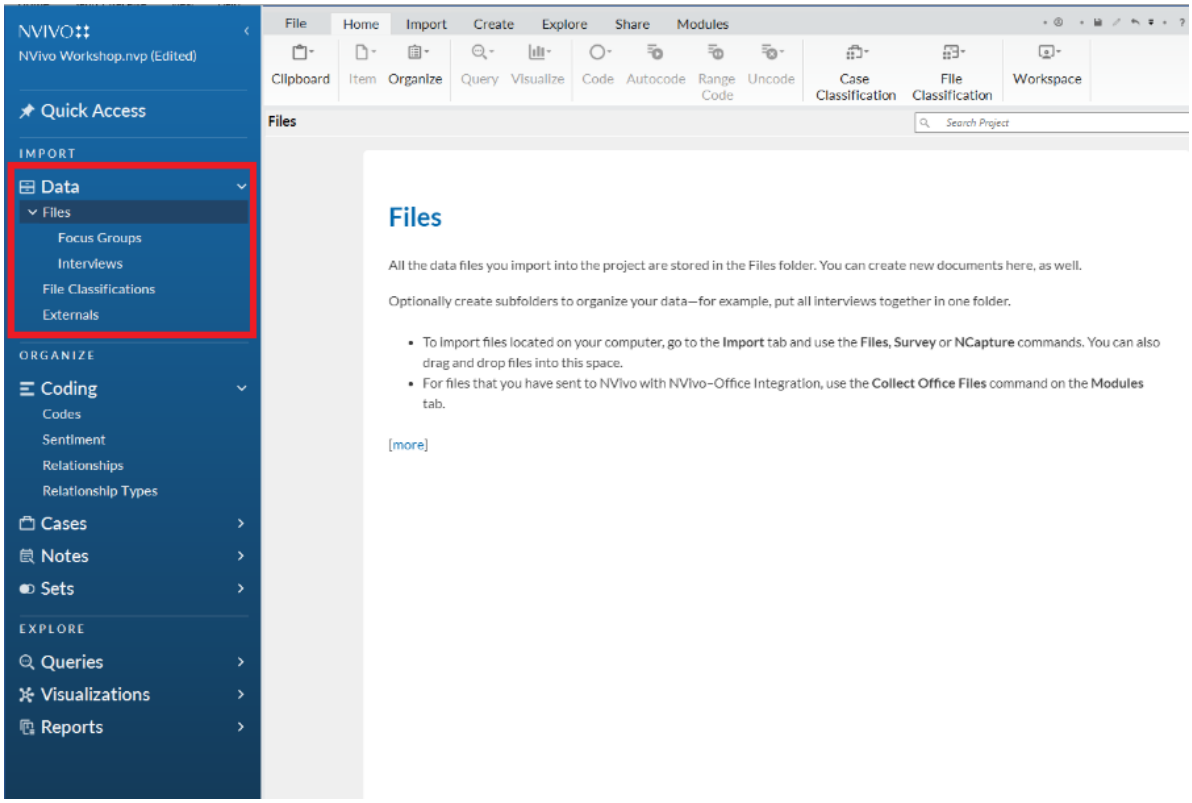


Figure 33: Importing data files into NVivo folders. **Source:** Author (NVivo screenshot).

Step 4: Creating Codes and Coding

Codes act as containers to hold references to specific themes, topics, or ideas in your data. Accessible from the **Codes** section in the left menu, which includes folders like **Codes** and **Sentiment**.

-Approaches to Coding:

- **Deductive**: Predefined codes are created before analyzing the data.
- **Inductive**: Codes are created as you analyze the data and discover new themes.
- **Combination**: Start with predefined codes but create new ones as themes emerge.

-Example Process:

- Begin by creating a few predefined codes in the **Codes** section.
- As you review your data, create additional codes as needed.

1-In the **Codes** section on the left panel, **right-click the "Codes" folder** and select **"New Code."**

Alternatively, you can open the **Create** tab from the ribbon menu and select **"Code"** to create a new code..

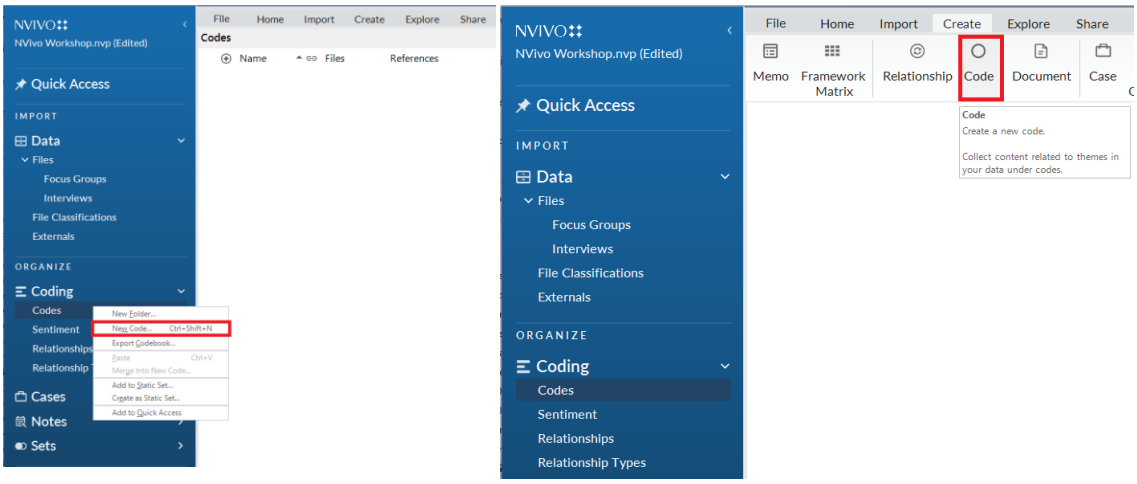


Figure 34: Creating a new code in NVivo from the codes section. **Source:** Author (NVivo screenshot).

2-Enter a name, a description and a nickname (optional) for your new code.

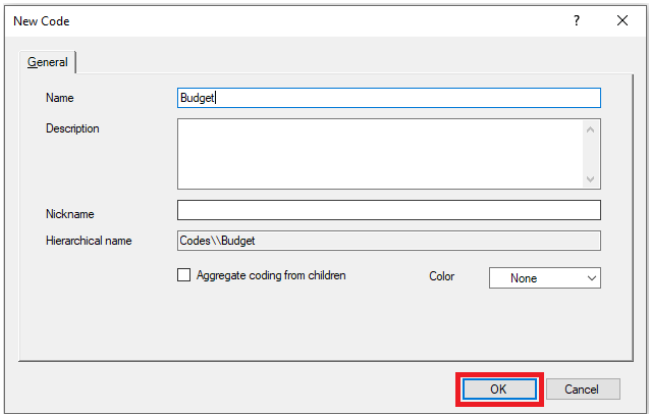


Figure 35: Entering a name, description, and nickname for a new code. **Source:** Author (NVivo screenshot).

Coding:

Open a file, highlight the text you want to code, right-click, and select **Code Selection**.

Next, **select the code you want to apply to the highlighted text** (for example, *Budget*). Then click **"Code Selection to 'Budget'."** The text is now successfully coded under that category.

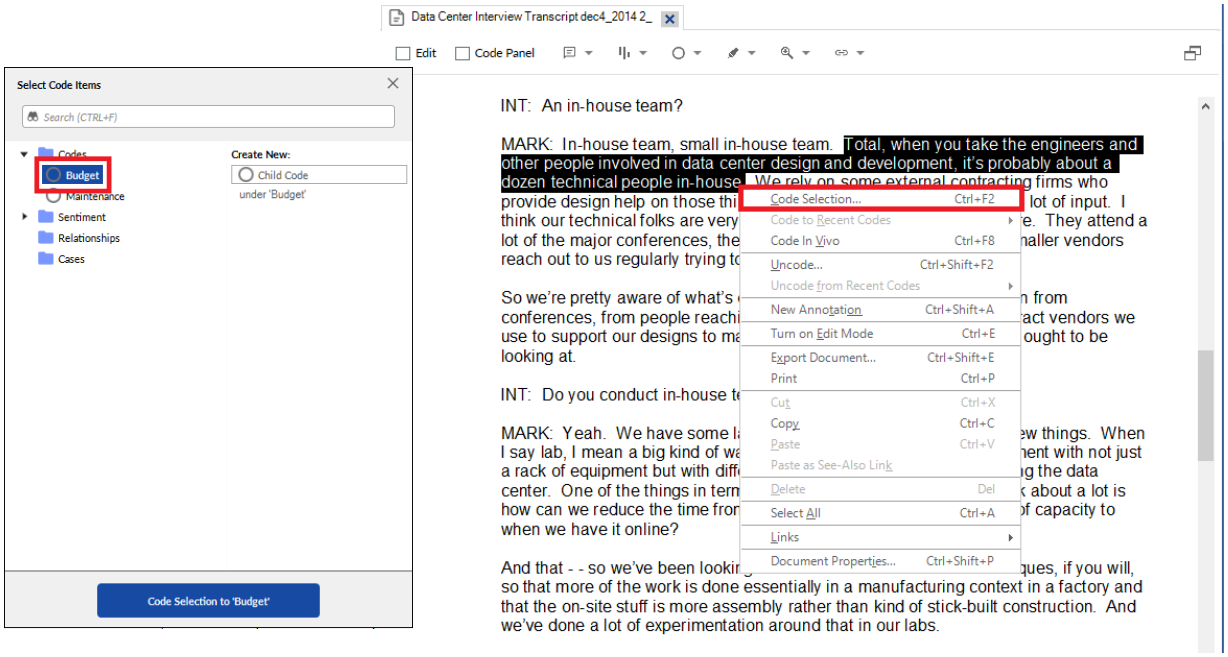


Figure 36: Coding Text in NVivo by selecting and assigning a code. **Source:** Author (NVivo screenshot).

Step 5: Query Data

NVivo provides query tools to analyze coded data. You can run **text search queries**, **word frequency queries**, or **matrix coding queries**.

A-Text Search

Text search lets users find specific words or phrases in your project items.

1. On the **Explore** tab, click **Text Search** or **Query Wizard**.

Choose **See where particular terms occur in content** if using the wizard.

2. Enter the word or phrase you want to search for. You can also add Boolean operators in your query via the **Special** button.
3. Select a **Find** option and choose where you want to search (Files and Externals/Selected Items/Selected Folders)
4. Run the query.

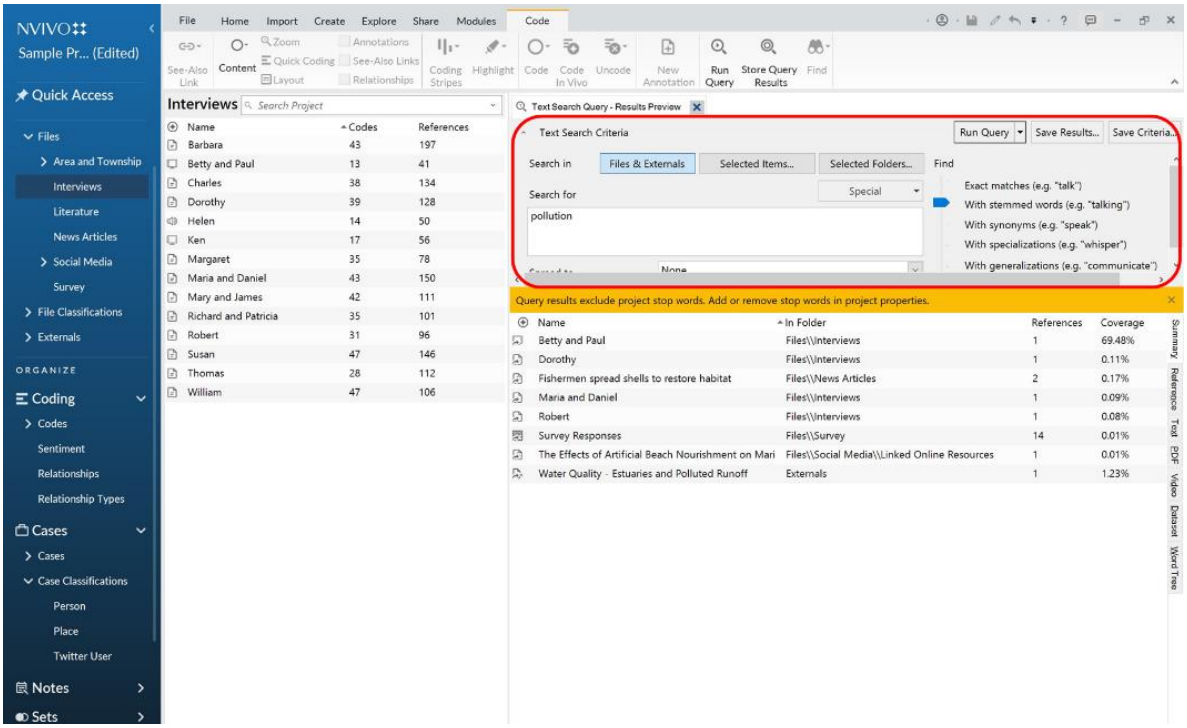


Figure 37: Running a text search query in NVivo. **Source:** Author (NVivo screenshot).

B-Word Frequency Query

Word frequency queries let users find the most frequently occurring words in your data.

1. On the **Explore** tab, click **Word Frequency** or **Query Wizard**.

Choose **Identify frequently occurring terms in content** if using the wizard.

2. Specify the terms you want to search for and choose where you want to search.
3. Run the query.

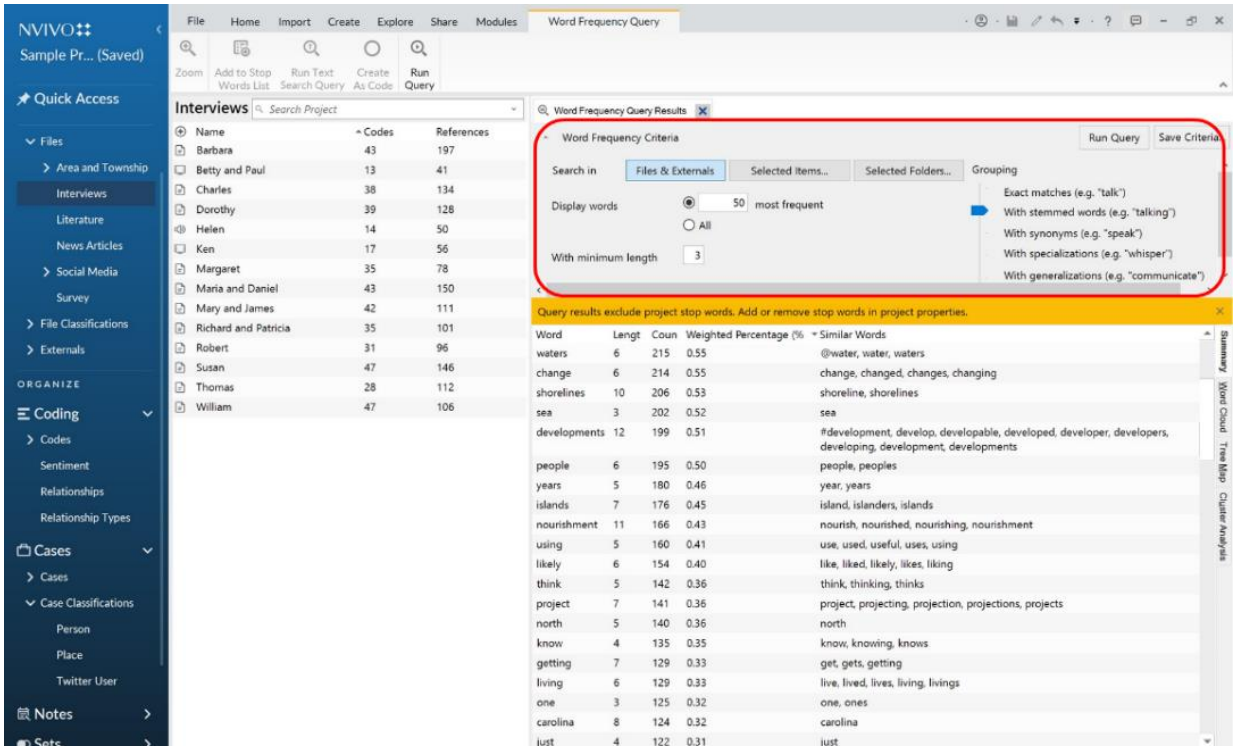


Figure 38: Running a word frequency query in NVivo. **Source:** Author (NVivo screenshot).

C/-Coding Query

You can run a coding query for two or more codes to see where they intersect (e.g. Negative attitudes toward Real estate development).

1. On the **Explore** tab, click **Queries** or **Query Wizard**.

Choose **Search for content based on how it is coded** if using the wizard.

2. Select what content you would like to search for.

e.g. To run a query on the intersection of the specific codes you are interested in, select **All these Codes or Cases**, then choose the relevant codes.

3. Choose where you want to search.
4. Run the query.

Figure 39: Running a coding query using the query wizard. **Source:** Author (NVivo screenshot).

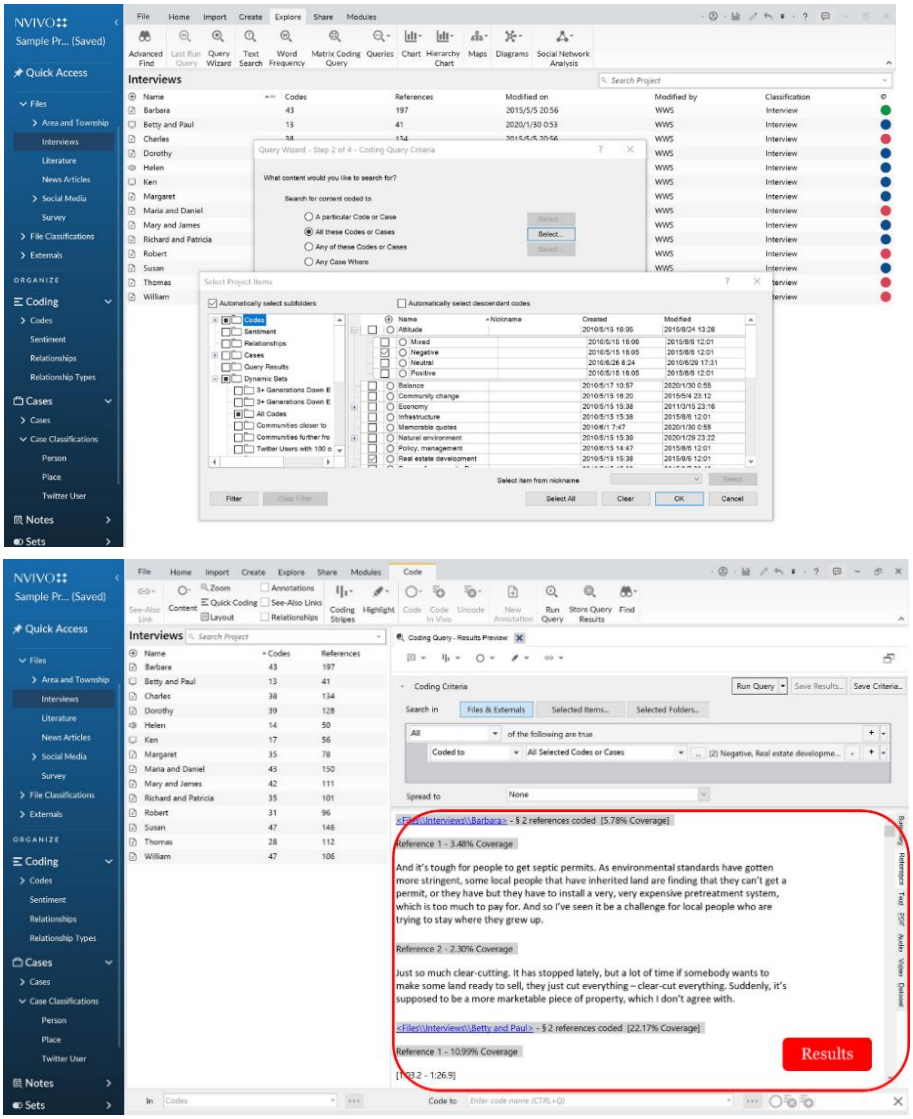


Figure 40: using coding query to explore code intersections in NVivo**. Source:** Author (NVivo screenshot).

Step 6: Analyze Data

After coding and running queries, NVivo allows you to explore your data through visual tools like **charts**, **word clouds**, and **models**.

A/-Charts

Charts can be used to present or explore your coding, cases, or files.

1. On the **Explore** tab, click **Chart**. The **Chart Wizard** appears.
2. Select the chart you would like to generate, and set the code and attributes for your chart.

The example demonstrates how to create a chart showing Real estate development coding by age group.

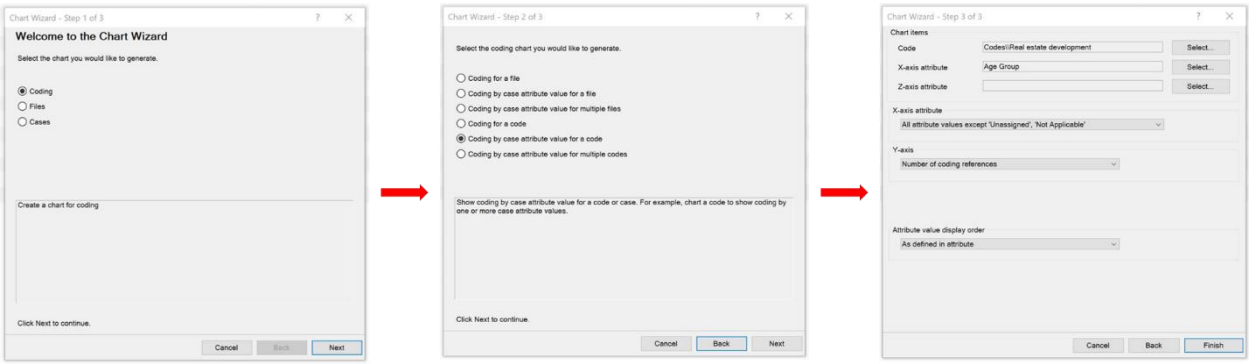


Figure 41: Using the chart wizard to visualize coding by case attributes. **Source:** Author (NVivo screenshot).

3. Click **Finish**.

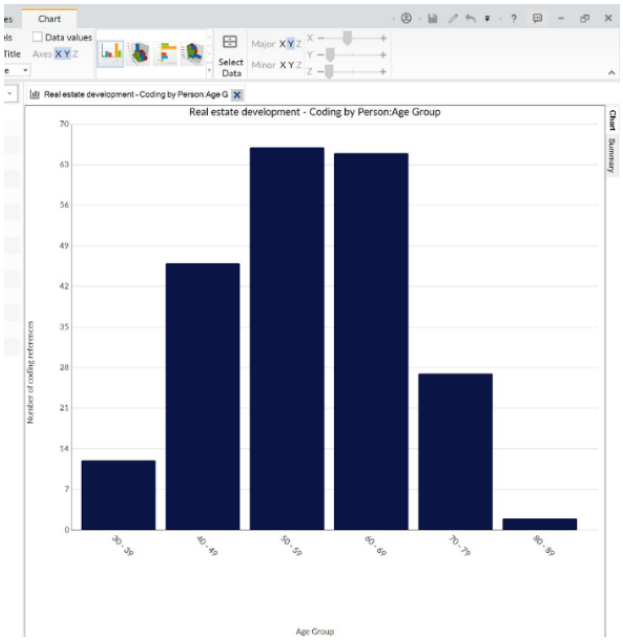


Figure 42: Creating a chart in NVivo to visualize coding by age group. **Source:** Author (NVivo screenshot).

B/-Word Clouds

You can use NVivo to generate word clouds to visualize word frequency.

1. Run the **Word Frequency Query**.
2. In the Detail View of the query results, click Word Cloud.

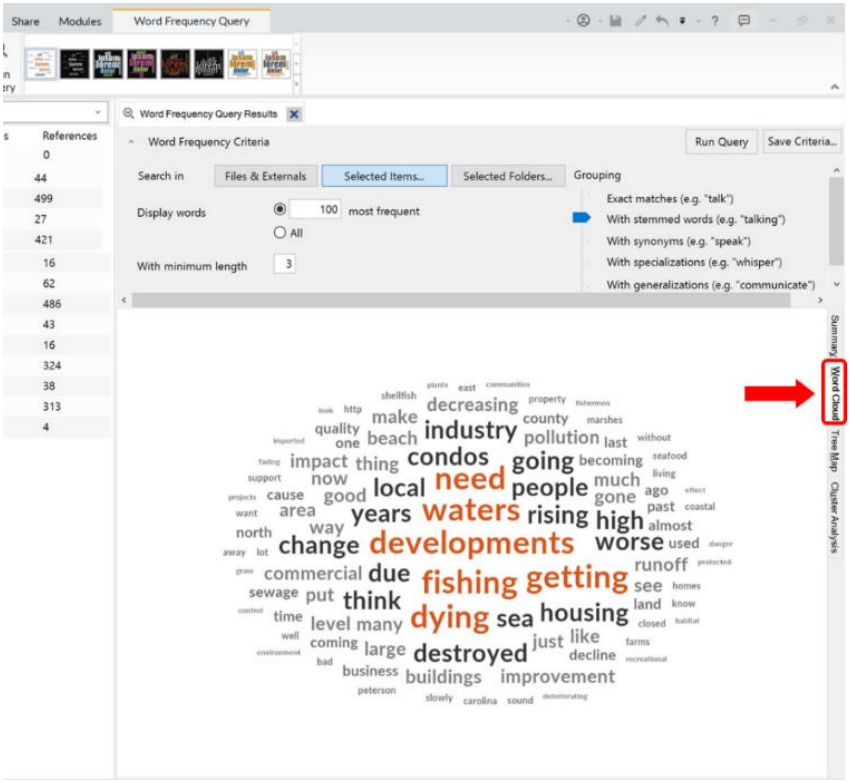


Figure 43: Visualizing word frequency using a word cloud in NVivo. **Source:** Author (NVivo screenshot).

Step 7: Export Results

Once your analysis is complete, you can export results to Word, Excel, or other formats.

To export your full list of codes, first open the **Codes** list and select at least one code. Then go to the **Share** menu and, from the **Export** drop-down menu, choose **Export List**. This will save all of your codes into a spreadsheet, including the number of files associated with each code and the number of referenced segments.

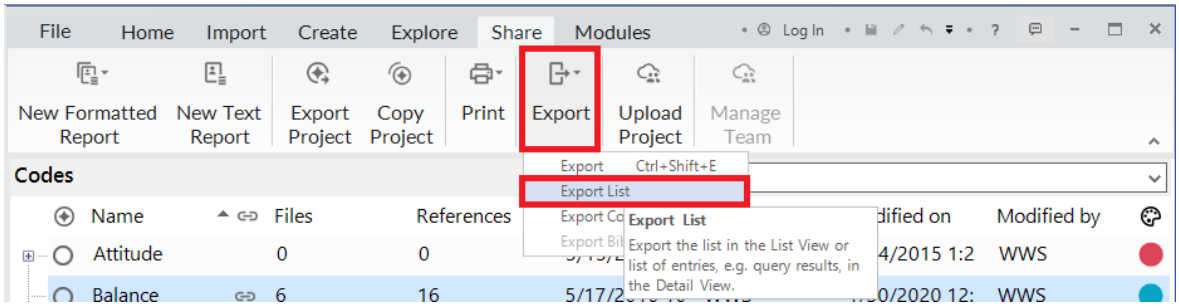


Figure 44: Using the export function in nvivo to save codes and reference counts to a spreadsheet. **Source:** Author (NVivo screenshot).

Go to your workshop folder, choose a name for the file (or keep the one already there), and click **Save**.

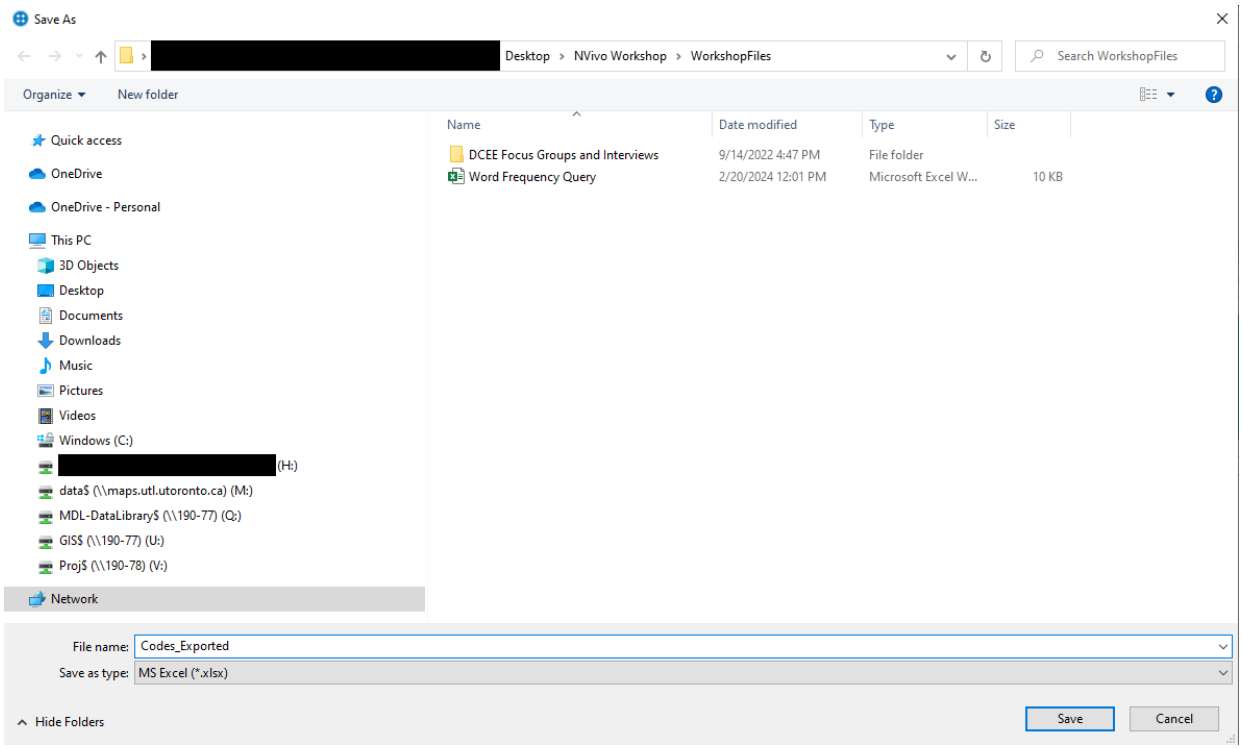


Figure 45: Selecting a file name and location for exported results. **Source:** Author (NVivo screenshot).

You can also export your codebook, which is a structured list of all your codes (or nodes) together with their descriptions, definitions, and related details. This helps clarify how and when each code should be applied. To do this, open the **Share** menu, choose **Export** from the drop-down list, and then select **Export Codebook**.

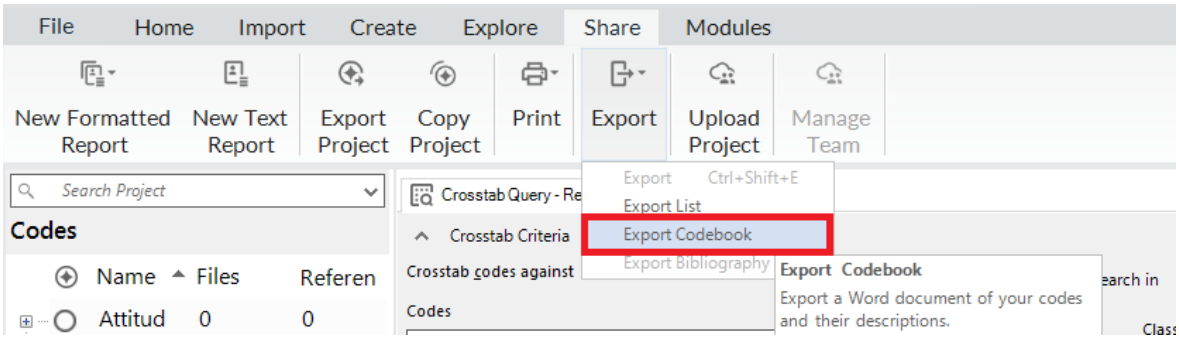


Figure 46: Exporting the codebook from the share menu. **Source:** Author (NVivo screenshot).

Select the option **"Include number of files and references."** This will generate a Word document containing this information. Keep the default settings and click **OK**. (https://survivingresearch.com/how-to-use-nvivo-step-by-step-guide-2025/)

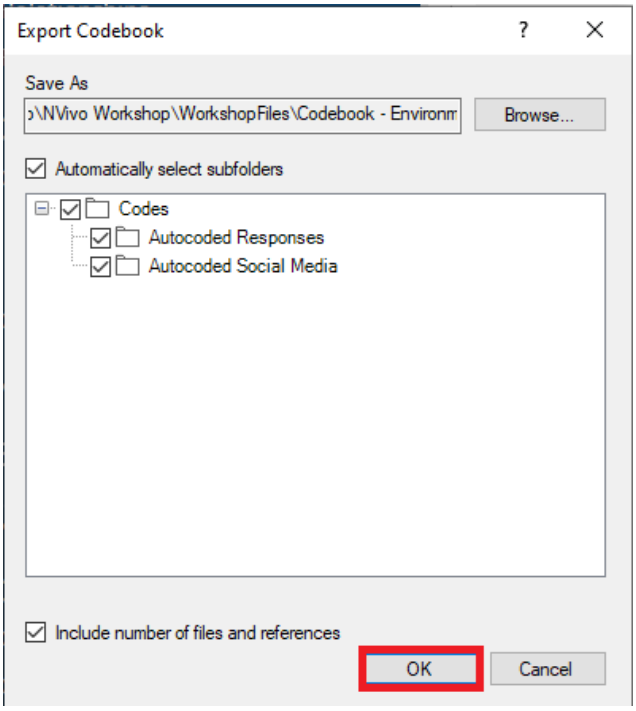


Figure 47: Export codebook settings and confirmation. **Source:** Author (NVivo screenshot).

Chapter 05 :
Data interpretation and reporting

V.1.What is data interpretation?

Data interpretation is the process of examining analyzed data or results to identify patterns, relationships, trends, and insights, and then explaining their meaning in the context of the research objectives. It involves making sense of the data to draw conclusions, support decision-making, and provide recommendations. (Dibekulu, 2020).

A well-structured data interpretation process is essential for making your data meaningful. It ensures that you draw accurate conclusions and make informed decisions based on your information. (https://www.questionpro.com/blog/data-interpretation/?utm)

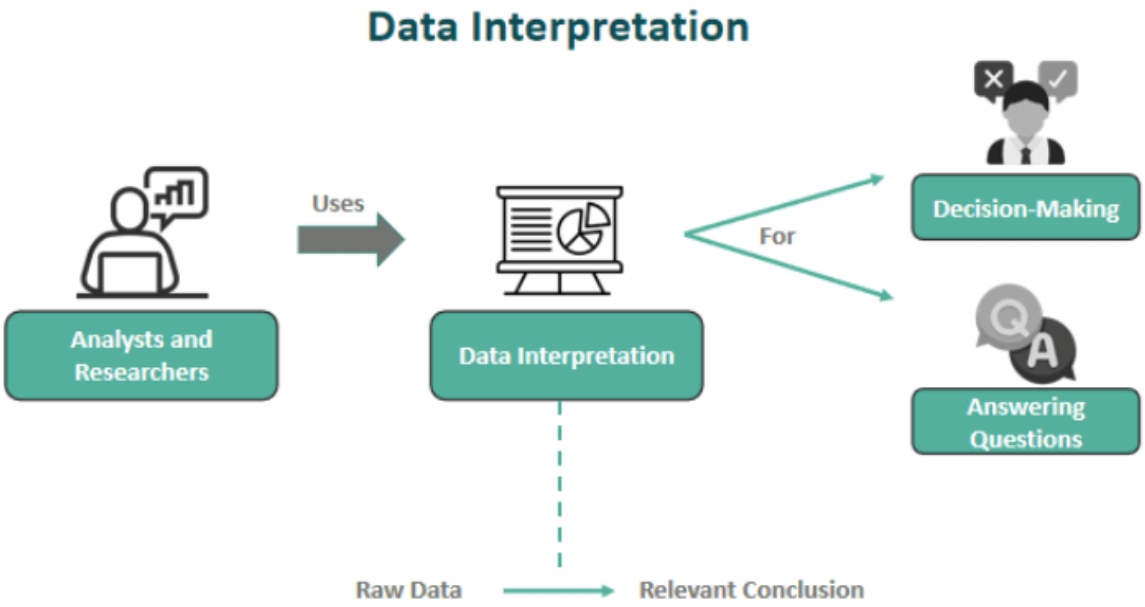


Figure 48: Data interpretation: from raw data to decision-making and answering questions. **Source:** https://www.wallstreetmojo.com/data-interpretation/

V.2. Importance of data interpretation

Data interpretation is important because it transforms raw data into meaningful insights that support informed decision-making and strategic planning. It helps identify patterns, validate hypotheses, and simplify complex information through clear summaries and visuals. By improving accuracy, efficiency, and communication with stakeholders, data interpretation enables organizations and researchers to better understand their context, assess risks, and guide future actions. As reliance on data continues to grow, strong data interpretation skills have become increasingly valuable for driving innovation and effective practice. (https://www.coursera.org/articles/data-interpretation)

V.3.Data interpretation methods

Data interpretation can be classified into two main types: quantitative and qualitative data interpretation

V.3.1. Quantitative data interpretation:

Quantitative data interpretation focuses on the analysis of numerical information, such as statistics, frequencies, and percentages. It relies heavily on mathematical and statistical techniques to summarize and describe data, identify trends, and explore relationships between variables. Visual tools such as tables, graphs, and charts are commonly used to present findings clearly and to support objective comparison and interpretation of results.

V.3.2.Qualitative data interpretation:

Qualitative data interpretation deals with non-numerical information such as interview transcripts, written reflections, and observational notes. While surveys may sometimes be used to assign numerical values to responses, qualitative interpretation primarily emphasizes understanding meanings, experiences, and perspectives. The analysis process involves identifying recurring themes, patterns, and concepts rather than relying on statistical summaries or visual representations (Silverman, 2011).

In simple terms, data interpretation involves understanding patterns in the data, ensuring it is relevant, and avoiding bias or incorrect assumptions. Quantitative methods deal with numbers, while qualitative methods focus on text and behavior (Amran, 2006).

V.4.Steps of data interpretation (interpreting results)

Data interpretation process involves several steps, as follow:

1. Assembling information (Data Collection)

Collect and organize all relevant data, including your own dataset and supplementary information such as historical records, weather data, or previous studies. Having all necessary information at hand allows a comprehensive view of the dataset and supports accurate interpretation.

2. Summarizing data

Create summaries using simple statistics, tables, and graphs to organize the data and highlight relationships and trends. This step transforms raw data into a form that is easier to analyze and interpret (Dates & Schoen,2002).

3. Linking findings to objectives

Each result should be directly connected to the research questions or objectives of the study. For example, if the objective is to identify major causes of schedule delays, findings such as "late material delivery" or "design changes" can be interpreted as directly addressing that objective and highlighting critical factors.

4. Identifying and explaining patterns

Analyze the results to detect trends, recurring issues, relationships, or contradictions, and explain their significance. For instance, delays may be more frequent in projects with multiple subcontractors and poor coordination, suggesting that communication complexity contributes to schedule slippage.

5. Connecting to literature and context

Compare your findings with previous studies and consider the specific context of your project. For example, if global studies indicate that material procurement issues cause delays, and your results confirm this, your findings are consistent with international trends. In a local context, such as Algerian construction projects, administrative approvals and supply chain limitations may further intensify delays (Dates & Schoen,2002).

6. Limitations and implications

Acknowledge any constraints affecting the interpretation of results and explain practical implications. For example, if the sample only included government projects, the findings may not fully represent private-sector projects. Implications could include improving procurement tracking, enhancing communication with subcontractors, or streamlining administrative approvals to reduce delays (Silverman, 2011).

7. Presenting Results

Finally, present findings, conclusions, and recommendations in a clear format using text, tables, and graphs, tailored to the intended audience. Whether through an oral presentation or written report, the goal is to ensure that insights from the data are understandable and actionable. (Dates & Schoen,2002).

V.5. Data reporting

Data reporting is the process of presenting collected and analyzed information in a structured way to communicate findings, support conclusions, and provide evidence for decision-making. A well-written data report ensures transparency, accuracy, and credibility in the research process.

Results should be communicated in a simple and accessible manner to all potential users. When reports are difficult to understand, the findings are less likely to be applied in practice, meaning that the time and financial resources invested in the evaluation may be wasted. Therefore, reports should present the main issues clearly and comprehensively, even for readers who were not directly involved in the evaluation process, so that they can easily follow and interpret the results (JICA, 2010).

V.5.1. Formats of Reporting Data

Data can be reported in various formats depending on the audience, purpose, and complexity of the information. Below are the main formats used for data reporting:

V.5.1.1.Written Reports

Written reports are formal documents that summarize data findings, analysis, and recommendations. Examples include research papers, business reports, theses, and dissertations. These reports typically include sections such as introduction, methodology, results, discussion, and conclusion. They provide detailed explanations using textual descriptions and often incorporate visuals such as tables, charts, and graphs to support the analysis.

V.5.1.2.Visual Reports

Visual reports focus on presenting data graphically for quick comprehension. Like; dashboards, infographics, and posters. They use charts such as bar, pie, and line graphs, as well as heatmaps, scatter plots, and diagrams. Visual reports are particularly useful for summarizing large datasets and highlighting key patterns and trends at a glance.

V.5.1.3.Presentations

Presentations summarize data in slides for verbal communication, such as PowerPoint, Google Slides, or Prezi presentations. They combine visuals, text, and bullet points to communicate key insights efficiently. Presentations are designed for live or virtual delivery to stakeholders and emphasize the main findings rather than detailed datasets.

V.5.1.4.Video Reports

Video reports communicate data through dynamic visual presentations, such as animated reports, recorded presentations, or tutorials. They use charts, visuals, voiceovers, and animations to engage the audience. Video reports are especially effective for reaching remote or diverse audiences while making the content more engaging and accessible. (Mortelmans, 2025).

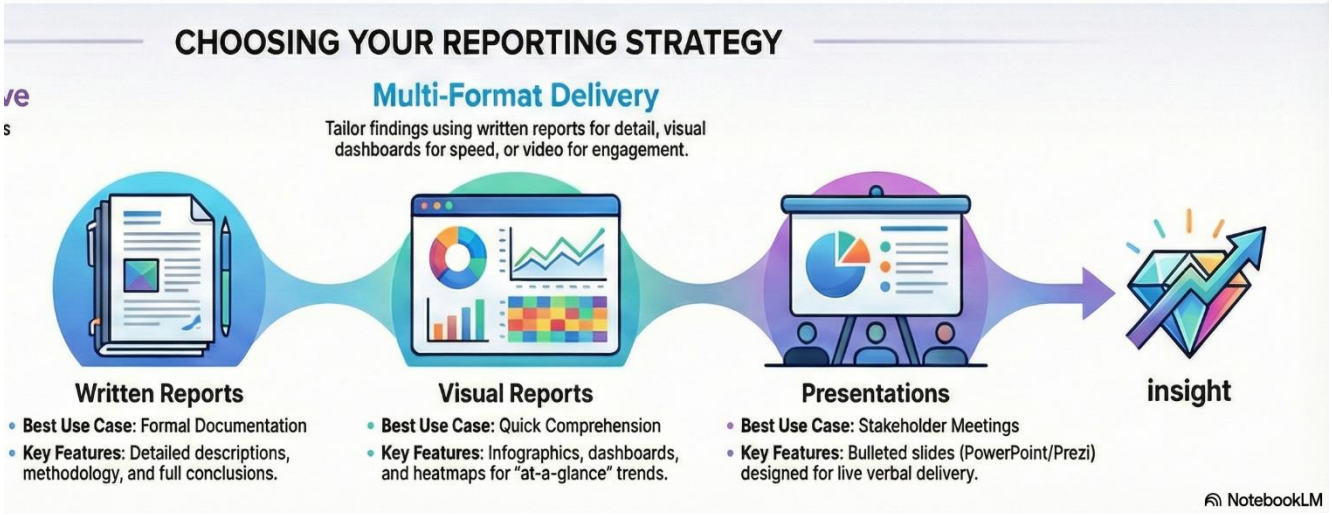


Figure 49: Reporting strategies for effective insight delivery *(Illustration generated by Notebook AI)*

Conclusion

This course handout has outlined the essential concepts, methods, and tools that underpin the practice of data analysis within academic research and professional environments. By guiding students through the processes of data collection, organization, interpretation, and reporting, the course emphasizes the importance of methodological rigor and critical reflection in producing reliable and meaningful knowledge.

The course is specifically intended for second-year Master students in Construction Project Management during the third semester. It is designed to support them in conducting the data analysis required for their master's thesis, enabling them to apply appropriate quantitative and qualitative techniques to real research problems in their field. At the same time, the analytical skills developed throughout the course provide a solid foundation for their future professional practice, where the ability to interpret and use data is essential for informed project planning, monitoring, and decision-making.

Ultimately, the course encourages students to move beyond a purely technical use of analytical tools and to develop a reflective and critical approach to data. By doing so, learners become better equipped to engage with real-world challenges, contribute to innovation in their field, and uphold the standards of academic and professional integrity. The skills and perspectives developed throughout this course are intended to support students not only in their studies but also throughout their professional careers.

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Appendices

Appendix 01: Glossary of Key Terms

In order to facilitate the understanding of fundamental concepts, the key terms included in this data analysis handout have been presented in both Arabic and English, accompanied by brief and concise definitions. This approach aims to help students standardize concepts, strengthen accurate analytical understanding, and connect data analysis terminology to its theoretical and practical applications.

Glossary of Chapter One : Introduction to Data analysis

Term (English)	Arabic Translation	Definition
Data	البيانات	Raw factual information such as numbers, text, images, sounds, symbols, and measurements collected for analysis and decision-making.
Data Analysis	تحليل البيانات	A set of methods and techniques used to transform collected data into meaningful information to support conclusions and decisions.
Research Objective	هدف البحث	A clearly defined goal or question that a study aims to address through data analysis.
Decision-Making	اتخاذ القرار	The process of selecting actions or strategies based on analyzed information and evidence.
Qualitative Data	بيانات نوعية	Non-numerical data that describe qualities, opinions, perceptions, experiences, or behaviors.
Quantitative Data	بيانات كمية	Numerical data that can be measured, counted, and analyzed statistically.
Data Collection	جمع البيانات	The process of gathering relevant data from various sources to address a research problem.
Data Cleaning	تنظيف البيانات	The process of identifying and correcting errors, inconsistencies, duplicates, or missing values in a dataset.
Data Preparation	تهيئة البيانات	Organizing and formatting data so it is ready for analysis, including coding and structuring variables.
Data Exploration	استكشاف البيانات	An initial examination of data to understand its structure, patterns, trends, and anomalies.

Data Visualization	تمثيل البيانات بيانيا	The graphical representation of data using charts, graphs, and dashboards to improve understanding.
Scatter Plot	مخطط مبعثر	A type of graph that displays the relationship between two numerical variables using points on a Cartesian plane.
Bar Chart	مخطط أعمدة	A chart that uses rectangular bars to compare values across different categories.
Correlation	الارتباط	A statistical measure that describes the strength and direction of a relationship between two variables.
Hypothesis	فرضية	A testable statement or assumption about the relationship between variables.
Interpretation of Results	تفسير النتائج	The process of explaining what the analysis findings mean in relation to the research objectives.
Reporting	عرض النتائج / التقرير	The presentation of analysis results in written, visual, or oral form for stakeholders or decision-makers.

Glossary of Chapter Two : Data Collection

Term (English)	Arabic Translation	Definition
Data Collection	جمع البيانات	The systematic process of gathering and measuring information on variables of interest for research purposes.
Primary Data	البيانات الأولية	Original data collected directly by the researcher for a specific study.
Secondary Data	البيانات الثانوية	Data previously collected and published by other researchers or organizations.
Questionnaire	استبيان	A structured research instrument composed of a set of questions used to collect data from respondents.
Interview	مقابلة	A data collection method based on direct questioning and recording participants' responses.
Focus Group Discussion (FGD)	مناقشة مجموعة مركزة	A guided group discussion used to explore attitudes, perceptions, and shared experiences.
Observation Method	أسلوب الملاحظة	Collecting data by directly observing behaviors, events, or processes in their natural setting.
Survey	مسح	A method of collecting data from a sample population, usually through questionnaires.
Case Study	دراسة حالة	An in-depth investigation of a single project, case, or phenomenon within its real context.
Experimental Method	المنهج التجريبي	A method that involves controlling and manipulating variables to observe their effects.
Structured Interview	مقابلة منظمة	An interview conducted using a fixed set of predefined questions.
Semi-Structured Interview	مقابلة شبه منظمة	An interview guided by prepared questions with flexibility for follow-up discussion.
Unstructured Interview	مقابلة غير منظمة	An informal interview without predetermined questions, resembling a conversation.

Closed-Ended Question	سؤال مغلق	A question with predefined response options.
Open-Ended Question	سؤال مفتوح	A question that allows respondents to answer freely in their own words.
Likert Scale	مقياس ليكرت	A scale used to measure levels of agreement or disagreement.
Observation Checklist	قائمة ملاحظة	A structured form used to systematically record observed behaviors or events.
Interview Guide	دليل المقابلة	A prepared list of questions or themes used to guide interviews.
Pilot Study	دراسة استطلاعية	A small-scale preliminary study conducted to test data collection tools and procedures.
Response Rate	معدل الاستجابة	The percentage of participants who complete a data collection instrument.

Glossary of Chapter Three : Fieldwork

Term (English)	Arabic Translation	Definition
Fieldwork	العمل الميداني	The process of collecting data directly from real-world settings relevant to a research study.
Field Site	موقع ميداني	The physical location where fieldwork activities and data collection take place.
Empirical Data	بيانات تجريبية	Data obtained through direct observation or experience rather than theory alone.
Planning Phase	مرحلة التخطيط	The preparatory stage of fieldwork involving defining objectives, methods, and logistics.
Fieldwork Plan	خطة العمل الميداني	A structured outline detailing methods, timeline, sampling, and resources for field data collection.
Sampling Strategy	استراتيجية أخذ العينات	A plan for selecting sites, participants, or cases to ensure relevant and representative data.
Logistical Preparation	التحضير اللوجستي	Arrangements related to access, equipment, transportation, budget, and personnel for fieldwork.
Execution Phase	مرحلة التنفيذ	The stage in which actual field data collection is carried out.
On-site Observation	الملاحظة الميدانية	Direct observation of activities, behaviors, or processes at the study site.
Field Notes	ملاحظات ميدانية	Written records documenting observations, events, and reflections during fieldwork.
Documentation	التوثيق	The systematic recording and storage of collected field data (notes, photos, recordings).
Data Integrity	سلامة البيانات	The accuracy, consistency, and reliability of collected data.
Analysis Phase	مرحلة التحليل	The stage where collected field data are organized, interpreted, and analyzed.
Data Coding	ترميز البيانات	The process of labeling qualitative data into categories or themes for analysis.

Thematic Analysis	التحليل الموضوعاتي	A qualitative analysis method focused on identifying recurring themes and patterns.
Quantitative Field Data	بيانات ميدانية كمية	Numerical data collected during fieldwork, such as time, cost, or resource measurements.
Qualitative Field Data	بيانات ميدانية نوعية	Descriptive data collected through interviews, observations, or open-ended responses.
Reporting Findings	عرض النتائج	Presenting analyzed fieldwork results in reports or presentations linked to research objectives.
Stakeholders	أصحاب المصلحة	Individuals or groups directly involved in, affected by, or having an interest in a project, organization, or decision-making process.

Glossary of Chapter Four : Data Analysis: Exploitation of the Data Collected

Term (English)	Arabic Translation	Definition
Data analysis tools	أدوات تحليل البيانات	Software and digital platforms used to process, analyze, visualize, and interpret data for decision-making.
Spreadsheet software	برامج الجداول الإلكترونية	Applications that organize data in rows and columns and perform calculations using formulas.
Data visualization tools	أدوات تصور البيانات	Software that converts data into charts, graphs, maps, and dashboards for easier interpretation.
Statistical analysis software	برامج التحليل الإحصائي	Programs that apply statistical methods to analyze numerical data and test hypotheses.
Qualitative data analysis software	برامج تحليل البيانات النوعية	Tools designed to analyze non-numerical data such as text, audio, and images.
SPSS	برنامج SPSS للتحليل الإحصائي	Statistical software used for managing and analyzing quantitative data.
Variable	متغير	A measurable characteristic that can take different values across cases.
Case	حالة / وحدة تحليل	A single unit of analysis such as a respondent, project, or observation.
Data View	عرض البيانات	SPSS interface for entering and editing data values.
Variable View	عرض المتغيرات	SPSS interface for defining variable properties and measurement levels.
Descriptive statistics	الإحصاءات الوصفية	Statistical measures that summarize data characteristics such as mean and standard deviation.
Frequency distribution	التوزيع التكراري	Arrangement showing how often values occur in a dataset.
Measure of central tendency	مقاييس النزعة المركزية	Statistical indicators such as mean, median, and mode that describe average values.
Measure of dispersion	مقاييس التشتت	Indicators such as range and standard deviation that describe data variability.

NVivo	برنامج NVivo لتحليل البيانات النوعية	Software used for qualitative and mixed-methods data analysis through coding and visualization.
Coding	الترميز	Process of labeling and categorizing qualitative data into themes.
Codebook	دليل الترميز	Structured list of codes with definitions used in qualitative analysis.
Query	استعلام	Tool used to search, compare, or explore coded data within NVivo.
Word frequency query	استعلام تكرار الكلمات	NVivo function that identifies the most frequently used words in qualitative data.
Matrix coding query	استعلام الترميز المصفوفي	Query that examines intersections between different codes or attributes.

Glossary of Chapter Five : Data interpretation and reporting

Term (English)	Arabic Translation	Definition
Data interpretation	تفسير البيانات	The process of examining analyzed data to identify patterns, relationships, trends, and insights, and explaining their meaning in the research context.
Quantitative data interpretation	تفسير البيانات الكمية	Analysis and explanation of numerical data using statistical and mathematical methods to identify trends, relationships, and patterns.
Qualitative data interpretation	تفسير البيانات النوعية	Analysis of non-numerical information such as interviews, texts, and observations to understand meanings, experiences, and themes.
Assembling information	تجميع المعلومات	Collecting and organizing all relevant data and supplementary sources to prepare for interpretation.
Summarizing data	تلخيص البيانات	Using statistics, tables, and graphs to condense raw data into a form suitable for analysis.
Linking findings to objectives	ربط النتائج بالأهداف	Connecting results directly to research questions or objectives to highlight critical factors.
Identifying patterns	تحديد الأنماط	Detecting recurring trends, relationships, or contradictions in the data and explaining their significance.
Literature comparison	مقارنة بالدراسات السابقة	Evaluating findings against previous studies and contextual information to validate or contrast results.
Limitations	القيود	Constraints or factors that may affect the accuracy or generalizability of data interpretation.
Implications	الآثار	Practical or theoretical consequences derived from the interpretation of results.
Data reporting	تقديم البيانات	Presenting analyzed data in a structured way to communicate findings, support conclusions, and inform decision-making.

Written reports	التقارير المكتوبة	Formal documents summarizing data findings, analysis, and recommendations, often including visuals.
Visual reports	التقارير المرئية	Graphical representations of data such as dashboards, charts, or infographics for quick comprehension.
Presentations	العروض التقديمية	Slideshows combining visuals and text to communicate key insights efficiently to stakeholders.
Video reports	التقارير الفيديوية	Dynamic presentations using video, animations, and voiceover to communicate data effectively to diverse audiences.

Appendix 02: Sample exercises and practice questions

This appendix provides a set of practical exercises designed to support students in applying key data analysis concepts using simplified datasets. The exercises aim to reinforce theoretical understanding through hands-on practice and guided analysis.

Pedagogical Note: All datasets used in this appendix are simplified and simulated for instructional purposes only. They are intended to support learning objectives and do not represent real construction projects or real-world data.

I. Short exercises with integrated datasets

Exercise 1: Identification of Data Types

Dataset 1: Project Characteristics

Project ID	Project Type	Duration (months)	Total Cost (Million DA)	Number of Workers
P01	Residential	12	85	40
P02	Commercial	18	140	60
P03	Infrastructure	24	220	80
P04	Residential	10	70	35

Tasks:

1. Identify qualitative and quantitative variables.
2. Classify quantitative variables as discrete or continuous.
3. Justify your classification.

Exercise 2: Data Cleaning and Preparation

Dataset 2: incomplete project data

Project ID	Duration (months)	Planned Cost (Million DA)	Actual Cost (Million DA)
P01	12	85	95
P02	—	140	165
P03	24	220	—
P04	10	70	78

Tasks:

1. Identify missing or incomplete values.

2. Propose appropriate data cleaning methods.
3. Explain how missing data can affect analysis results.

Exercise 3: Descriptive Statistics

Dataset 3: project durations

Project ID	Duration (months)
P01	12
P02	18
P03	24
P04	10
P05	15

Tasks:

1. Calculate the mean, median, and range.
2. Interpret what these values reveal about project duration variability.

II- Interpretation questions with data

Question 1: Project delays analysis

Dataset 4: Planned vs actual duration

Project ID	Planned Duration (months)	Actual Duration (months)
P01	12	15
P02	18	22
P03	24	24
P04	10	14

Tasks:

1. Identify projects experiencing delays.
2. Calculate the delay for each project.
3. Interpret possible reasons for the observed delays.

Question 2: Causes of delays

Dataset 5: Delay Causes

Project ID	Material Delay	Labor Shortage	Design Changes
P01	Yes	No	Yes
P02	Yes	Yes	No
P03	No	Yes	Yes
P04	No	No	Yes

Tasks:

1. Identify the most frequent cause of delay.
2. Explain how this information can support project decision-making.

III- Mini Case Studies

Case Study 1: Cost overruns

Dataset 6: Planned vs Actual Costs

Project ID	Planned Cost (Million DA)	Actual Cost (Million DA)
P01	85	95
P02	140	165
P03	220	210
P04	70	78

Tasks:

1. Identify projects with cost overruns.
2. Calculate cost differences.
3. Propose recommendations to reduce future overruns.

Case Study 2: Stakeholder Satisfaction

Dataset 7: Satisfaction Survey Results
(Scale: 1 = Very Dissatisfied, 5 = Very Satisfied)

Stakeholder	Cost Management	Schedule Respect	Communication	Overall Satisfaction
S1	3	2	4	3
S2	4	3	3	3
S3	2	2	2	2
S4	5	4	5	5

Tasks:

1. Identify the weakest satisfaction dimension.
2. Interpret stakeholder perceptions.
3. Suggest improvement strategies.

Appendix 03: Course content according to the ministry's official curriculum

Identification de la matière d'enseignement

Intitulé : **ANALYSE DES DONNEES**
Unité d'enseignement : **UED**
Nombre de Crédits: **1** Coefficient : **1**
Volume horaire hebdomadaire total : **1H30**

- Cours (nombre d'heures par semaine) : **1H30**
- Travaux dirigés (nombre d'heures par semaine) : ……
- Travaux pratiques (nombre d'heures par semaine) : ……

Description de la matière d'enseignement

Prérequis :
Avoir des connaissances en :

- Mathématiques ;
- Statistiques ;
- Traitement du texte (Word, Excel, …)
- Maitrise de la langue.

Objectif général du la matière d'enseignement :
A la fin du semestre, l'étudiant sera capable de mener un travail de recherche et de maîtriser tout le processus couvrant les différentes étapes de la phase de collecte et d'analyse des données jusqu'à la rédaction du rapport et la prise de décision.
Objectifs d'apprentissage :
A la fin du cours, l'apprenant sera capable de :
A la fin du semestre, l'étudiant sera capable de :

- Réaliser le processus de collecte des données ;
- Confectionner un questionnaire ;
- Analyser l'information ;
- Rédiger un rapport ;
- Prendre des décisions

Contenu de la matière d'enseignement

Le programme de cette matière s'articule autour des points suivants :

- Introduction à la matière ;
- La collecte des données :
  - Définition ;
  - Objectifs de la collecte ;
  - Outils de collecte des données ;
  - Choix des outils ;
  - Confection des outils de collecte des données ;
  - Processus de collecte des données ;
- Travail de terrain ;
- Analyse des données : exploitation des données recueillies (quantitatives et qualitatives)

- Le logiciel SPSS (données quantitatives) ;
- Le logiciel Nvivo (données qualitatives).

Modalités d'évaluation

Nature du contrôle	**Pondération en (%)**
Examen	**100**
Total	**100**

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