

SPSS Basics

An Online PowerPoint Presentation for the
Research Methodology Course

of the

Nigerian Post Graduate Medical College

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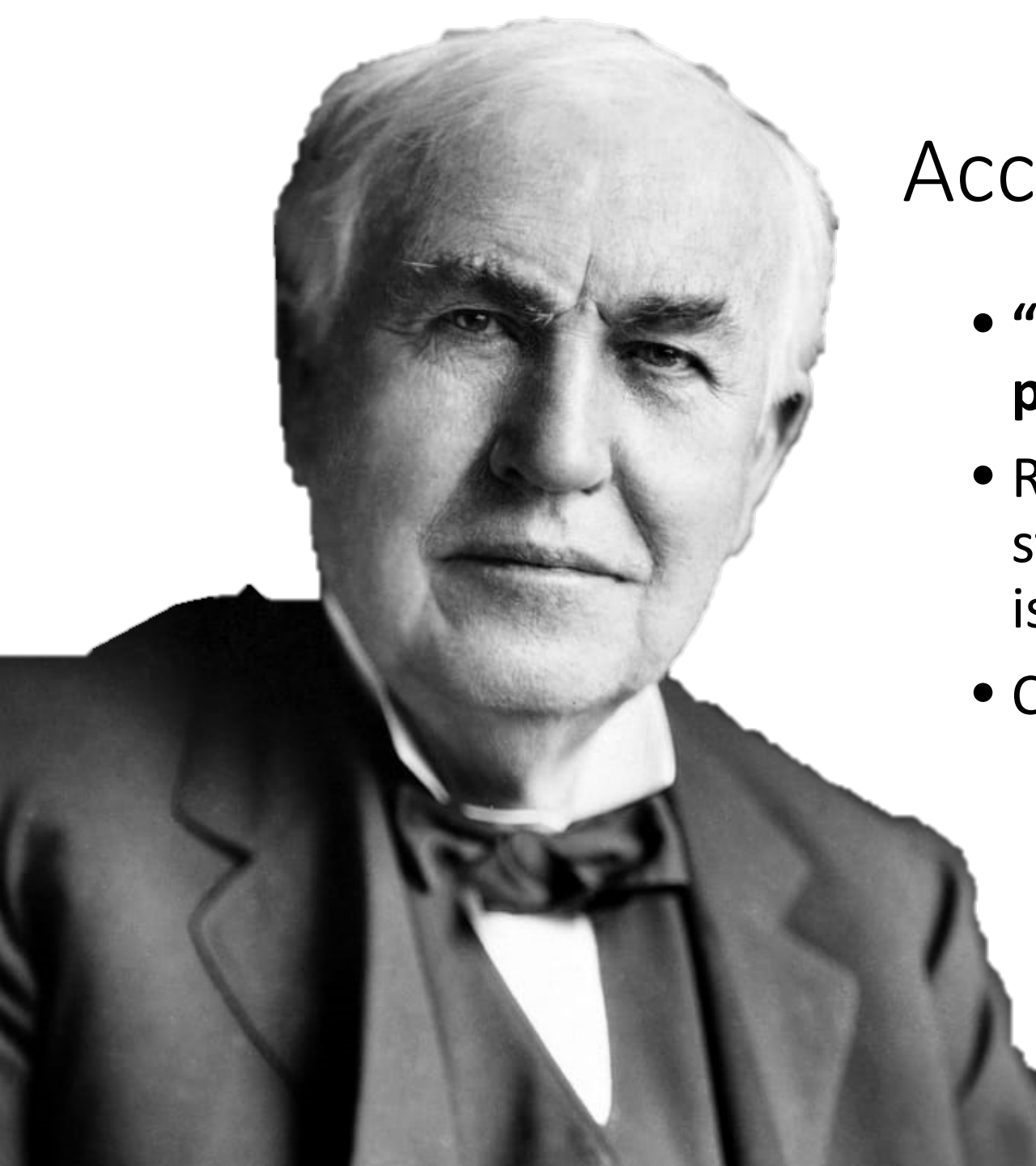
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Objective

- The objective of this presentation is to make the resident doctor preparing for his or her part II project confident enough to analyse his or her data using SPSS.
- Of course, you cannot become an expert in SPSS by reading or listening to a two-hour presentation
- But, we want to stimulate your interest in such a way that you will be encouraged to continue studying the subject



According to Thomas Edison

- **“Genius is 1% inspiration and 99% perspiration”**
- Reading this stuff is your inspiration, sticking with it and doing further reading is your perspiration!
- Come, let’s make you a “genius”!

Research and Statistics: The Basics

Research Problem

- A research process begins with a problem of interest to the researcher.
- A research problem is a statement that asks about the relationships between variables.
- Statistics can be used to find solutions for such research problems by asking the following questions:
 - What kind should be collected?
 - How much data need to be collected?
 - How can we analyze the data and draw conclusions from it?
 - How can we assess the strength of the conclusions and evaluate their uncertainty?

Variables

- A characteristic that takes different values in different situations
- Variables are what you measure in research
- Examples:
 - Sex: A discrete variable that can take only two values (Male or Female)
 - Age: A continuous variable that can take a large number of values
- In research, variables are divided into two: independent and dependent variables

Independent and Dependent Variable

- **Independent variable:** What the researcher manipulates, or what can change on its own and be measured. Usually, an independent variable is not affected by any other variable in the experiment. It either changes on its own or is manipulated
- **Dependent variable:** What is being studied. It is what changes as a result of the changes to the independent variable

The Independent Variable is what you change, and the dependent variable is what changes because of that.

Example: Independent and dependent variables

- You are interested in how stress affects heart rates.
- **Independent variable:** Stress
- **Dependent variable:** Heart rate

- You can directly manipulate stress levels and measure the resultant changes in heart rate

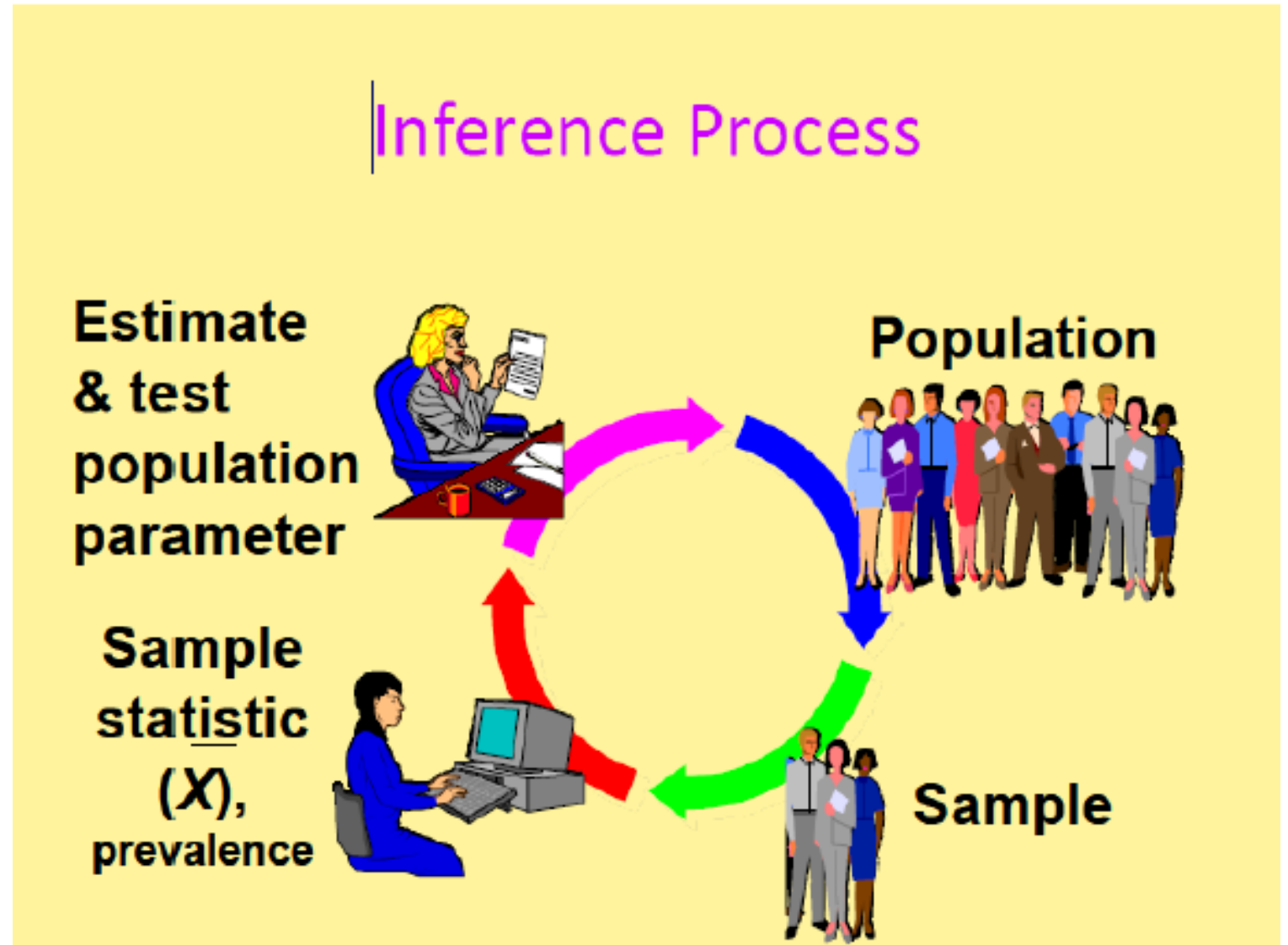
Hypothesis and Research Questions

- **Research hypotheses** are predictive statements about the relationship between variables.
- **Example of Hypothesis:** Students who take only one test per day will score better on standardized tests than students who take two tests in one day.
- **Research questions** do not entail specific predictions and are phrased in question format.
- **Example of Research Question:** Is there a difference in students' scores on a standardized test if they took two tests in one day versus taking only one test on each of two days?

Descriptive and inferential statistics

- These are the two broad statistical methods
- **Descriptive statistics** is the summarization of data which quantitatively describes the data. The statistics can be used to represent the data
- Descriptive statistics presents data using graphs, tables, and numbers such as averages, measures of variation, and percentiles.
- **Inferential statistics** makes assumptions and predictions about population based on the data drawn from the population
- The two primary methods for making inference are estimation and hypothesis testing.

The process of inference statistics



Estimation (Point and interval estimate)

- Estimation is a the process of making inferences from a sample about an unknown population parameter
- A point estimate answers the question, “what do you think is the value of this parameter?”
- Interval estimate (Confidence Interval) is an estimate constructed on the basis that a specified proportion of the confidence interval include the true parameter in repeated sampling.
- Combining point estimates with confidence intervals give the most information.

Interpreting Confidence Intervals

- Suppose that a 95% confidence interval for the true proportion of hypertension in a city is:

0.07 - 0.11

- An investigator is 95% confident that the true percentage of hypertensive patients in the city is between 7% and 11%.
- Although the interval from 0.07 to 0.11 may or may not contain the true proportion, 95% of intervals formed in this manner will contain the true proportion.

Scales of Measurement

Differences between measurements, true zero exists

Differences between measurements but no true zero

Ordered Categories (rankings, order, or scaling but no exact difference)

Categories (no ordering or direction)

Ratio Scale

Interval Scale

Ordinal Scale

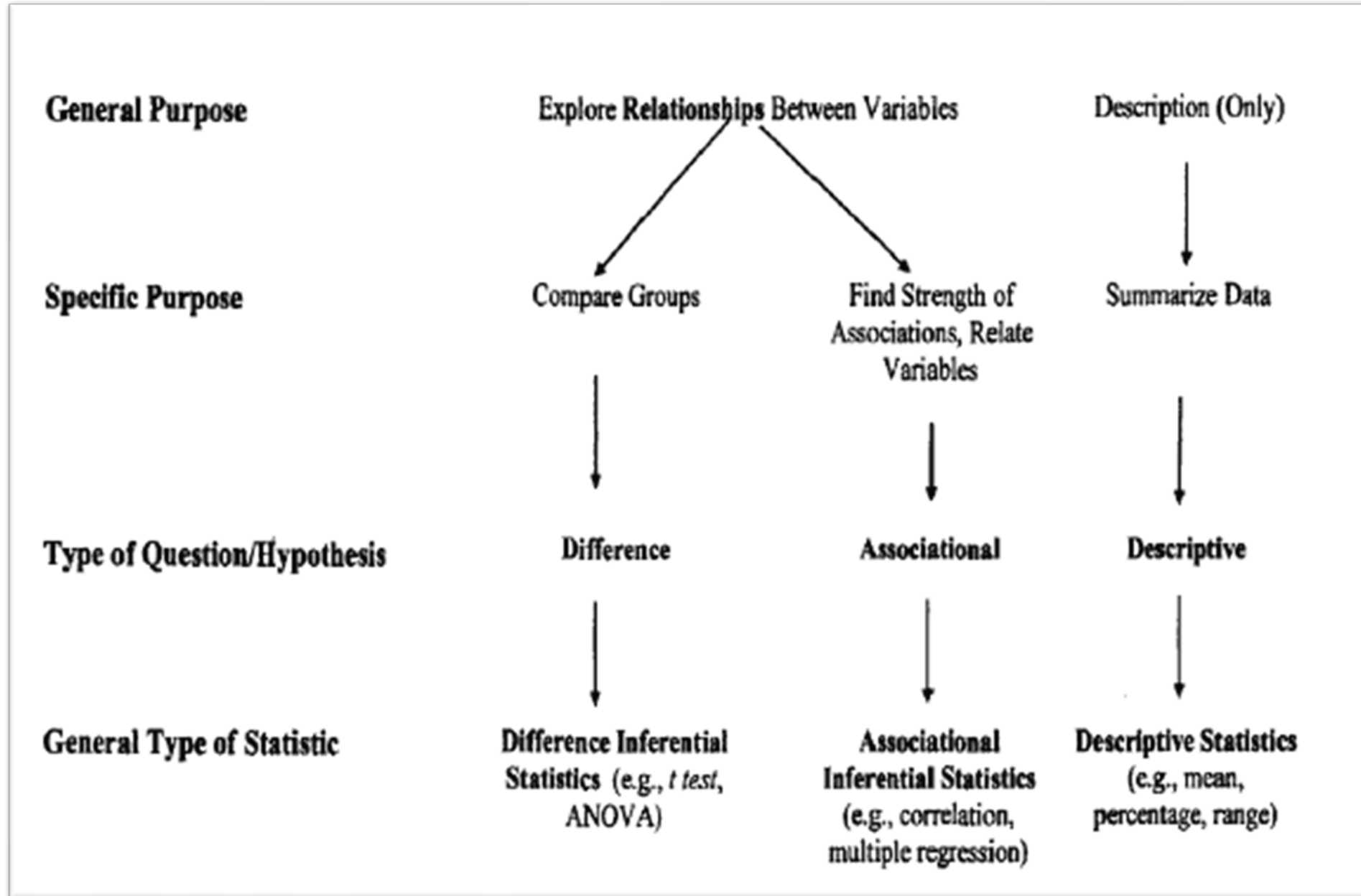
Nominal Scale



Quantitative Variable

Qualitative Variable

Guide to statistics Usage



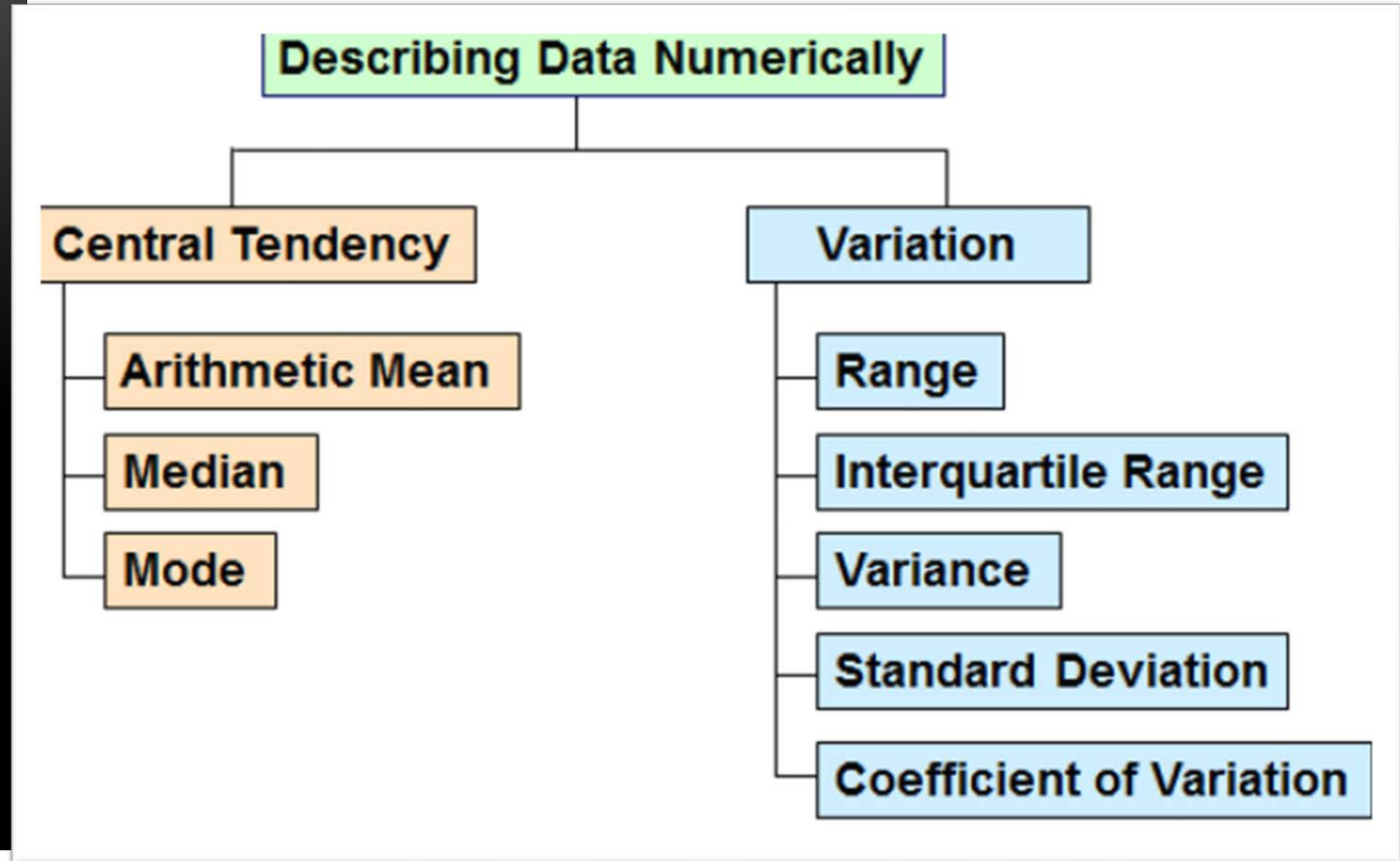
Role of Statistics in Research



Methods of Data Presentation

- Data in raw form are usually not easy to use for decision making.
- Data can be presented using
 - Table (of counts, percentages). It can be one way, contingency or multi-way in general.
 - Chart (bar and pie)
 - Graph (histogram, frequency polygons, line plot, stem and leaf plot)
 - Statistical quantities such as mean, range, standard deviation, etc:
- The type of diagram/ graph to use depends on the variable being summarized.

Describing Data Graphically



Basics of SPSS

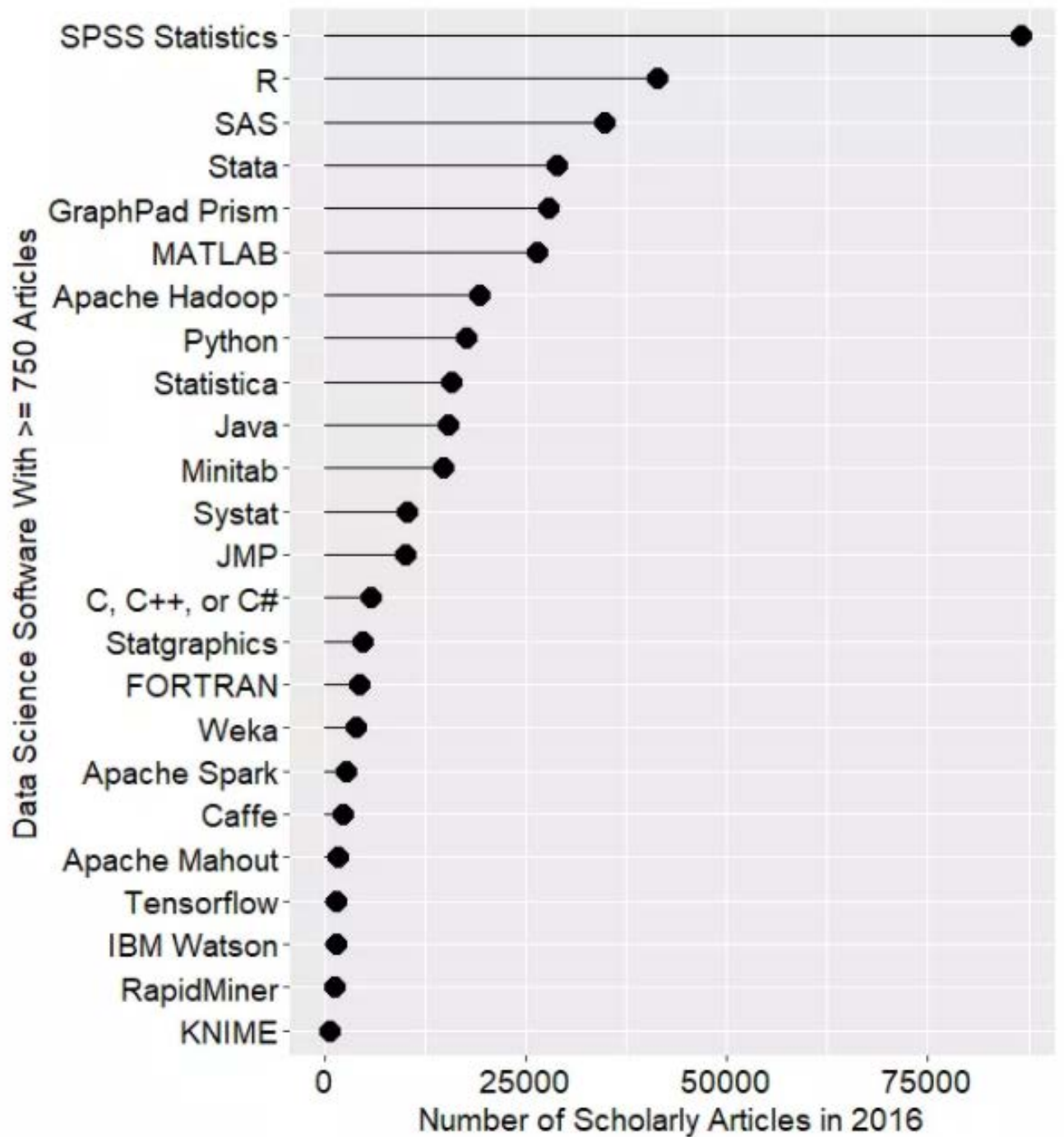
What is SPSS?

- A computer statistic package that provides different statistical procedures within a unified framework.
- Currently owned and developed by IBM corporation and is **called IBM SPSS Statistics**
- SPSS stands for "Statistical Product and Service Solutions".
- SPSS is a very powerful and user friendly program.
- It uses both a graphic and a syntax interface.
- SPSS can take data from almost any type of file and use them to generate tabulated reports, charts, and plots of distributions and trends, descriptive statistics, and conduct complex statistical analyses.



WHY SPSS?

Based on the number of scholarly articles in 2016, SPSS was the most popular statistic package.



Why SPSS?

Data Format and Compatibility

- .sav file to save data
- .spo to save output files
- Syntax files (.sps) for programming
- Import
 - Excel files (.xls, .xlsx),
 - Text files (.csv, .txt, .dat),
 - SAS (.sas7bdat),
 - Stata (.dta)
- Export
 - Excel files (.xls, .xlsx),
 - Text files (.csv, .dat),
 - SAS (.sas7bdat),
 - Stata (.dta)

Why SPSS?

- Easy and intuitive user interface; menus and dialog boxes
- Has more statistical procedures than most researchers will ever need
- For those who need more, syntax for more powerful analyses is available
- Also has tools for charts and tables
- Easily exclude data and handle missing data
- Similar feel to Excel
- Can import data from most other statistical software and databases

SPSS Windows

- Unlike Microsoft Excel, where all activities are done in a single window with the file extension .xls, SPSS has different windows for different procedures
- The most common windows in SPSS are:

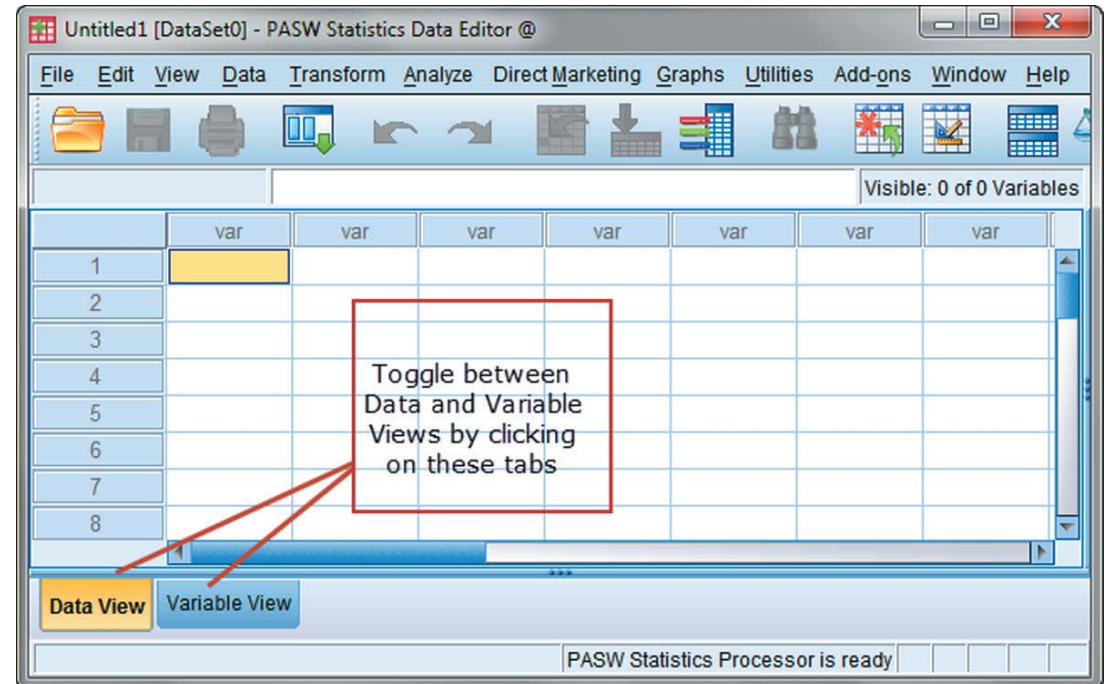
| Window | File Extension | Uses |
|--------------------|-----------------------------------|--|
| Data Editor | .sav | For entering and manipulating data |
| Statistic Viewer | .spv | For displaying results of all data analysis and displaying the syntax of procedures. |
| Pivot Table Editor | None (extension of output viewer) | For manipulation of tables |
| Chart Editor | None (extension of output viewer) | For manipulation of charts |
| Syntax Editor | .sps | For carrying out analysis using syntax |

The Data Editor Window

- The data editor window is a spreadsheet with rows and columns
- It is used to:
 - create a new data file and enter data;
 - display the contents of the data;
 - make changes to the data and run statistical analysis.
- There are two views in this window, namely **data view** and **variable view**

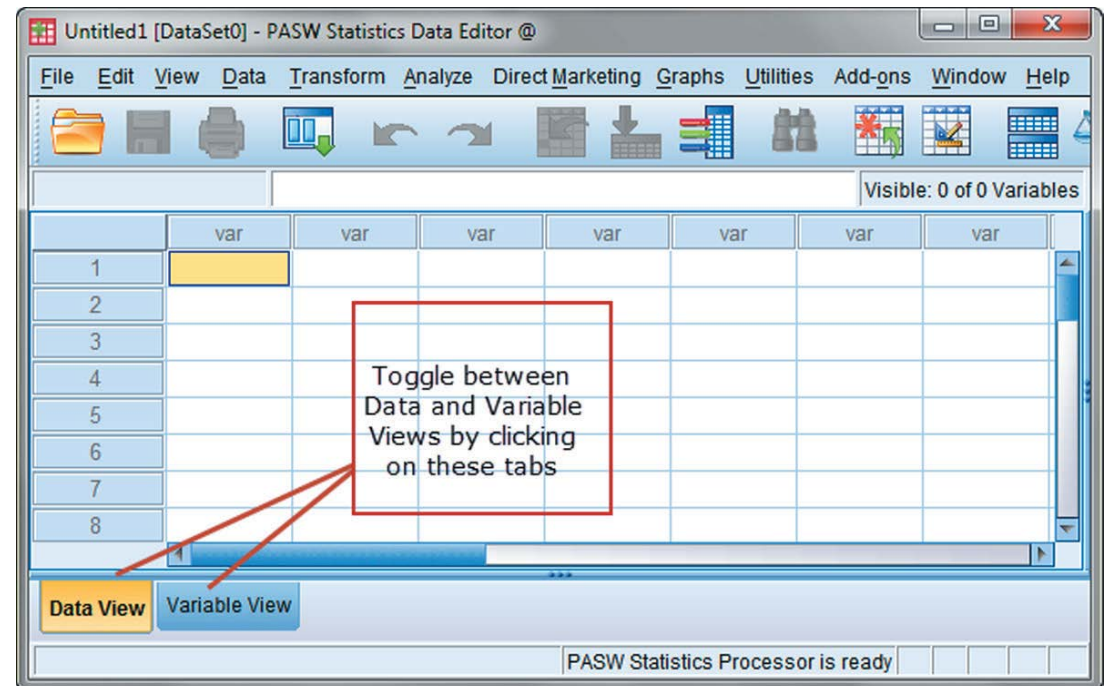
The Data Editor Window

- Use the “Data View” and “Variable View” tabs to toggle between the two views of the Data Editor
- The **Data View** of the Data Editor allows for the display, manipulation and analysis of data
- The “**Variable View**” is where variables are defined.



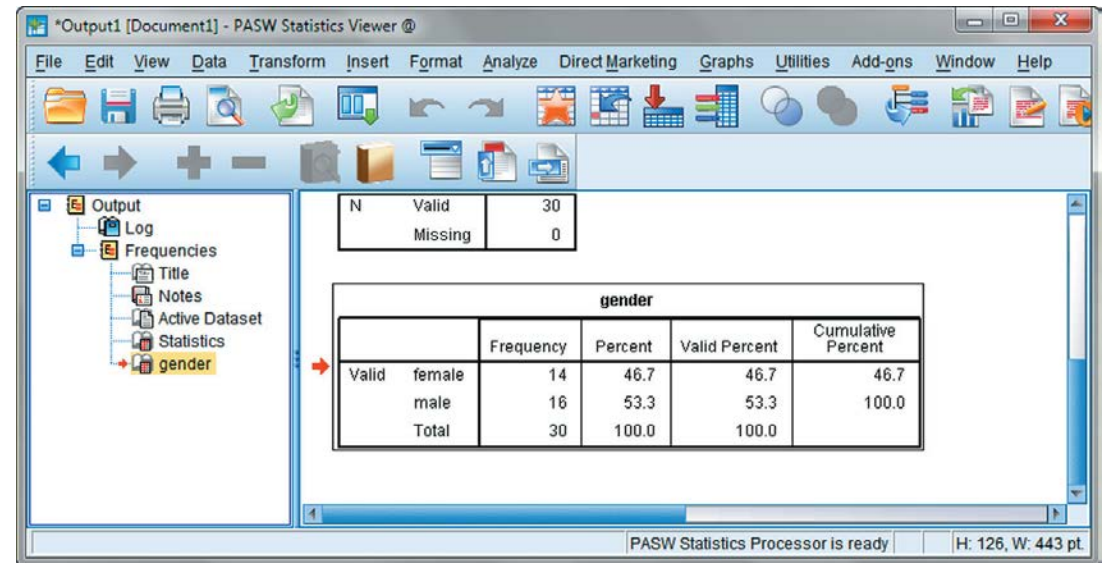
The Data Editor Window

- The Columns contain the variables
- Each variable name is unique and must not be the same as any other
- The rows contain the cases (participants). If there are 200 respondents in your study, then you'll have 200 rows.
- Each cell in the grid contains the value of one subject on one variable.



The Statistic Viewer Window

- It displays the results of all statistical procedures
- It displays the syntax of all analysis done
- It has two panes: right-hand & left-hand.
- Right-hand pane contains statistical tables, charts, and text output.
- Left-hand pane comprises a tree structure, which provides an outline view of the contents.



The screenshot shows the PASW Statistics Viewer window with the following data:

| N | | Valid | 30 |
|---|---------|-------|----|
| | Missing | | 0 |

| gender | | | | | |
|--------|--------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | female | 14 | 46.7 | 46.7 | 46.7 |
| | male | 16 | 53.3 | 53.3 | 100.0 |
| | Total | 30 | 100.0 | 100.0 | |

The interface includes a menu bar (File, Edit, View, Data, Transform, Insert, Format, Analyze, Direct Marketing, Graphs, Utilities, Add-ons, Window, Help), a toolbar with various icons, and a tree view on the left showing the hierarchy: Output > Log > Frequencies > Title > Notes > Active Dataset > Statistics > gender.

Pivot Table Editor

- This window will allow you to edit the contents of a table displayed by SPSS.
- Get to the Pivot Table Editor window by:
 - Double clicking a table
 - Right-clicking a table and choosing “*Edit in ...*” in the context menu .

Pivot Table

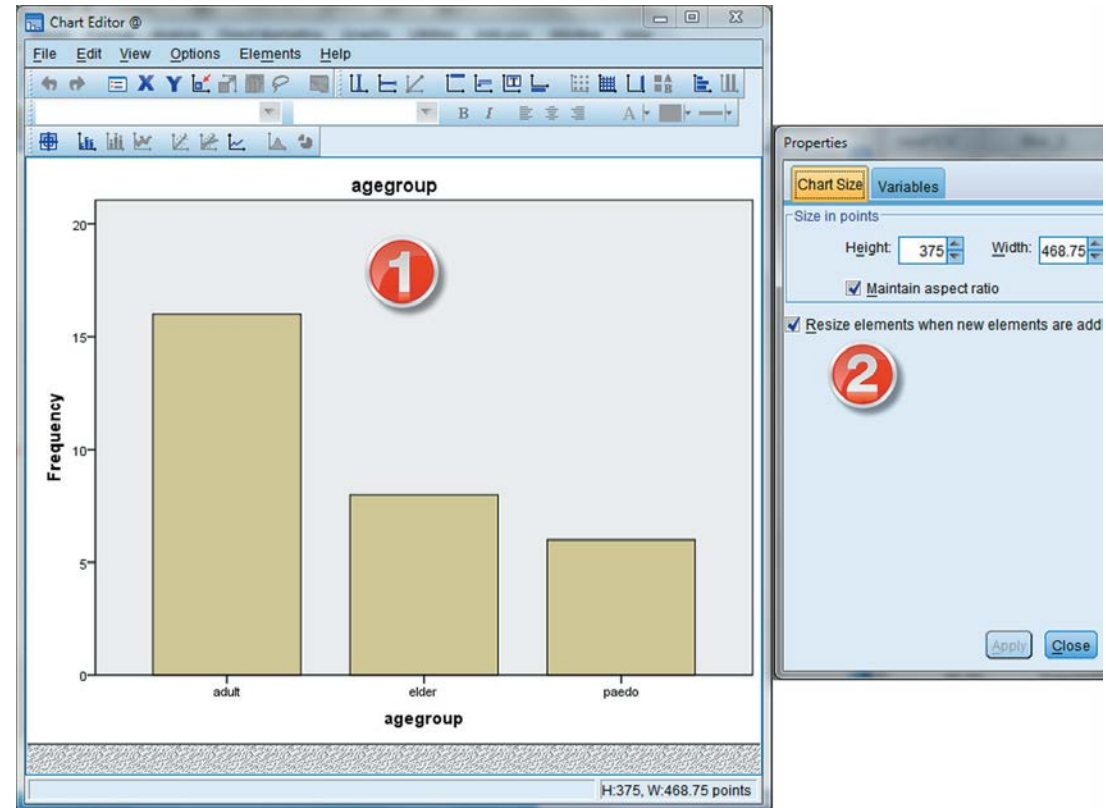
The screenshot shows the SPSS Pivot Table Editor window. The main window displays a pivot table for the variable 'gender'. The pivot table has the following data:

| gender | | | | | |
|--------|--------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | female | 14 | 46.7 | 46.7 | 46.7 |
| | male | 16 | 53.3 | 53.3 | 100.0 |
| | Total | 30 | 100.0 | 100.0 | |

The Pivot Table Editor window is overlaid on the main window, showing the 'Pivot' and 'Statistics' tabs. The 'Pivot' tab is active, and the 'gender' variable is selected in the 'ROW' field. The 'Statistics' tab is also visible, showing the 'COLUMN' field.

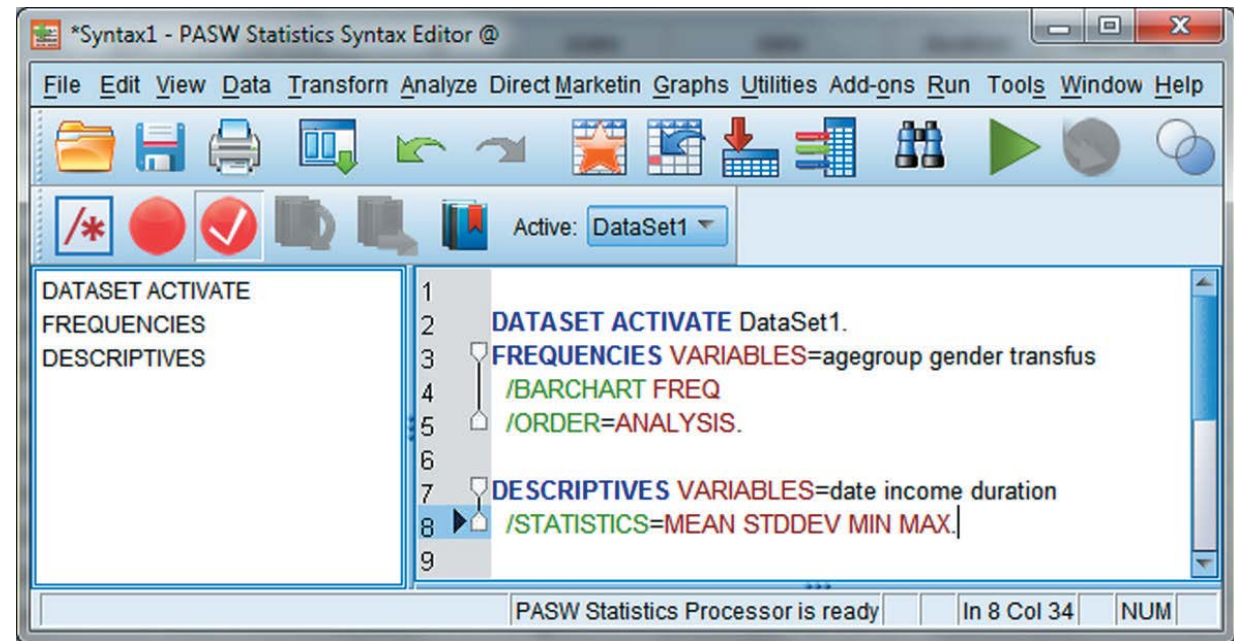
Chart Editor Window

- This is for editing charts produced by SPSS.
- Get to the Chart Editor Window by
 - Double clicking a chart in the Statistic Viewer window
 - Right-clicking a chart and selecting *Edit* from the context menu
- You can change the different attributes like fonts, colours and types of charts



Syntax Editor Window

- Syntax is a computer code which produces a specific output.
- You may use this window if you wish to run SPSS commands instead of clicking on the pull-down menus.
- The Syntax Editor is recommended when there is a need to repeat a procedure.
- Some complex procedures are available using only syntax
- Use the normal SPSS menus to set up the basic commands and paste them on Syntax Editor Window.



Naming variables

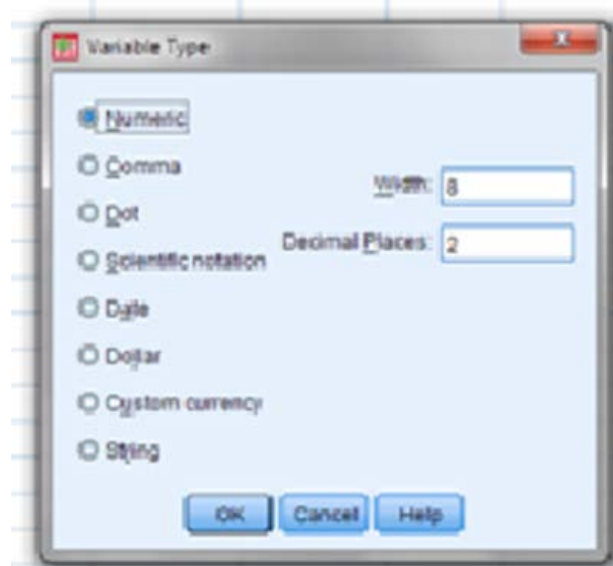
- Do this by clicking a cell in the Name column
- Variable names must begin with a letter
- It cannot start with numbers
- It cannot end with a period.
- Blanks and special characters (!, ?, " -, & and *) cannot be used.
- Each variable name must be unique with no duplications.
- Reserved words: ALL, AND, BY, EQ, GE, GT, LE, LT, NE, NOT, OT, TO, WITH cannot be used as variable names

Specifying Variable Type

After specifying a name, click the next cell to the right, in the Type column to specify the type

The default is “Numeric”

Click the button in the right side of the cell to bring out the dialog box that will allow you to change to the data type



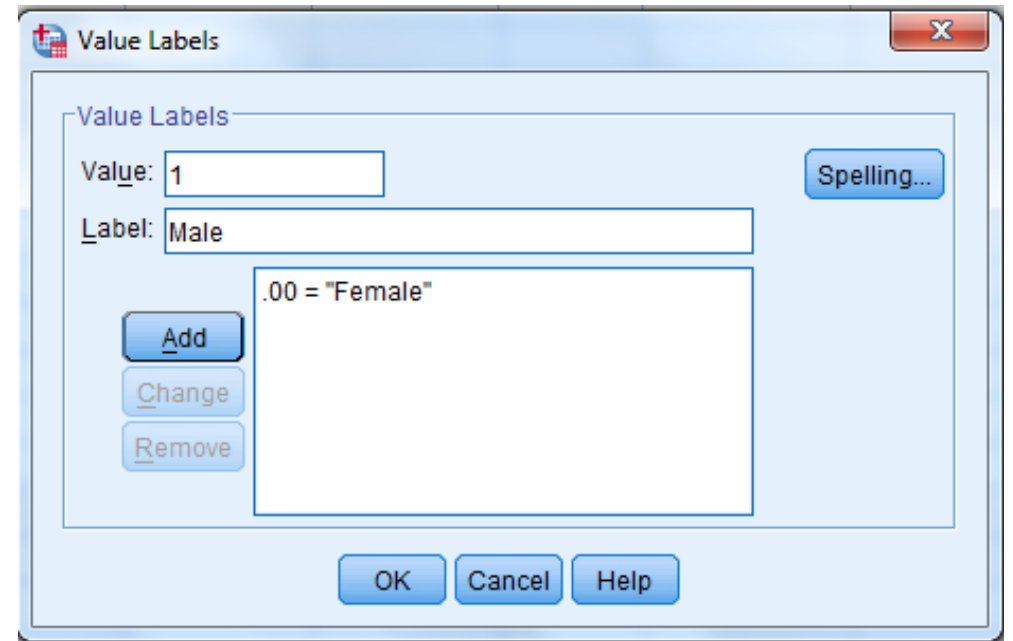
Specifying other Variable attributes

- Width: Number of character places. The default is eight.
- Decimals: number of decimals in case of Numeric type.
- Label: descriptive name of a variable, e.g., if you give a variable the name DOB, the corresponding label can be “Date of Birth in years”.
 - These descriptive labels are displayed in output.
- Values: these are labels attached to category codes. E.g., Female = 0; Male = 1
 - Labels make it fast, easy and more accurate to enter categorical data

How to assign labels to variables

This is only useful for categorical variables e.g. Sex

- Enter the value e.g. 1 in the Value text box,
- Enter the label e.g. Male in the Label text box, then click on Add
- Repeat these step for Female using the value 2
- Finally, click on OK.



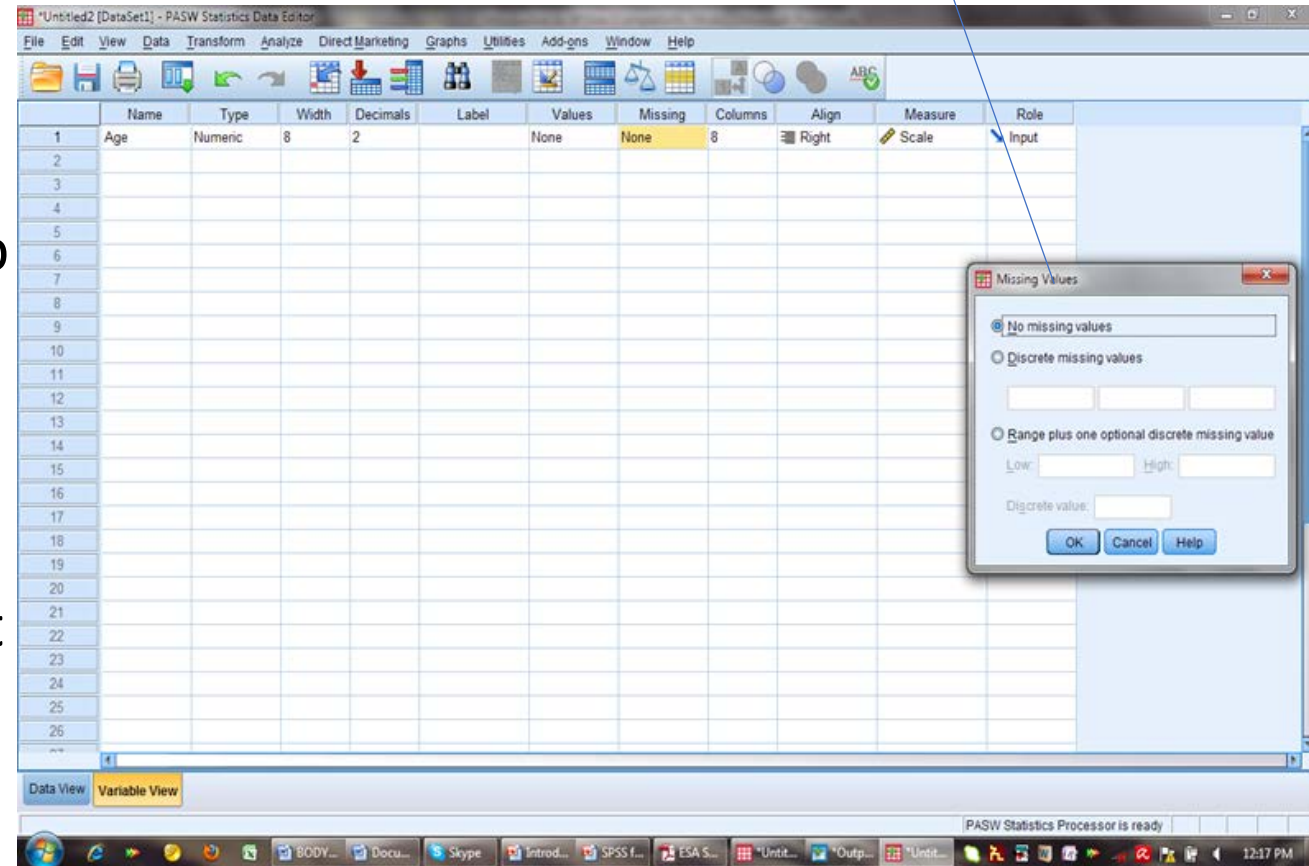
Specifying Missing values

- Missing: defines specified data values as user-missing
- For example, to indicate data that are missing because a respondent refused to answer and data missing because the question didn't apply to that respondent.
- Data values that are specified as user-missing are flagged for special treatment and are excluded from most calculations

Assigning missing values

- Select the cell under missing value column
- Click the button in the cell to bring up the dialogue box for missing values
- Specify the missing values. I use the discrete missing values most of the time
- Note that missing values must have the same type attribute as the parent variable i.e. if the variable is date, then missing values too must be a date

Missing Value dialog box

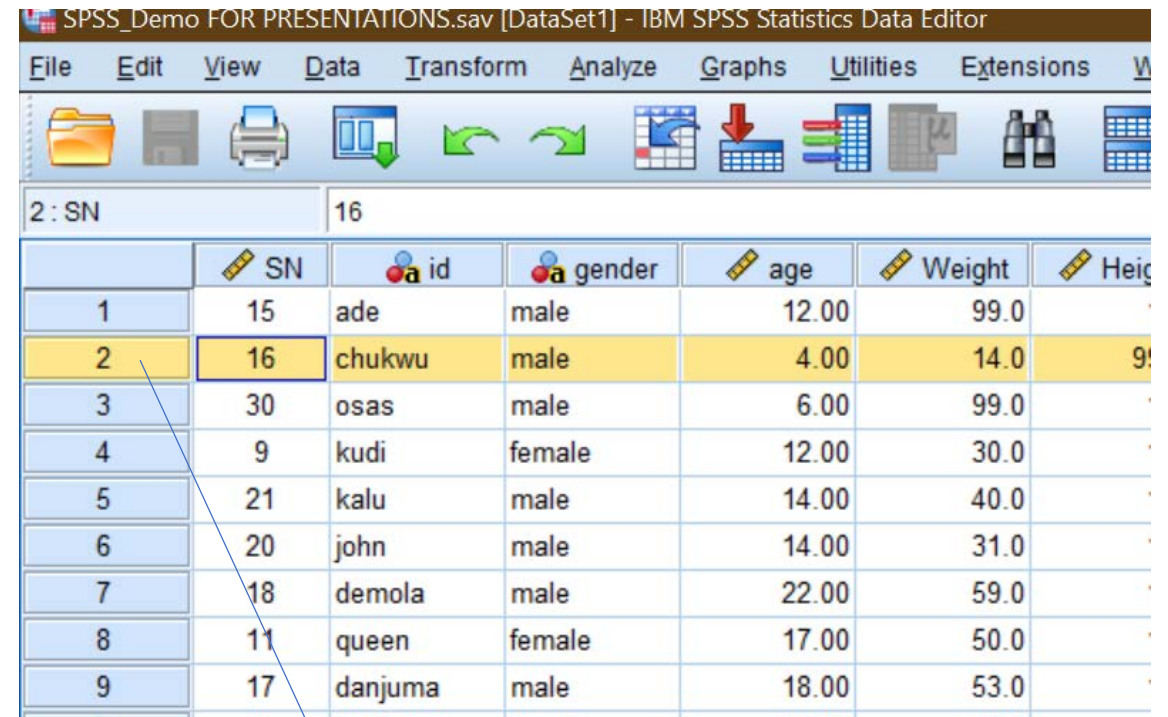


Entering Data

- After missing values have been assigned, you may begin to enter data
- The remaining items on the variable view are automatically entered by the software
- Click Data View tab to go back to the Data Editor window
- The variables you have entered will be seen, each to its own column.
- You enter data into each cell by placing the data in the cell and typing-in the value for the cell

Deleting Cells, Rows or Columns

- To delete an entry for a cell, click on the cell and press **Delete**.
- Entire rows can be deleted by clicking on the grey cell at the left hand side and pressing the **Delete** key on the keyboard.
- Columns (Variables) can be deleted by clicking on the variable title and hitting delete
- To clear contents of columns without deleting the entire column, right-click at the top of the column which contains the variable to be deleted and choose **Clear**.



The screenshot shows the IBM SPSS Statistics Data Editor interface. The title bar reads "SPSS_Demo FOR PRESENTATIONS.sav [DataSet1] - IBM SPSS Statistics Data Editor". The menu bar includes File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, and Extensions. The toolbar contains icons for file operations, navigation, and data manipulation. The main window displays a data table with the following columns: SN, id, gender, age, Weight, and Height. The row index is shown as "2 : SN" and "16". The data table is as follows:

| | SN | id | gender | age | Weight | Height |
|---|----|---------|--------|-------|--------|--------|
| 1 | 15 | ade | male | 12.00 | 99.0 | |
| 2 | 16 | chukwu | male | 4.00 | 14.0 | 99.0 |
| 3 | 30 | osas | male | 6.00 | 99.0 | |
| 4 | 9 | kudi | female | 12.00 | 30.0 | |
| 5 | 21 | kalu | male | 14.00 | 40.0 | |
| 6 | 20 | john | male | 14.00 | 31.0 | |
| 7 | 18 | demola | male | 22.00 | 59.0 | |
| 8 | 11 | queen | female | 17.00 | 50.0 | |
| 9 | 17 | danjuma | male | 18.00 | 53.0 | |

This row had been selected by clicking on the grey cell. To delete this column, just hit **DELETE** key on the keyboard

Data Cleaning

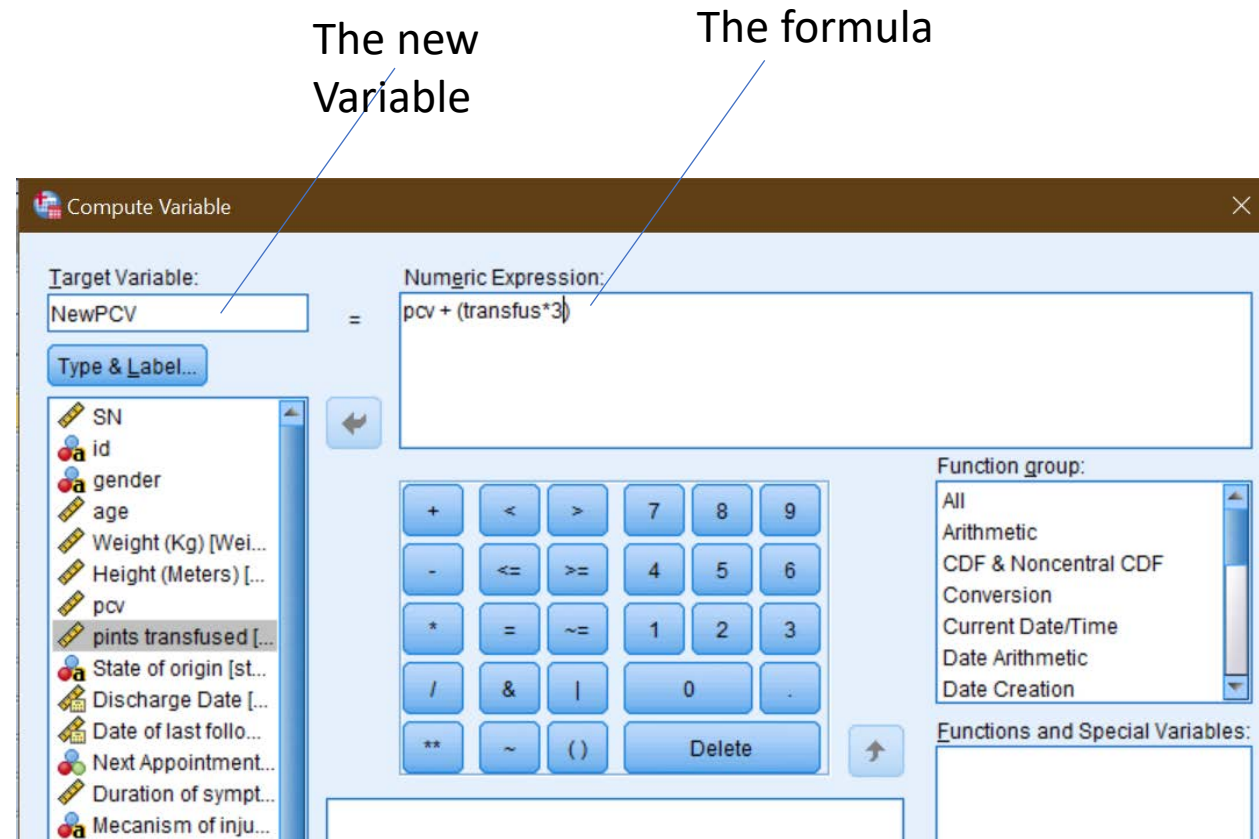
Manipulating (Cleaning) Data

- There are many ways to manipulate your data. This is part of the data cleaning procedures to prepare your data for analysis. Some of the ways you can do this include:
- COMPUTING new variables
- RECODING a variable to another
- DATE and TIME manipulations for creating a unit e.g. Age from a Date variable e.g. Date of Birth
- AUTOMATIC Recode for recoding string variables to numerically coded variables
- BINING which allows you to create groups from a numeric variable. The new groups will be presented as a new variable
- DUMMY VARIABLE allow you to create a binary or dummy variable from a string variable

We will only illustrate Recoding and Computing in this presentation. For further reading, please see my book “**Getting to know SPSS**”

Computing New Variable

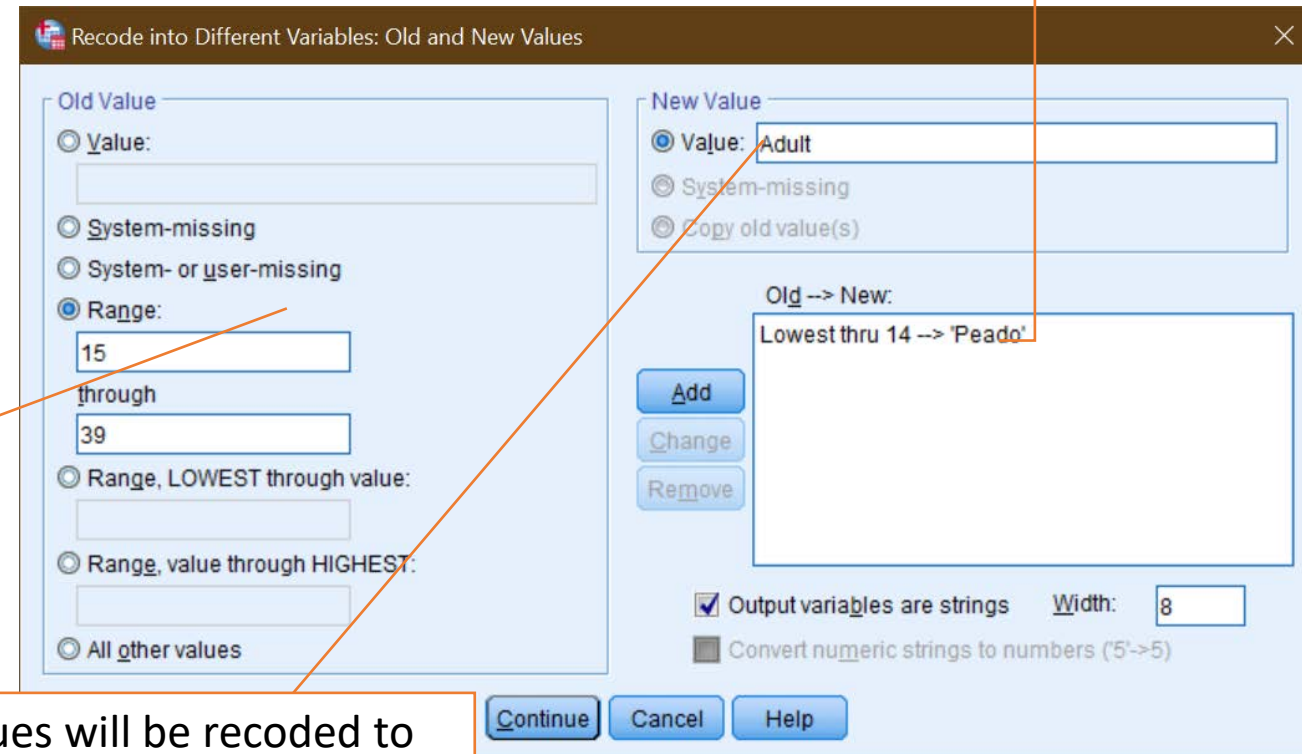
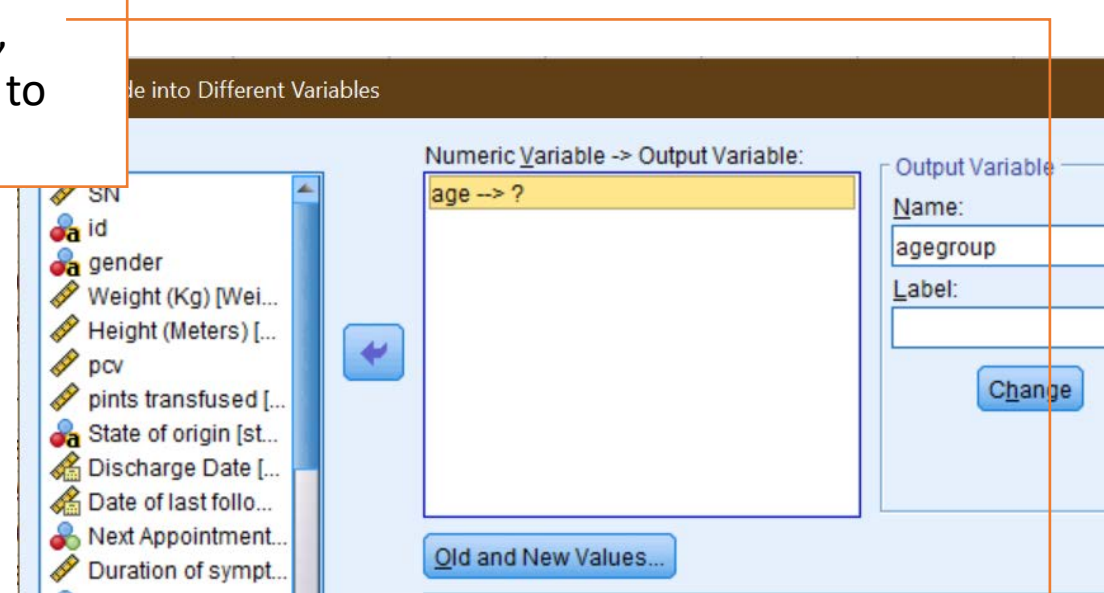
- It is possible to derive a new variable from existing variables, e.g. by combining, summing or dividing them with each other.
- This is done by creating a formula in the Compute dialogue box for SPSS to calculate.
- Use **Transform > Compute Variable**
- In the Target Variable: box enter the name of the new variable to be created.
- In the example we will create NewPCV from the formula, $pcv + (transfuse * 3)$



Recoding

- Use **Transform > Recode into Different Variables**
- Move the variable to be recoded to Variables box
- Write the name of the output variable (the new variable), and click Change
- Click on the Old and New Values button to bring up the second dialog box.
- Click the range and put in the range of values you want to recode into the first category.
- In the new value, put the category name. If this is a text, first check the Output are strings tab.
- Click on the Add button.
- Input the values for the other categories
- Click on continue to go back to the first dialogue box
- Click OK in the first dialog box to create the new variable

This lists the completed steps. Here, Lowest through 14 is to be recoded to Paedo



Values waiting to be recoded

This is what the values will be recoded to

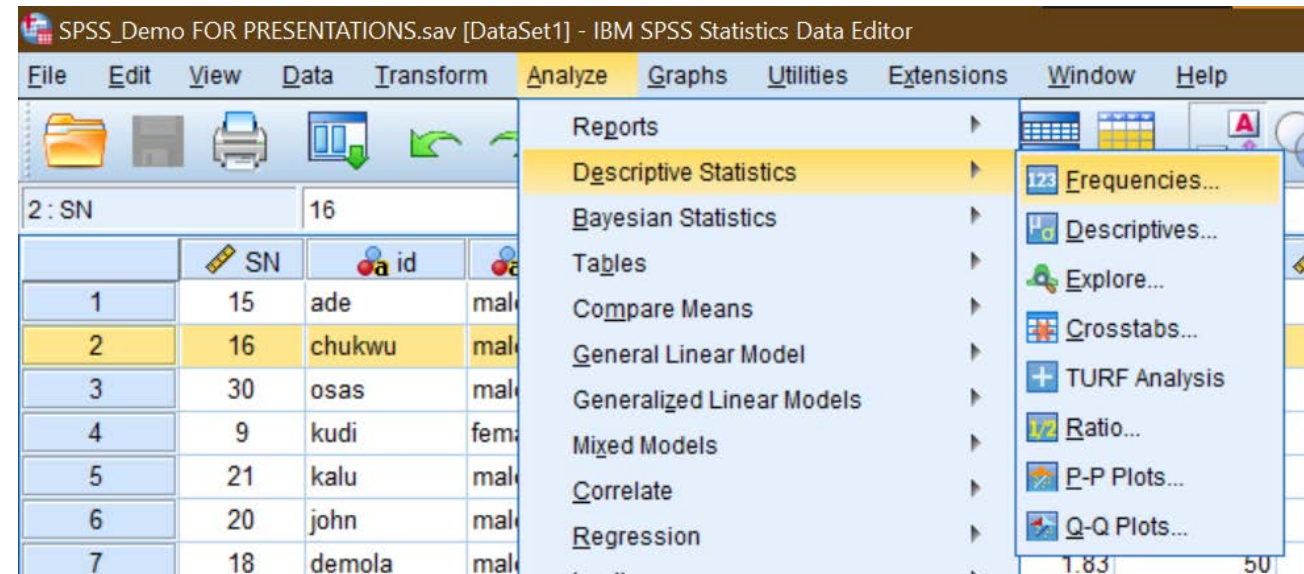
Analysis in SPSS

Intro to Analysis in SPSS

- Once the data has been cleaned, you may begin data analysis
- Analysis is broadly divided into two depending on the number of variables used for the analysis:
 - Univariate: Only one variable is used for the analysis
 - Multivariate: Two or more variables are used for the analysis. Bivariate (with only two variables) is a subset.
- You must always do univariate analysis first, because the result of the statistics may sometimes reveal errors in your data that need correction. In fact, some regard univariate analysis as part of the data cleaning process

Univariate Analysis

- Use **Analyze>Descriptive Statistics** to access most univariate analysis procedures
- Use frequency for categorical variables
- Use Explore and Descriptives for numeric variables
- Crosstabs is strictly speaking, not a univariate analysis.



How to do Frequency

- Click **Analyze>Descriptive Statistics>Frequency**
- In the frequency dialog box, select and move the variables for frequency analysis for to the Variable(s) box
- Make sure that Display frequency tables tab is selected
- Then click OK
- A frequency table of the selected variables will be produced in the Statistics Viewer Window

The frequency table for the two variables in the statistics viewer

List of variables for frequency analysis

The screenshot shows the SPSS interface. The 'Frequencies' dialog box is open, with 'gender' and 'State of origin [state]' selected in the 'Variable(s):' list. The 'Display frequency tables' checkbox is checked. Below the dialog box, the 'Statistics Viewer' window displays two frequency tables.

Frequency Table for gender

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|--------|-----------|---------|---------------|--------------------|
| Valid | female | 14 | 46.7 | 46.7 | 46.7 |
| | male | 16 | 53.3 | 53.3 | 100.0 |
| Total | | 30 | 100.0 | 100.0 | |

Frequency Table for State of origin

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-------|-----------|---------|---------------|--------------------|
| Valid | osun | 2 | 6.7 | 6.9 | 6.9 |
| | delta | 3 | 10.0 | 10.3 | 17.2 |
| | ekiti | 5 | 16.7 | 17.2 | 34.5 |
| | ogun | 3 | 10.0 | 10.3 | 44.8 |
| | kano | 3 | 10.0 | 10.3 | 55.2 |

Interpreting the Frequency output

The screenshot shows the IBM SPSS Statistics Viewer interface. The main window displays two frequency tables. The first table is for the variable 'gender', and the second is for 'State of origin'. The 'gender' table has a red circle around the 'female' category. The 'State of origin' table lists categories: osun, delta, ekiti, ogun, and kano. The left sidebar shows a tree view of the output, with 'Frequency Table' selected under 'Statistics'.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|--------|-----------|---------|---------------|--------------------|
| Valid | female | 14 | 46.7 | 46.7 | 46.7 |
| | male | 16 | 53.3 | 53.3 | 100.0 |
| | Total | 30 | 100.0 | 100.0 | |

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-------|-----------|---------|---------------|--------------------|
| Valid | osun | 2 | 6.7 | 6.9 | 6.9 |
| | delta | 3 | 10.0 | 10.3 | 17.2 |
| | ekiti | 5 | 16.7 | 17.2 | 34.5 |
| | ogun | 3 | 10.0 | 10.3 | 44.8 |
| | kano | 3 | 10.0 | 10.3 | 55.2 |

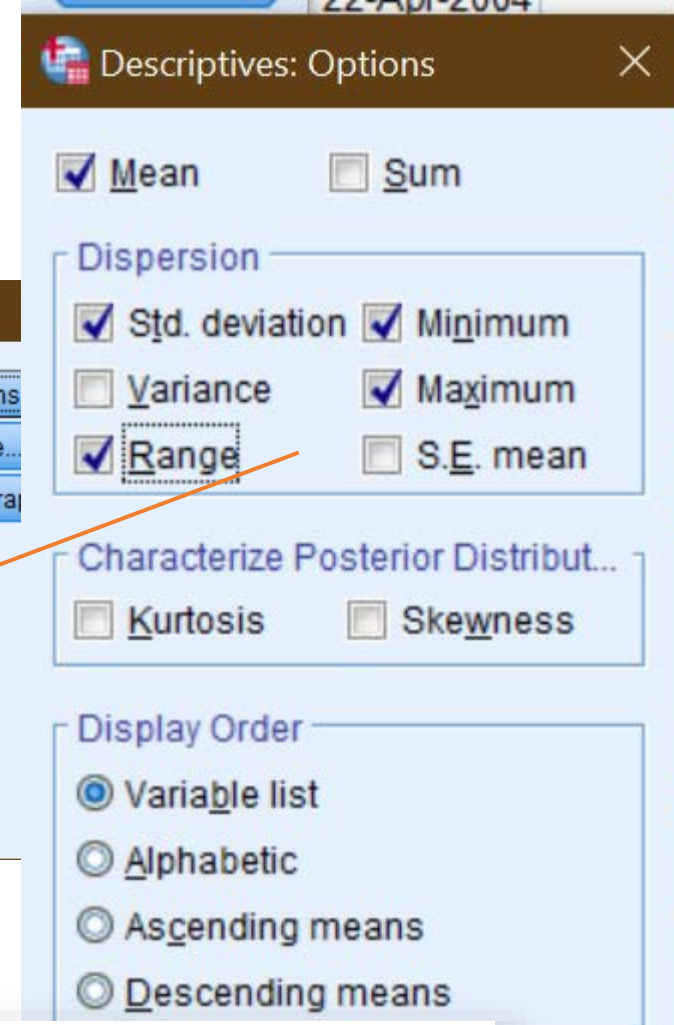
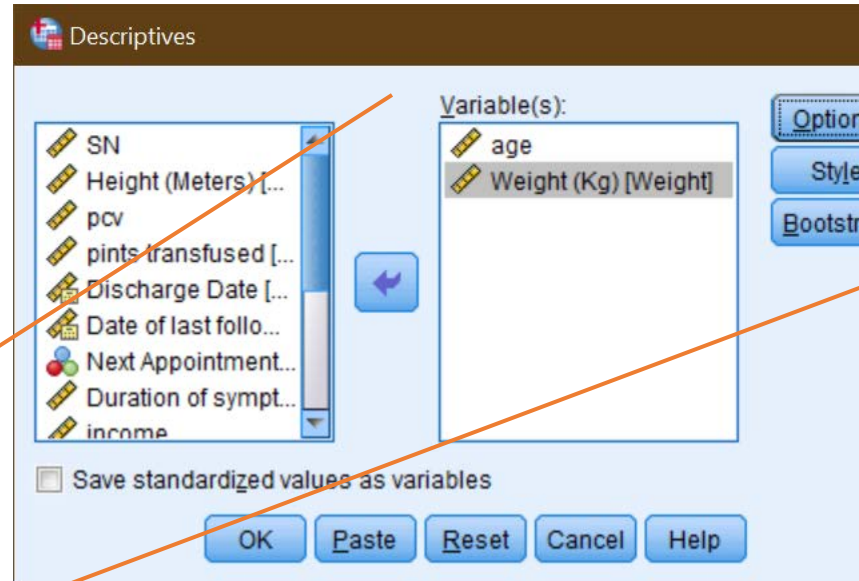
This column contains the categories of the variable

The variable for frequency analysis. Each variable has its table

- The Percent column contains the percentage of each category
- The Valid Percent column excludes missing values
- Both values are the same when there are no missing values
- Valid percent will be greater if there are missing values
- Valid percent should be reported unless the researcher has specific reasons for reporting percent

How to check for Measures of Central Tendency and Dispersion

- You may use the descriptives, explore or even the frequency command for this
- Go to **Analyze>Descriptive Statistics>Descriptives**
- Move the variables to the Variable(s) box
- Click options to select the univariate statistics you want
- Click Continue, then Click OK
- The result will be displayed in the Statistic viewer window



| Descriptive Statistics | | | | | | |
|------------------------|----|-------|---------|---------|---------|----------------|
| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
| age | 30 | 72.00 | 4.00 | 76.00 | 28.8000 | 18.56285 |
| Weight (Kg) | 28 | 88.0 | 14.0 | 102.0 | 63.107 | 19.8501 |
| Valid N (listwise) | 28 | | | | | |

Interpreting the Descriptives Output

→ Descriptives

| Descriptive Statistics | | | | | | |
|------------------------|----|-------|---------|---------|---------|----------------|
| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
| age | 30 | 72.00 | 4.00 | 76.00 | 28.8000 | 18.56285 |
| Weight (Kg) | 28 | 88.0 | 14.0 | 102.0 | 63.107 | 19.8501 |
| Valid N (listwise) | 28 | | | | | |

Each statistic requested has its own column

For example, the Mean age is 28.0000 (SD is 18.56285) and the mean weight is 63.107 (19.8501)

List of variables for Descriptives analysis

Multivariate Analysis

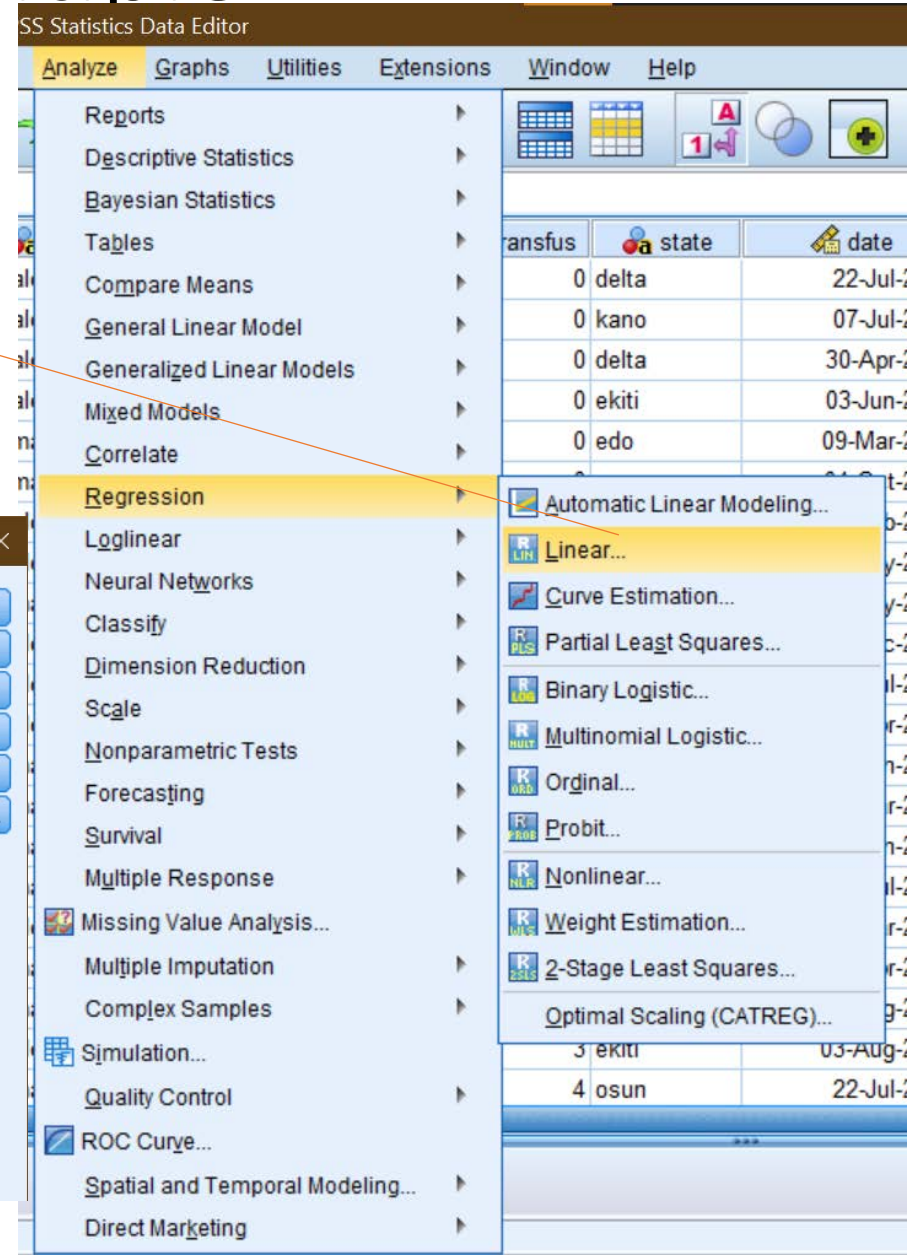
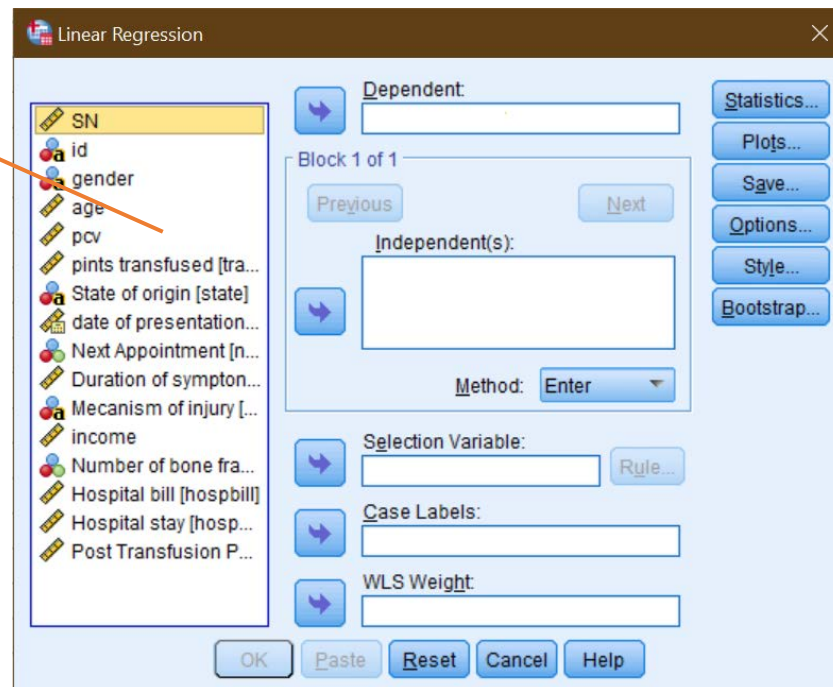
- You can run multivariate Analysis by clicking **Analyze** and making your selection from the menu list
- Broad categories are grouped together to make it easier for you to find the statistics you want to use.
- For example, t-group of statistics and ANOVA are grouped under Compare Means, all correlation statistics are grouped under Correlation and all non-parametric statistics are under
- In the illustration, the cursor is on the Compared means sub menu and the statistics under the submenu are displayed for you to make your selection

The screenshot shows the SPSS Statistics Data Editor interface. The 'Analyze' menu is open, and the 'Compare Means' submenu is selected. The 'Means...' option is highlighted, showing a list of statistical tests. The background shows a data table with columns for state and date.

| state | date |
|-------|-------------|
| edo | 04-May-2004 |
| niger | 09-May-2004 |
| ogun | 21-Dec-2003 |
| enugu | 08-Jul-2004 |
| osun | 22-Apr-2004 |
| ekiti | 02-Jan-2004 |
| edo | 01-Mar-2004 |
| abia | 03-Jun-2004 |
| abia | 07-Jul-2004 |
| edo | 12-Mar-2004 |
| kano | 04-Apr-2004 |
| niger | 03-Aug-2004 |
| ekiti | 03-Aug-2004 |
| osun | 22-Jul-2004 |

Multivariate Analysis: Find multiple Regression

- Click **Analyze>Regression>Linear**
- This gives you the Linear Regression dialogue box where you can carry out both linear and multiple regressions



Rome was not built in a day....

My target for you

- I want you to be able to analyze your project all by yourself. The advantage of doing this is enormous:
- You will know and understand your project better
- As a result, you will have more confidence when defending your project
- You will be preparing yourself for your post-part II life. This is very important especially if you want to go into academics
- Even, if you don't want to do researches, its still good for you to understand statistics.....

How to achieve the target

- **There are no shortcuts!**
- You must **practice** statistics using SPSS (or any other statistic software of your choice)
- I recommend at least 3 hours of practice per week
- Use your project as the motivation (great if you are just starting your project!)
- Use my book, or any other book for learning.

REMEMBER: Practice, practice & practice!

Get my book “Getting to know SPSS”

- Best selling book on the subject in Nigeria
- In its 5th edition!
- Contains all you need to complete your Part II project:
- SPSS
- Zotero or Endnote to manage your reference with ease
- Searching the Internet to make literature review easy



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Getting to Know
SPSS
with Zotero, Endnote, Hinari, Pubmed
and Google Scholar Supplements

THE BEST SELLER IS BACK AND IS VASTLY IMPROVED

- 9 Brand New Chapters - including ANCOVA, Factorial ANOVA, Survival Analysis, Effect Size etc.
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- Includes a new chapter on Zotero, the free reference manager
- And all the old staples that made the book so popular

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**GREAT WORKS
ARE PERFORMED
NOT BY STRENGTH
BUT BY PERSEVERANCE.**

-SAMUEL JOHNSON



**Persistent is the
key to Success**

To ask questions, please join the
forum at www.oluwadiya.com



THANK YOU