

## Week 3: Data Visualization and Reporting

### Objective:

By the end of this week, students should be able to:

Create and customize visualizations in Excel using basic charts, graphs, and dashboards.

Use Power BI to design advanced interactive dashboards with drill-down features, filters, and slicers.

Apply Python to create visualizations using libraries like Matplotlib, Seaborn, and Plotly for deeper data insights and business reporting.

### Session 1: Thursday - Visualization in Excel

#### Lecture Content:

#### 1. Introduction to Data Visualization (Excel)

Importance of Visualization: Visualizations help in interpreting large datasets and making data-driven decisions.

Types of Charts in Excel: Understanding when to use different chart types.

Bar Charts: Compare quantities across different categories.

Line Charts: Show trends over time.

Pie Charts: Show parts of a whole.

Scatter Plots: Show relationships between two variables.

Combo Charts: Combine different types (e.g., bar and line) to display multi-dimensional data.

#### 2. Creating Basic Charts in Excel

Column/Bar Charts: Visualize sales, profits, or revenue across different categories.

Line Charts: Track performance over time (e.g., sales growth over months).

Pie Charts: Display product category breakdowns.

#### Example:

Create a bar chart comparing the total sales of each department in a company over a 12-month period.

#### 3. Building a Simple Excel Dashboard

PivotTables: Summarize and analyze large datasets.

Slicers: Add interactivity to PivotTables and charts.

Conditional Formatting: Highlight key metrics or trends (e.g., color scales for performance indicators).

Case Scenario for Excel: Retail Sales Dashboard

Scenario: A retail business tracks sales data from 5 regions over 6 months. The manager needs to visualize:

Total sales per region.

Monthly sales trends.

Sales distribution by product category.

Steps:

Data Preparation: Import sales data (Date, Region, Sales, Product Category).

Create Charts:

Bar Chart: Compare total sales across regions.

Line Chart: Show sales trends for each region over time.

Pie Chart: Represent the percentage of sales by product category.

Build Dashboard: Combine the visualizations into a single dashboard with slicers to filter by region and month.

Excel Techniques:

Use of Slicers: Allow users to filter data dynamically (e.g., filter by Region).

Conditional Formatting: Highlight top-performing regions or months with green and low-performing ones with red.

Session 2: Saturday - Advanced Visualization in Power BI

Lecture Content:

### 1. Introduction to Power BI

What is Power BI?: A powerful data visualization tool that connects to various data sources and creates interactive dashboards and reports.

Power BI Interface: Learn about the main components: Report View, Data View, and Model View.

### 2. Creating Visuals in Power BI

Basic Visualizations:

Column charts, bar charts, and pie charts.

Table visuals and KPI cards.

Map visualizations for geospatial data.

### 3. Advanced Power BI Features

Drill-Downs: Allows users to click on a visualization and see more detailed data.

Filters and Slicers: Add interactivity and enable users to explore data dynamically.

Bookmarks: Save specific views or states in a report for easy navigation.

Example:

Create a column chart to show revenue by department and implement a drill-down feature to break down revenue by product category within each department.

#### 4. Publishing and Sharing Power BI Reports

Power BI Service: Publish your reports to the Power BI service to share with stakeholders.

Sharing Options: Share reports via email or embed them into web pages.

Case Scenario for Power BI: Financial Reporting Dashboard

Scenario: A finance team wants to create a dashboard to monitor company revenue, expenses, and profit margin for the last 3 years.

Steps:

Data Preparation: Import data (Revenue, Expenses, Profit) from Excel.

Create Visualizations:

Bar Chart: Visualize revenue by department.

Line Chart: Show profit trends over 3 years.

KPI Cards: Display key metrics such as total revenue and total profit.

Interactive Elements:

Filters: Add filters for different years, departments, and categories.

Drill-down: Allow users to click on department revenue and see detailed product-level revenue.

Power BI Techniques:

Creating Drillthroughs: Users can right-click and drill down into more granular data.

Using Slicers and Filters: Allow users to filter data dynamically, e.g., by department or time period.

Independent Work: Lab - Build Interactive Business Reports

Students will work on an interactive business report using:

Excel for basic visualizations and dashboards.

Power BI for advanced, interactive dashboards.

The report should include:

Excel Dashboard: Use PivotTables, slicers, and conditional formatting.

Power BI Report: Include at least two interactive visualizations with drill-downs and slicers.

Expected Outcome:

A business-ready report demonstrating how Excel and Power BI can provide actionable insights through visualizations.

### Session 3: Python for Data Visualization

#### Lecture Content:

#### 1. Introduction to Data Visualization in Python

Python Libraries: Overview of essential libraries for data visualization.

Matplotlib: Basic charting and plotting.

Seaborn: Statistical visualizations.

Plotly: Interactive, web-ready visualizations.

#### 2. Creating Visuals with Matplotlib

Basic Line and Bar Charts: Plotting simple charts.

Customizing Visuals: Add titles, labels, and gridlines.

#### 3. Advanced Visuals with Seaborn

Pairplot: Visualize relationships between multiple variables.

Heatmaps: Show correlations between features in a dataset.

#### 4. Interactive Visuals with Plotly

Creating Interactive Dashboards: Use Plotly for interactive charts that allow zooming, hover-text, and click events.

#### Example:

Create a pairplot of a sales dataset to show relationships between sales volume, advertising spend, and product category.

#### Case Scenario for Python Visualization: Marketing Analysis

Scenario: A marketing team needs to analyze the impact of advertising spend on sales performance.

#### Steps:

Data: Import a dataset with columns for advertising spend, sales, and product category.

#### Matplotlib Visualization:

Create a scatter plot to visualize the relationship between advertising spend and sales.

Customize with titles and labels.

#### Seaborn Heatmap:

Show correlations between various marketing channels and sales.

#### Plotly Dashboard:

Build an interactive chart for sales and advertising trends over time.

#### Python Techniques:

Seaborn Pairplot: For exploring relationships between multiple numerical variables.

Plotly Interactive Dashboards: To create web-based interactive visualizations.

Summary and Conclusion

Excel: Ideal for creating quick and interactive dashboards using slicers and PivotTables.

Power BI: More advanced tool for creating highly interactive, shareable dashboards with drill-downs and real-time updates.

Python: Offers flexibility in creating custom, interactive visualizations with libraries like Matplotlib, Seaborn, and Plotly, ideal for more complex data analysis.

Assignment: Data Visualization Project

Objective: Students will create a final project that integrates all the concepts learned:

Excel: Build a dashboard with key visualizations (e.g., sales, finance, or HR data).

Power BI: Create an interactive report with filters, drilldowns, and KPIs.

Python: Visualize data using Python (e.g., scatter plots, heatmaps, pairplots).

Evaluation Criteria:

Clarity of Visualizations: How clearly do the visualizations communicate key insights?

Interactivity: Are the reports interactive and easy to use?

Insight Generation: Do the visualizations help in understanding key business trends and making decisions?

This lecture plan should give students a comprehensive understanding of data visualization and equip them with the skills to create meaningful, interactive reports and dashboards.

Week 3: Data Visualization and Reporting

Objective:

By the end of the week, you will be able to:

Create dynamic, interactive visualizations in Excel and Power BI. Visualize business data and gain insights using Python libraries (Matplotlib, Seaborn, Plotly). Build real-world reports to inform decision-making.

Thursday (6:00 PM - 8:00 PM): Visualization in Excel (Charts, Graphs, Dashboards)

Introduction to Excel Visualization

Let's start by discussing the role of data visualization in Excel. Visualization allows you to turn raw data into insights that are visually easy to understand. With tools like Charts, Graphs, and Dashboards, you can quickly analyze business data and create reports that help make decisions.

1. Types of Excel Charts

Bar and Column Charts: Great for comparing categories. A bar chart works well for categories like products, sales departments, or regions.

Line Charts: Best for showing trends over time. For example, you might use a line chart to show monthly sales growth.

Pie Charts: Useful for showing proportions, like how each product contributes to total sales.

Scatter Plots: Used to show relationships between two variables (e.g., advertising spend and sales).

Case Scenario: Retail Business Dashboard

Scenario: You are tasked with creating a dashboard for a retail business that tracks sales by department, monthly trends, and the percentage of sales by product category.

Step 1: Prepare Your Data Your sales data should include columns like:

Date  
Region  
Department  
Product Category  
Sales Amount

Example:

Date	Region	Department	Product Category	Sales Amount
2024-01-01	East	Electronics	Mobile	500
2024-01-01	West	Apparel	Shoes	200
2024-01-02	East	Electronics	Laptop	1000

Step 2: Create Bar Charts Create a Bar Chart to visualize total sales by department.

Steps:

Select the data range.

Go to Insert > Bar Chart and choose a Clustered Bar chart.

Excel will generate a bar chart showing the sales for each department.

Step 3: Create Line Chart for Monthly Trends To visualize sales trends over time:

Use a Line Chart to show how sales fluctuate over months.

Plot the Date on the x-axis and Sales Amount on the y-axis.

Step 4: Create a Pie Chart for Product Category Breakdown A Pie Chart can show how much each product category contributes to total sales.

Select sales by category.

Go to Insert > Pie Chart, and Excel will display the percentage breakdown of sales per category.

Step 5: Create a Dashboard Combine these charts into a dashboard by placing them in a single worksheet.

Use PivotTables to summarize the data. For example, a PivotTable could show sales by region.

Add Slicers for interactivity, allowing users to filter by region or department.

Practical Exercise:

Take a sample retail dataset and create a Dashboard with a Bar Chart, Line Chart, and Pie Chart. Add Slicers to filter the data by region and department.

Saturday (6:00 PM - 8:00 PM): Advanced Visualization in Power BI (Dashboards, Drilldowns, Filters)

Introduction to Power BI

Power BI is a business intelligence tool that enables you to connect to various data sources, perform analysis, and create interactive reports and dashboards. Unlike Excel, Power BI is designed to handle larger datasets and allow for advanced features like drill-downs, filters, and real-time updates.

1. Creating Visuals in Power BI

Column Charts: Visualize category comparisons, such as sales per region or department.

Line Charts: Show trends over time. For example, monitor the performance of sales month-to-month.

Map Visualizations: Use Power BI's ability to plot data on maps for geospatial analysis.

KPI Cards: Display key metrics (e.g., total sales, profit margin) at a glance.

Case Scenario: Financial Reporting Dashboard

Scenario: A finance department wants to create a financial dashboard to monitor:

Total Revenue

Total Expenses

Profit Margin by department for the last 3 years.

Step 1: Data Import

Import data from Excel, CSV, or connect to a database (e.g., SQL Server).

Your data might look like this:

Department	Revenue	Expenses	Date
Marketing	5000	3000	2022-01-01
Sales	8000	4000	2022-01-01

Step 2: Create a Column Chart

Use the Column Chart to show Revenue by Department.

Select Department for the axis and Revenue for the values.

Step 3: Create a Line Chart for Trends

Create a Line Chart showing Revenue Trends Over Time.

Use the Date field on the x-axis and Revenue on the y-axis.

Step 4: Add Filters and Drilldowns

Add a Date filter to allow users to filter by year or quarter.

Implement a Drillthrough feature. For example, allow users to click on a department's revenue and see a detailed breakdown of expenses by category for that department.

Step 5: Create Interactive Dashboards

Combine these visuals into an interactive dashboard.

Add Slicers to let users filter by year or department.



Practical Exercise:

Create a financial dashboard in Power BI with the given dataset, including visualizations, drilldowns, and slicers.

Independent Work: Lab - Build Interactive Business Reports

This lab focuses on creating interactive reports using Excel and Power BI. You will:

Design an Excel Dashboard using charts, PivotTables, and slicers.

Create a Power BI Dashboard that includes drilldowns and slicers.

Python for Data Visualization

1. Introduction to Python Visualization Libraries

In Python, there are several libraries to create visualizations:

Matplotlib: The most basic library for creating static plots.

Seaborn: Built on top of Matplotlib, Seaborn makes it easier to create statistical plots.

Plotly: For interactive charts that can be shared on websites.

2. Creating Visualizations with Matplotlib

Matplotlib is perfect for creating simple, static plots.

Line Plot:

Use `matplotlib.pyplot.plot()` to create line plots.

```
import matplotlib.pyplot as plt
```

```
months = ['January', 'February', 'March', 'April']
```

```
sales = [200, 450, 300, 500]
```

```
plt.plot(months, sales)
```

```
plt.title('Monthly Sales')
```

```
plt.xlabel('Month')
```

```
plt.ylabel('Sales ($)')
```

```
plt.show()
```

Bar Plot:

Use `bar()` to create bar charts.

```
plt.bar(months, sales)
```

```
plt.title('Monthly Sales Comparison')
```

```
plt.xlabel('Month')
```

```
plt.ylabel('Sales ($)')
```

```
plt.show()
```

3. Seaborn for Statistical Plots

Seaborn makes it easier to create more complex visualizations, like heatmaps, pairplots, and violin plots.

Heatmap: Visualize correlations in data.

```
import seaborn as sns
import pandas as pd
data = {'Sales': [100, 200, 300], 'Advertising': [50, 75, 100], 'Profit': [20, 30, 50]}
df = pd.DataFrame(data)
sns.heatmap(df.corr(), annot=True)
plt.show()
```

Pairplot: Show relationships between multiple variables.

```
sns.pairplot(df)
plt.show()
```

#### 4. Plotly for Interactive Visualizations

Plotly lets you create interactive charts. These charts allow users to zoom in, hover over data points, and click on legends.

Interactive Line Chart:

```
import plotly.express as px
fig = px.line(df, x='Month', y='Sales', title='Monthly Sales')
fig.show()
```

Practical Exercise:

Python Exercise: Create a line chart and bar chart in Matplotlib. Then, create a heatmap with Seaborn and an interactive plot with Plotly.