DATA ANALYSIS & INSIGHTS

WELCOME TO DAY 1
WELCOME & INTRODUCTIONS
COURSE OVERVIEW

DAY 1
Gathering, working with, visualizing, and contextualizing data

DAY 2
Thinking critically and analytically, using problem-solving frameworks, and making decisions and recommendations

DAY 3
Presenting findings, creating a call to action, and sharing participant work
### COURSE FRAMEWORK

**ORGANIZE**
- Data Preparation
- Business Math
- Working with Data

**TRANSLATE**
- Visualization
- Infographics
- Dashboards
- Contextual Thinking

**ANALYZE**
- Drawing Conclusions
- Analytical Thinking
- Problem Solving
- Decision Making & Recommendations

**COMMUNICATE**
- Communication Plan
- Storytelling
- Framing Benefits
- Call to Action
AGENDA

START

WELCOME & INTRODUCTIONS

DATA PREPARATION

Getting to know each other and reflecting on individual learning goals.

Thinking broadly about data. Reflecting on opportunity costs. Getting ready to work with sample data sets.
AGENDA

WORKING WITH DATA

Working with sample data to practice core calculations, filtering, and pivoting.

Practicing with visual cues and applying contrast for better communication. Decluttering and getting to the point.

BUSINESS MATH

Identifying categories of data. Determining the right chart or graph for the job. Recognizing chart or graph formats to avoid.

VISUALIZATION

Practicing with visual cues and applying contrast for better communication. Decluttering and getting to the point.
AGENDA

REFLECTION, ASSIGNMENTS, & WRAP-UP

Creating preliminary infographic elements. Selecting metrics and indicators for dashboards.

CONTEXTUAL THINKING

Reflecting on the workshop experience. Identifying valuable concepts from today’s training.
WHAT’S IN IT FOR ME?

Examine essential steps for organizing data and beginning an analysis.

Practice core calculations in Excel.

Understand and select effective chart types.

Use tools and techniques to transform graphs and charts so they communicate with visual impact.

Assemble some preliminary infographics and dashboards.

Identify and develop Key Performance Indicators (KPIs) to use during your data analysis.

Based on valid KPIs, begin forming conclusions about your data analysis.

Develop a presentation that allows for easy decision-making for stakeholders.
INTRODUCTIONS & GOALS

What is your name?

What is your business? Position? Role? Location?

What would you like to get out of this experience?
- “When I get back to work, I want to ...”
- “My time here will be well spent if ...”
DATA PREPARATION
IDENTIFYING YOUR PROBLEM
& DEFINING YOUR QUESTIONS
EVERY GOOD STORY HAS A PROBLEM

Are you trying to solve the right one?
FINDING THE DATA

Where will the data come from?
Are you gathering quality data?
What else do you need to know?
Where can you get more data?
Who will make use of your analysis?
GATHERING COMPLETE INFORMATION
Avoid generalizing. Gather the right data for the right audience, even if that means creating separate presentations.

While gathering information, keep the purpose in mind. What will people need to know or do with this data?

Is the data already out there, or do you need to conduct interviews, organize focus groups, make observations, or do additional research?
THREE DATA-GATHERING QUESTIONS

- Who is the audience?
- Who will make decisions based on your findings?
- What do you know about this person or group of people?
- Do they have biases that might lead them to support or resist your message?
THREE DATA-GATHERING QUESTIONS

What? What data is available to strengthen your case?

Is your audience familiar with this data or is it new to them?

What are the risks? Find the weak points and address them.

What will a successful outcome look like?
THREE DATA-GATHERING QUESTIONS

Within the limitations of the time and space that you have available to you, **how** will you tell your story?
GATHERING COMPLETE INFORMATION

Dates and Times
Dates and times for the span of data collected are clear.

Locations
Locations from where data was gathered are documented.

Measurements
Metrics are consistent and conversions are applied where necessary.
TROUBLESHOOTING INCOMPLETE DATA

Examine the case study assigned to your group.

Consider how the lack of complete data may hold up progress on this task or project.

List some ways that you might be able to overcome this obstacle.

Consider what you would share with others as best practices for gathering complete information. Develop some practical advice.
WORKING WITH DATA
CHOOSING THE RIGHT CHART TYPE
FOUR CATEGORIES FOR WORKING WITH DATA
COMPARISON

OVER TIME

VERTICAL BAR CHART

Single or Few Categories

LINE CHART

Many Categories

CIRCULAR AREA CHART

Cyclical Data

LINE CHART

Non-Cyclical Data

AMONG ITEMS

VERTICAL BAR CHART

Few Categories

HORIZONTAL BAR CHART

Single Variable

Few Categories

TABLE WITH EMBEDDED CHARTS

Single Variable

Many Categories

VARIABLE WIDTH COLUMN CHART

Two Variables Per Item

ORGANIZE

TRANSLATE

ANALYZE

COMMUNICATE
RELATIONSHIP

SCATTERPLOT
Two Variables

SCATTERPLOT BUBBLE SIZE
Three or More Variables

ORGANIZE  TRANSLATE  ANALYZE  COMMUNICATE
DISTRIBUTION

BAR HISTOGRAM
Few Data Points

LINE HISTOGRAM
Many Data Points

SCATTERPLOT
Two Variables

Single Variable

ORGANIZE  TRANSLATE  ANALYZE  COMMUNICATE
WHAT TYPE OF STORY DO YOU NEED TO TELL?

You’ve sampled the weights of 20 random finished and packaged standard five-pound boxes of washers and need to show that there’s too much variation.
You’ve sampled the weights of 20 random finished and packaged standard five-pound boxes of washers and need to show that there’s too much variation.
WHAT TYPE OF STORY DO YOU NEED TO TELL?

You have plastics traveling through a factory line and need to measure the thickness as it’s affected by 20 different processes when it moves through the line.
WHAT TYPE OF STORY DO YOU NEED TO TELL?

You have plastics traveling through a factory line and need to measure the thickness as it’s affected by 20 different processes when it moves through the line.
WHAT TYPE OF STORY DO YOU NEED TO TELL?

You have multiple populations and need to highlight key differences among them.
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WHAT TYPE OF STORY DO YOU NEED TO TELL?

You need to communicate a variety of responses to a customer experience survey (65% strongly agree, 22% somewhat agree, ... etc.).
You need to communicate **a variety of responses** to a customer experience survey (65% strongly agree, 22% somewhat agree, ... etc.).
### USE PROMPTS TO HONE THE MAIN IDEA

<table>
<thead>
<tr>
<th>What am I trying to say or show?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A relationship between increased automation in manufacturing and fewer jobs being available. Automation increases profits but creates a need for new jobs that are hard to fill.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I need to convince my audience that ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Although profits are higher, robots are killing manufacturing jobs and creating a massive skills gap that offsets those short-term gains.</td>
</tr>
</tbody>
</table>
**USE PROMPTS TO HONE THE MAIN IDEA**

<table>
<thead>
<tr>
<th>What am I trying to say or show?</th>
<th>I need to convince my audience that ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>The relationship between unbundling products and declining revenue.</td>
<td>Unbundling our software suite will devastate revenue streams.</td>
</tr>
<tr>
<td>What am I trying to say or show?</td>
<td>I need to convince my audience that ...</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Our customer base is a large, growing, diverse, and underserved market.</td>
<td>Growth in the market is coming from consumers who are hungry for cloud-based services, younger, and more technically savvy than they think.</td>
</tr>
</tbody>
</table>
LOOK FOR THE AHA! MOMENT

Your audience just wants to understand the point. **Look for ways to help them have that aha! moment.**

- **Ask** yourself, “What’s the story?”
- **Use** categories and prompts to help you get there
- **Try** making some sketches
- **Solicit** opinions and reactions from colleagues
- **Listen** carefully to responses and let them shape the way you decide to tell the story
LUNCH BREAK
DIRECTING THE AUDIENCE’S ATTENTION
AUDIENCE ATTENTION IS DRAWN TO DIFFERENCE

Orientation  Shape  Length  Width
Size  Curvature  Added marks  Enclosure
Hue  Intensity  Spatial position  Motion

ORGANIZE  TRANSLATE  ANALYZE  COMMUNICATE
Layering a few of these visual differentiators will usually achieve the most dramatic effect.

Let’s take a look at an example that layers the differentiators of position, color / intensity, and added marks.
LITTLE DIFFERENTIATION

Weighted Performance Index

- Competitor A
- Competitor B
- Competitor C
- Our business
- Competitor D
- Competitor E

Price
Convenience
Relationship
Service
Selection

0 1 2 3 4 5 6

ORGANIZE
TRANSFORM
ANALYZE
COMMUNICATE
Weighted Performance Index

- Competitor A
- Competitor B
- Competitor C
- Our business
- Competitor D
- Competitor E

<table>
<thead>
<tr>
<th>Feature</th>
<th>Competitor A</th>
<th>Competitor B</th>
<th>Competitor C</th>
<th>Our business</th>
<th>Competitor D</th>
<th>Competitor E</th>
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</thead>
<tbody>
<tr>
<td>Price</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>0</td>
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<tr>
<td>Convenience</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Relationship</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Service</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Selection</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>
ADDED MARKS

Weighted Performance Index | Relative Rank

<table>
<thead>
<tr>
<th>Category</th>
<th>Our Business</th>
<th>Competitor A</th>
<th>Competitor B</th>
<th>Competitor C</th>
<th>Competitor D</th>
<th>Competitor E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>1 of 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convenience</td>
<td></td>
<td>2 of 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td></td>
<td></td>
<td></td>
<td>6 of 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 of 6</td>
<td></td>
</tr>
</tbody>
</table>
**Prettentione Attributes**

**Bold text** signals important concepts, topics, or main ideas.

**Color** can signal importance but also provide identification or convey a certain feeling or mood.

*Italics* grab attention but also add emphasis or signify supplemental information.

Increased text **size** can make important concepts or types of text (e.g., headings) stand out from the rest.
MORE PREATTENTIVE ATTRIBUTES

Underlining is an alternative to bold or italics

Outlining text can make a bolder statement than underlining

Spatial separation

The use of white space (e.g., space between a heading and the body text that follows) is another effective way to help your audience slow down and pay attention to a key idea.
REFLECTION, ASSIGNMENTS, & WRAP-UP
What did you get out of this training workshop?

Was there anything from today’s methods, models, or best practices that stood out for you?

What’s one thing that you could change about what you do, or how you do it, when you return to work?

Did you get what you expected?
15-MINUTE KPI READING

Take the next 15 minutes to complete the assigned reading on KPIs. We will debrief when we discuss this concept again during our Day 2 class.
Instructions for self-directed assignment: prepare presentation including data analysis and insights, storytelling methods, a chart, an infographic, and the beginnings of a dashboard.

Watch two videos from the Storytelling with Data blog: (1) Declutter and (2) Contrast.

Assignment: Find a time this week to speak with your manager about finding two or three KPIs that you are accountable for or that your group is measured by.

Complete Day 1 Evaluation.
Data Analysis & Insights
Facilitator Guide Day 1
Five Tips for Great Instruction
In addition to being able to draw upon your experience and subject matter expertise, great instructors know how to ...

- Be a Guide on the Side vs. Sage on the Stage: Share what you know, and then allow space for the participants to explore and connect with the material and each other’s contributions
- Be a Consummate Host: Invite discussion, listen attentively, involve everyone, be positive and non-judgmental, and manage the pace and timing to keep things on track
- Be an Energizer: Share your passion and energy authentically with expressions, vocal variety, and body language (within your comfort zone) to raise the energy level of the room
- Be a Coach: Provide your own motivational stories, give clear instructions, check for understanding, and reinforce the importance of practice by encouraging full engagement in activities
- Be a Leader’s Leader: Be a role model for curiosity and opening your mind to new ideas while in a position of seniority

Throughout the course, please find opportunities to informally share best practices with the participants.

Facilitator Overview: Providing Feedback
The primary objective of this course is to inspire participants to hold themselves and their organization to the highest of standards. Therefore, it is critical for you to provide constructive, detailed, and behavior-based feedback following each exercise. You must be willing to spend time to pay attention to the exercises. You must also provide both developmental and motivational feedback.

The following are a few additional notes on the effective delivery of feedback:

- Be specific about what the participant did or said and why it was effective or ineffective
- Always provide the feedback in terms of behaviors and not in terms of perceptions, inferences, or personal traits; focus the feedback on what participants say or do and never on who they are
- State why you think what they did or said was effective or ineffective
- Whenever applicable, explore and suggest alternative actions so that participants can improve
- Whenever applicable, reinforce how alternative actions will be more effective
• Look for additional opportunities to provide feedback such as at breaks, during lunch, at the conclusion of the day, or possibly at a separate time for those who are interested

Remember: Behaviors can be seen or heard. Inferences are based on conclusions we draw from our perceptions.

Facilitator Overview: Class Size and Timing
• The ideal class size is 25 participants
• When you use small-group activities, find opportunities to allow the participants to work with a variety of classmates; ask people to form mixed groups in an organized way (“Let’s count off by six and form six groups!”), get them to move to their new workspaces, and then provide the instructions for your activity
• Your allotted time has been designed according to accepted instructional principles with recourse to the complete set of sessions that are included in this workshop; your time must include your personal introduction, your presentation, setting up and debriefing any activities, and responding to questions

Course Materials
Participants will be provided with a workbook to record the discussion themes, notes, takeaways, and action plans.

Classroom Supplies
Name table tents
Flip chart
Excel and PowerPoint files
  • Project Estimating Worksheet (XLS)
  • Fleet Hour Dataset (XLS)
  • Example Pivot Table (XLS)
  • Hurricane Dataset (XLS)
  • Preattention Attributes Activity Slides (PPT)
Post-It Notes
Markers
KPI Reading
Icon Key

- Present Slide
- Say
- Transition
- Activity
- Do
- Facilitator Note
- Ask
- Reflection Activity
- Materials Required
- Debrief
- Pairs Activity
- Small-Group Activity
- Large-Group Activity
- Explore
- Navigate
- Break
- Lunch Break
## Day 1 Agenda

<table>
<thead>
<tr>
<th>Order</th>
<th>Module Name</th>
<th>Duration</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Welcome &amp; Introductions</td>
<td>60 minutes</td>
<td>8:00–9:00 a.m.</td>
</tr>
<tr>
<td>1.2</td>
<td>Data Preparation</td>
<td>60 minutes</td>
<td>9:00–10:00 a.m.</td>
</tr>
<tr>
<td></td>
<td>Break</td>
<td>15 minutes</td>
<td>10:00–10:15 a.m.</td>
</tr>
<tr>
<td>1.3</td>
<td>Business Math</td>
<td>30 minutes</td>
<td>10:15–10:45 a.m.</td>
</tr>
<tr>
<td>1.4</td>
<td>Working with Data</td>
<td>45 minutes</td>
<td>10:45–11:30 a.m.</td>
</tr>
<tr>
<td></td>
<td>Lunch</td>
<td>60 minutes</td>
<td>11:30 a.m.–12:30 p.m.</td>
</tr>
<tr>
<td>1.5</td>
<td>Visualization</td>
<td>105 minutes</td>
<td>12:30–2:15 p.m.</td>
</tr>
<tr>
<td></td>
<td>Break</td>
<td>15 minutes</td>
<td>2:15–2:30 p.m.</td>
</tr>
<tr>
<td>1.6</td>
<td>Contextual Thinking</td>
<td>90 minutes</td>
<td>2:30–4:00 p.m.</td>
</tr>
<tr>
<td>1.7</td>
<td>Reflection, Assignments, &amp; Wrap-Up</td>
<td>30 minutes</td>
<td>4:00–4:30 p.m.</td>
</tr>
</tbody>
</table>
**Welcome & Introductions**

*Slide Title:* Welcome to Day 1

**Say**

[Welcome the class and introduce yourself.]
Welcome & Introductions

**Slide Title:** Welcome & Introductions

---

**Say**

Now that I’ve had a chance to introduce myself, I’ll give you an overview of the course so that you can have an idea of what to expect today and over the next three weeks, and then you’ll all have a chance to introduce yourselves too.
Welcome & Introductions

Slide Title: Course Overview

Say

[Cover the slide content.]
Welcome & Introductions

Slide Title: Course Framework

Say
This is the basic framework that the course will follow. We have four major topics — organize, translate, analyze, and communicate — and there are additional subtopics within each of our major topics here.

You will find tab images throughout the workbook that correspond with these major topics. You will also notice visual cues at the foot of most slides that indicate the major topic that we’re currently covering.

The framework references on the slides and throughout your workbook will help orient you and help you track your progress through the course.
Welcome & Introductions

Slide Title: Agenda

Say

[Share the agenda, and go over break and lunch expectations.]
Welcome & Introductions

Slide Title: What’s in It for Me?

Say
Now that we’ve had an overview of the course, you might be asking, “What’s in it for me?” Well, I’ll tell you ...

You will ... [Cover the slide content.]
Welcome & Introductions

**Slide Title:** Introductions & Goals

**Materials:** Name tents, markers

**Activity Time:** 10–15 mins.

**PW Page:** 3  
**Slide:** 9

**Say**

[Ask participants what they wish to get from today’s workshop, and ask if there are any questions from last week.

If the group size is smaller than 15, have them introduce each other. If time allows, you can give participants a few minutes to record their goals on page 3 of the workbook.]
For the first lesson of the day, we’re going to talk about data preparation. Before you can begin any analysis, you’ll first need to gather and prepare data.
Data Preparation

Slide Title: Identifying Your Problem & Defining Your Questions

Transition

As we set out to talk about data preparation, we’re going to begin by talking about how to get started. We’ll cover how to use questions to help you decide where to start and how to identify the central problem that you’re setting out to solve. And we’re also going to talk about storytelling.
Data Preparation

**Slide Title:** Every Good Story Has a Problem

Say

There’s a conflict central to every story, but before you set out to gather data, you need to make sure you’re trying to solve the right problem.

Try asking yourself some of the following questions:

- What is the basic need at the heart of this problem? Does one step in the process need to be repaired or improved? Or does the whole process need to be overhauled?
- What’s the desired outcome? That is, who are your stakeholders and what do they want?
- Who will benefit and why? Answering this question can help you determine whether this is a problem that’s worthwhile solving in the first place. If there is little benefit to a solution, your efforts will probably be put to use on solving a problem where the return on your investment offers a greater business value

Ask

What other questions might help you determine if you’re setting out to solve the right problem?
Say
We’ve established that every good story has a central idea — a conflict — but every good story also has great details. Not only do you need to know where you’re going to get the data to solve your problem, but you also need to make sure that it’s quality data. And you need to know any other information related to the data that will help you make sense of it.

What if the data is incomplete? You’ll need to know where to turn to find supplemental data. And last but not least, who is your audience? You need to know how this data will be used once you’ve compiled it.

Who are you telling your story to? Your audience will be a big influence on helping you shape the type of story that you decide to tell.

These are all questions that this course will help you answer over the next three weeks, starting today with gathering and preparing the data.

Ask
In preparation for this class, you’ve all chosen an issue: a problem related to your role that you’ll work on analyzing over the course of the next three weeks.

What sources will you turn to in order to gather data related to your chosen problem or issue? How will you ensure that the data is quality and complete?
Transition

[Mention that the best place to start is coming up with a plan to gather complete information.]
Data Preparation

**Slide Title:** Three Data-Gathering Questions for the Complete Story

**Facilitator Note**

**Caution** participants not to be selective solely for the purpose of achieving a desired result. The data still needs to be accurate and representational, but it should also be selected to suit the purpose of the presenter and audience.

**Say**

Asking yourself the “who,” “what,” and “how” of data gathering will help you ensure that you’re gathering the data that you need to tell the complete story.

[Go over the who, what, and how of gathering data.]

- **Who?** Discuss the importance of avoiding generalization to suit multiple audiences, even if it means gathering data differently and creating different presentations for different audiences.
- **What?** Discuss how the purpose of their task or mission will shape the choices that participants will make when gathering data.
- **How?** It’s important at this stage to think about whether or not all the necessary data is available or whether additional data needs to be collected. Talk about some of the methods mentioned on this slide, and see if participants can add others.]
Data Preparation

**Slide Title: Three Data-Gathering Questions**

**Say**

[Discuss the types of data that might be gathered and common risks or outcomes associated with different sources of data. Risks or outcomes might be related to the source or to the audience. Share your own examples.]

**Do**

Start a new flip chart page and write an example for the *who* question, leaving room for what and how.

**Ask**

[Ask participants to share some quick examples of their own with the whole class. Add some of these to the flip chart list, under “who,” if it seems helpful.]
**Data Preparation**

**Slide Title: Three Data-Gathering Questions**

**Say**

[Discuss the types of data that might be gathered and any common risks or outcomes associated with different sources of data. Risks or outcomes might be related to the source or to the audience. Share your own examples.]

**Do**

Add an example for the what question to your flip chart.

**Ask**

[Ask participants to think about the ways in which they commonly gather data for presentations and the typical level of familiarity that their common audiences have with those types of data. Do they commonly find or even overlook risks? What sorts of outcomes do they typically experience and what does an ideal outcome look like?

Add some of these to the flip chart list, under “what,” if it seems helpful.]
Say

[Discuss potential requirements and limitations for gathering and presenting data and how those might shape the choices that participants will make. Share your own examples.]

Do

Add an example for the how question to your flip chart.

Ask

[Ask participants to think about the typical limitations in which they operate in their daily work lives. How much time do they have to gather data? What are the limitations of the source material that they have to work with? How much time do they have to prepare and present? How do these limitations affect the choices that they make in gathering and presenting data?

Add some of these to the flip chart list, under “how,” if it seems helpful.]
Say

[Discuss the importance of each of these aspects of the data:

- Dates and times
- Locations
- Measurements]

Do

Use your flip chart to organize class responses to questions below about gathering data by dates, locations, and metrics.

Ask

[Ask about dates and times:

- Why is it important for dates and times to be prominently displayed?
- If consumers of the data don’t have a timestamp, how does this affect the utility of the data?

Ask about locations:

- Why are the locations or systems from which the data was drawn important?
- What if there’s a need to gather more data to supplement your findings?
- Do the analysis and report make it clear where to go?

Ask about the importance of using consistent metrics or making conversions where necessary.
Are we comparing apples to apples?]
Data Preparation

**Slide Title:** Troubleshooting Incomplete Data

**Materials:** Workbooks and something to write with

**Activity Time:** 15–20 mins.

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**PW Page:** 10–11

**Slide:** 20

**Small Group Activity**

**Direct** participants to follow the instructions on the activity slide and in the workbook on pages 10 and 11. Once they’ve had some time to read their brief case study (printed for you on the next page), and have had a couple of minutes to think about the questions, have them discuss in small groups the perils of working with incomplete data, using the worksheet in the workbook to guide them.

**Debrief**

Ask participants to share the results of their small-group discussion.

For which cases did groups feel that the lack of complete data would hold up the project?

Ask the class to think about how they might account for the differences based on the types of missing data.

What types of ideas did groups come up with for overcoming or mitigating the effects of incomplete data?

What best practices can groups share for gathering complete information?

Be sure to conclude the debriefing time by discussing why missing data that is not random is a much greater concern than missing data that’s random. Missing data that’s not random is a sign of problems with the data-gathering process.
Case Studies: Working with Incomplete Data

**Data Missing Completely at Random**

A satisfaction survey is given to customers in September and again in January. 50% of all respondents from September were randomly sampled to respond to the survey again in January, with all potential respondents completing surveys at both time points. Missing data has no systematic relationship to any of the variables present or unmeasured (age, sex, race, level of satisfaction, length of customer relationship, etc.) and is therefore completely random.

**Data Missing at Random**

A customer satisfaction survey is part of a company initiative to increase customer retention. This effort requires a focus on data related to customers who reported low satisfaction scores in a September survey, coupled with an intervention to help raise the satisfaction of these dissatisfied customers. The focus on this specific group of customers means that missing data is still random.

**Data Missing Not at Random**

A satisfaction survey is given to customers in September and again in January. The entire population of customers surveyed in September are once again selected to take the survey again in January. Upon analyzing the January results, the increase in satisfaction scores is significantly higher than expected. It is suspected that most of the customers who responded to the January survey were those whose satisfaction had increased, while those who remained dissatisfied opted not to take the survey, and so missing data is not due to a random condition.
Data Preparation

Slide Title: Coffee Break

Break
Say
Let’s take a coffee break and come back in 15 minutes for our Business Math lesson.
Transition
Now that we’ve considered how to perform different calculations and how to filter and display data for different purposes, let’s consider some other ways of working with data.
Say

Once you’ve analyzed the data and you’re ready to visualize it for your audience, it’s important to make sure that you choose the right type of chart for the story that you want your data to tell.
It can be useful to have some basic categories by which to organize the types of data you might be working with and to help consider possibilities for the ways in which you might like to visualize the data. The four categories we’re going to consider here are comparison, composition, relationship, and distribution, and in the following slides we’ll take a closer look at each category.

These are also shown on pages 30 and 31 of the workbook.
Say
[Focusing on the top row of charts, say ... ] Comparisons might be over a period of time. For these types of comparisons ...

- Bars are recommended for fewer categories
- While lines are recommended when you have many categories
- Cyclical area charts are useful for showing how different categories overlap
- And line charts can depict a simple trend with data over a linear period of time

Here, along this top row of comparisons over time, we might imagine [point to each of the four chart types as you suggest content for each chart] ...

- A **vertical bar chart** reporting revenue and expenses
- A **line chart** monitoring the performance of our stock in comparison to competitors
- A **circular area chart** reporting sales targets over an eight-month period
- A **line chart** that reports production rates for a single product

[Continued on next page ... ]
[Focusing on the bottom row of charts, say ... ] Comparisons among items are going to be best represented with different types of bars or columns.

Here, along this bottom row of comparisons among items, we might imagine [point to each of the four chart types as you suggest content for each chart]:

- **A vertical bar chart** reporting budget targets by category
- **A horizontal bar chart** comparing sales strategies for three different models
- **A table with embedded charts** comparing production across multiple facilities
- **A variable width column chart** where bar width represents volume (e.g., number of widgets sold) while bar height represents an alternate value (e.g., sales revenue)

**Ask**

Which types of charts listed here do you most commonly use?

[This is a good opportunity for a show of hands — bars? lines? cyclical data? — or to just have some quick “shout outs” rather than a long discussion.]
Say

[Focusing on the top row of charts, say …] If you’re displaying data that makes up the composition of a larger whole, you might have a situation where that composition changes over time. In those cases, you might choose stacked bar or stacked area charts.

Here, along this top row, depicting compositions that change over time, we might imagine [point to each of the four chart types as you suggest content for each chart] …

- **A stacked bar chart** where only relative differences matter (e.g., how big is our share of the market in each region?)

- **A stacked bar chart** where relative and absolute differences matter, where the sum of the values is just as important as the totals (e.g., expenditures over time across several products and services)

- **Stacked area charts** are effective in depicting the same types of relative (e.g., market share) or relative and absolute differences (e.g., expenses over time across several categories) but can be more useful than stacked bars when you want to emphasize trends

[Continued on next page … ]
[Focusing on the bottom row of charts, say ... ] In situations where the composition is static or unchanging, you might try a waterfall or stacked bar chart with subcomponents. Later in our lesson, we’ll see some other options that are preferable to the standard pie chart.

Here, along this bottom row, depicting compositions that change over time, we might imagine [skipping over the pie chart, point to each of the three remaining chart types as you suggest content for each chart] ...

- **A waterfall chart** where you’re tracking accumulations and subtractions, such as an inventory analysis that tracks units in stock by how many are damaged, refurbished, and saleable

- **A stacked bar chart** that shows components of components (e.g., specific parts and their subcomponents)

- **A tree map** can be useful to display hierarchical data with subordinate components nested inside larger rectangles (e.g., larger rectangles might represent regions or departments while smaller rectangles might represent subcategories within each)

**Ask**

Which types of charts listed here do you most commonly use?

[Again, ask for a quick show of hands or shout out.]
Say
If you need to show the relationship between different categories of data, a scatterplot might be a good choice. A scatterplot with varied bubble sizes can be used to represent larger or smaller values among categories or items.

Ask
Who here has used scatterplots?
[Ask for another show of hands. If you have time, you might engage the class in a brief discussion about different types of charts that they like or dislike for different jobs and purposes.]
Finally, in portraying distribution, for a single variable you might choose a bar histogram when you have a few data points; for example, the distribution of a specific resource over a period of time. Or, you might choose a line histogram when you have many data points; for example, when you need to compare test results for a group of parts or subassemblies.

If you have two or more variables, a scatterplot might be a good choice; for example, a simple set of survey results where categories and responses are limited. If there are too many categories of data, the scatterplot may not be your best choice.

Ask
Does anyone here use histograms or scatterplots to visualize distributions?

[Again, ask for a quick show of hands or shout out.]
Working with Data

Slide Title: What Type of Story Do You Need to Tell?

Transition
Now that we’ve considered some categories of data, next, we’ll consider some different scenarios and contemplate which category — which type of story — that particular scenario would best fit into.

Say
[Read the scenario description on the slide and ask participants to consider what type of story is represented by the data: comparison, distribution, composition, or relationship.

Direct participants to circle their answer on page 32 in their workbooks.]
**Working with Data**

**Slide Title: What Type of Story Do You Need to Tell?**

---

**Say**

If you need to show acceptable levels of variation and where items fall outside those limits, *distribution* would be the right choice.

Here, you can see that our sampled boxes contained anywhere from 80 to 89 ounces (where 80 ounces equals a pound). Perhaps our acceptable range might be 80 to 82 ounces. This way of visualizing the data helps us to see how often our packaged weights fall outside of an acceptable level of variation.
Say

[Read the scenario description on the slide and ask participants to consider what type of story is represented by the data: comparison, distribution, composition, or relationship.

Direct participants to circle their answer on page 32 in their workbooks.]
Say
In this situation, **relationship** is the right choice. If you need to show how something is affected by a process, you’re looking for relationships of cause and effect. Often when working with data relationships, we’re looking for correlation — e.g., what’s the relationship between age and blood pressure, education and income level, a manufacturer and failure rates, a production process and how materials are affected on the line, as with our plastics example here.

In this example, we’re looking at sources of variation, and we’ll be learning more about this later today. As the plastic travels through this process, at some points it’s crossing the threshold of what’s considered acceptable thickness for the product or packaging. We’re looking for the outliers on this chart so that we can identify the specific points in the process that we need to analyze to get to the root of the problem.
Working with Data

**Slide Title:** What Type of Story Do You Need to Tell?

**PW Page:** 32

**Slide:** 33

**Say**

[Read the scenario description on the slide and ask participants to consider what type of story is represented by the data: comparison, distribution, composition, or relationship.]

**Direct** participants to circle their answer on page 32 in their workbooks.]
Working with Data

**Slide Title:** What Type of Story Do You Need to Tell?

**Say**

In this situation, **comparison** is the clear choice. If you need to show similarities or differences, you’re going to use **comparison** or comparative analysis.
Say

[Read the scenario description on the slide and ask participants to consider what type of story is represented by the data: comparison, distribution, composition, or relationship.]

Direct participants to circle their answer on page 32 in their workbooks.]
Say
If you need to know how parts come together to make up a whole (like levels of satisfaction across multiple aspects of customer experience), **composition** would be the right choice.

Note that we have a stacked bar chart here to represent the different satisfaction levels in each category, always equaling 100 percent of customers surveyed.
Say
So far, we’ve talked about gathering data and making calculations, and we’ve started to talk about how to conceptualize some basic categories of data, but how do we get to the main idea? Using these simple prompts — “what am I trying to say or show” and “I need to convince them that ...” — can be a useful tool in helping them get to the main idea.

Say
[Read the “What am I trying to say or show?” example, followed by the “I need to convince them that ...” statement.]

Ask
How does the main idea statement here help to provide a way to approach the data that might be lacking?

Facilitator Note
While the main idea statement is more focused, be sure to point out the importance of the first prompt “What am I trying to say or show?” in helping participants reach the more focused approach to working with and presenting data.
Working with Data

**Slide Title:** Use Prompts to Hone the Main Idea

**Say**

[Read] the “What am I trying to say or show?” example, followed by the “I need to convince them that ...” statement.

Think about **verb choices** and other **persuasive language** that show up in the main idea statement that weren't present in responding to the first prompt. For example, in the first example, “killing manufacturing jobs” or “creating a **massive** skills gap.” In this example, notice the verb “**devastate** revenue streams.”

**Ask**

How do these persuasive words affect the approach to the data, its visualization, and its presentation?
Working with Data

**Slide Title: Use Prompts to Hone the Main Idea**

**PW Page: 33  Slide: 39**

**Say**

[Read the “What am I trying to say or show?” example, followed by the “I need to convince them that ...” statement.]

Look for ways that the second statement includes language that isn’t just more persuasive but is also more specific.

**Ask**

How do the additional details help shape the purpose for the data?
Working with Data

Slide Title: Look for the Aha! Moment

Say
Now that you have some tools for categorizing your data and honing the message or main idea, you might also need to consider further steps to help you get from the message to actually working out the visualization of the data. The process described here can help.

[Cover the content about finding the aha! moment.]
Lunch
[Let participants know that it’s time to break for lunch, and that the class will resume at 12:30 p.m. to learn about data visualization in greater detail.]
Say
In this lesson, we’re going to consider different aspects of visualization.
Now that we’ve talked about how to get rid of some of the material that might be distracting your audience from your message, let’s talk about how to direct their attention toward what matters most to you as the presenter.
Say
Data can be made to stand out by using simple ways of differentiating.

Ask
Take a moment to scan these differentiators (also shown on page 44 in your workbooks): orientation, shape, length, etc. Which stand out most for you? Why?

Say
Notice, for each category, how the visually different item immediately jumps out. We can use this same principle to direct an audience’s attention to the details that we most want them to pay attention to.

Ask
How did the differentiators change your experience of the visualized data that we looked at today?

Feel free to record any thoughts on page 44 in your workbooks.

[Ask for a couple of volunteers to share their thoughts.]
Once we understand the different types of differentiators, we can look at layering them to achieve an even more dramatic effect. Today we’re going to look at how to layer position, color, and add marks.
Here we have very little differentiation.

This is a data visualization in progress that will attempt to highlight a company’s business performance in comparison to its competitors, rated in each category on a scale from one to six.

Note that with all the visual differentiation stripped from this chart, as viewers, we’re at a loss as to what we should pay attention to first. We feel lost in the data.

Over the next three slides, we’re going to add the visual differentiation that will make a world of difference in this chart’s readability.
Say

Here’s the same visual now using **color** to emphasize the data that’s most important: “our business.” This is a fictional company, by the way, and not a chart representing our company’s data.

Color adds emphasis. Note how the “our business” label in the legend has also been changed to the corresponding color from the chart.
Visualization

Slide Title: Position

Say

Here’s the same visual now using color and position to emphasize the data that’s most important.

This change adds important context to the data. The purpose of the data about competitors is to see how it compares to the data about “our business.”

Using the differentiator of position, we’ve moved “our business” to the first position among the companies compared here.
Say
Here’s the same visual now using position, color, and **added marks** to emphasize the data that’s most important.

We can add even more detail to the chart, adjacent to the item on the chart to which each data point corresponds. This method provides additional detail without adding clutter. Here, we’ve indicated the ranking of “our company” in comparison to our competitors.

In a customer experience survey, our imaginary company here ranked ...

- First out of six for price
- Second out of six for convenience
- Fourth out of six for relationship
- And sixth out of six for service and selection
Transition
Now that we’ve looked at visual differentiators that are effective at transforming graphical data, let’s look at some ways to direct the audience’s attention by visually altering the look of the text.

Say
Preattentive attributes are messages that direct your audience to what you want them to look at or what you think is most important.

[Read the slide content about the types of preattentive attributes.]
Say

[Cover the content on the additional preattentive attributes.]

It’s important to note here that whenever you’re making choices for slides or documents of any kind, be sure to check our corporate style guide to ensure that your choices fall within corporate standards for style and branding. The advice that we offer here is general, and is meant to be applied with consideration to what’s appropriate within the context of the given task or project.

For example, PowerPoint presentations should use the corporate PowerPoint template and …

- Should not change the font style or color
- Should not choose a font size less than 18 point or greater than 20 point
- Should use bold to emphasize a word or phrase
- Should not apply more than one type style to the same text (e.g., bold plus underline)

PowerPoint is only one way that you might be sharing your message. Use visual differentiation and preattentive attributes as you’re able within the style and branding guidelines that govern the type of document you’re working on, and only in ways that they help clarify your message. A little emphasis goes a long way!
Break

Say

Let’s take a coffee break and come back in 15 minutes to talk about contextual thinking.
We’ve reached the end of the day, and we just have a few items of business to attend to as we conclude.
Reflection, Assignments, & Wrap-Up

Slide Title: Reflection

Materials: Workbook

Activity Time: 5 mins.

PW Page: 66   Slide: 54

Say
As we wrap up today’s class, we’re going to conclude by taking some time to reflect on today’s training, what’s been most meaningful, how what you’ve learned today might change the way you do your job, and what more you might like to get out of a course on this topic.

[Read the reflection questions and allow participants the time needed to record their answers in their workbooks on page 66.]
Reflection, Assignments, & Wrap-Up

**Slide Title:** 15-Minute KPI Reading

**Materials:** KPI Reading

**Activity Time:** 15 mins.

**PW Page:** 66

**Slides:** 55

**Do**

Hand out the assigned reading or instruct students to access the reading via the portal, depending on the preferred delivery method for your setting for this course and day.

**Say**

Take the next fifteen minutes to complete the assigned reading on KPIs. We will debrief the reading when we discuss this concept again during our Day 2 class.
Reflection, Assignments, & Wrap-Up

**Slide Title:** Assignments & Wrap-Up

**PW Page:** 67  
**Slide:** 56

**Say**

(Cover the instructions for the self-directed assignment, pointing participants to page 67 in their workbooks.

**Mention** the videos and reading to be completed before your next class.

**Hand out** the Day 2 evaluation and ask participants to stay and complete them, making sure to collect them as everyone leaves for the day.)
Data Analysis & Insights

Days 1-3
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## Analysis & Insight Course Framework

### Organize
- Data Preparation
- Business Math
- Working with Data

### Translate
- Data Visualization
- Infographics
- Dashboards
- Contextual Thinking

### Analyze
- Drawing Conclusions
- Analytical Thinking
- Problem Solving
- Decision Making & Recommendations

### Communicate
- Communication Plan
- Storytelling
- Framing Benefits
- Call to Action
## DAY 1

<table>
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<th>DURATION</th>
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<tr>
<td>Welcome &amp; Introductions</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Data Preparation</td>
<td>90 minutes</td>
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<tr>
<td>Break</td>
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<tr>
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</tr>
<tr>
<td>Reflection, Assignment, &amp; Wrap-Up</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>
INTRODUCTIONS & GOALS

What are you hoping or expecting to get out of this course?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What’s one skill or outcome that you want to improve or accomplish during this course?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

“When I go back to work, I want to ...”

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

“My time here will be well spent if ...”

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Three Data-Gathering Questions for the Complete Story

Ask yourself the three data-gathering questions:

**WHO?**
- Who is the audience?
- Who will make decisions based on your findings?
- What do you know about this person or group of people?
- Do they have biases that might lead them to support or resist your message?
- What data is available to strengthen your case?
- Is your audience familiar with this data or is it new to them?

**WHAT?**
- What are the risks? Find the weak points and address them.
- What will a successful outcome look like?

**HOW?**
- How will you tell your story?
- What limitations (time and space) will guide this decision?

The first step in data preparation is ensuring that you’ve gathered complete information. Be sure to consider the following categories:

- Dates and times for the span of data collected need to be clear.
- Locations from where the data was gathered need to be documented.
- Measurements/metrics need to be consistent, and conversions need to be applied where necessary.
Case Studies: Working with Incomplete Data

**Data Missing Completely at Random**
A satisfaction survey is given to customers in September and again in January. Fifty percent of all respondents from September were randomly sampled to respond to the survey again in January, with all potential respondents completing surveys at both time points. Missing data has no systematic relationship to any of the variables present or unmeasured (age, sex, race, level of satisfaction, length of customer relationship, etc.) and is therefore completely random.

**Data Missing at Random**
A customer-satisfaction survey is part of a company initiative to increase customer retention. This effort requires a focus on data related to customers who reported low satisfaction scores in a September survey, coupled with an intervention to help raise the satisfaction of these dissatisfied customers. The focus on this specific group of customers means that missing data is still random.

**Data Missing Not at Random**
A satisfaction survey is given to customers in September and again in January. The entire population of customers surveyed in September is once again selected to take the survey again in January. Upon analyzing the January results, the increase in satisfaction scores is significantly higher than expected. It is suspected that most of the customers who responded to the January survey were those whose satisfaction had increased, while those who remained dissatisfied opted not to take the survey, and so missing data is not due to a random condition.
Activity: Troubleshooting Incomplete Data

Examine the case study assigned to your group.

Will the lack of complete data hold up progress on this task or project? Why or why not?

If progress on the project will be affected, how might you be able to overcome this obstacle?

What would you share with others as best practices for gathering complete information?
WORKING WITH DATA

Understanding some basic categories of data can help you organize some go-to chart types that you can have at the ready whenever you’re working with data that you will also need to visualize in some way.

Comparison over Time

**VERTICAL BAR CHART**
- Single or Few Categories

**LINE CHART**
- Many Categories

**CIRCULAR AREA CHART**
- Cyclical Data

**LINE CHART**
- Non-Cyclical Data

Comparison Among Items

**VERTICAL BAR CHART**
- Few Categories

**HORIZONTAL BAR CHART**
- Few Categories

**TABLE WITH EMBEDDED CHARTS**
- Many Categories

**VARIABLE-WIDTH COLUMN CHART**
- Two Variables per Item

Composition, Changing over Time

**STACKED 100% BAR CHART**
- Only Relative Differences Matter

**STACKED BAR CHART**
- Relative and Absolute Differences Matter

**STACKED AREA 100% CHART**
- Only Relative Differences Matter

**STACKED AREA CHART**
- Relative and Absolute Differences Matter
Composition, Static

- **Pie Chart**: Simple Share of Total
- **Waterfall Chart**: Accumulation or Subtraction to Total
- **Stacked 100% Bar Chart with Subcomponents**: Components of Components
- **Tree Map**: Accumulation to Total and Absolute Difference Matters

Relationship

- **Scatterplot**: Two Variables
- **Scatterplot Bubble Size**: Three or More Variables

Distribution

- **Bar Histogram**: Few Data Points
- **Line Histogram**: Many Data Points
- **Scatterplot**: Two Variables
What Type of Story Do You Need to Tell?

For each data story, select the category — comparison, distribution, composition, relationship — that you feel best suits the story.

1. You’ve sampled the weights of twenty finished and packaged standard five-pound boxes of washers and need to show that there’s too much variation.

   Comparison  Composition  Relationship  Distribution

2. You have plastics traveling through a factory line and need to measure the thickness as it’s affected by 20 different processes when it moves through the line.

   Comparison  Composition  Relationship  Distribution

3. You have two populations and need to highlight key differences between them.

   Comparison  Composition  Relationship  Distribution

4. You need to communicate a variety of responses in a customer-satisfaction survey (65 percent strongly agree, 22 percent somewhat agree, etc.)

   Comparison  Composition  Relationship  Distribution
Using Prompts to Hone the Main Idea

What am I trying to show?
A relationship between increased automation in manufacturing and fewer jobs being available. Automation increases profits but creates a need for new jobs that are hard to fill.

I need to convince my audience that ...
Although profits are higher, robots are killing manufacturing jobs and creating a massive skills gap that offsets those short-term gains.

What am I trying to show?
The relationship between unbundling products and declining revenue.

I need to convince my audience that ...
Unbundling our software suite will devastate revenue streams.

What am I trying to show?
Our customer base is a large, growing, diverse, and underserved market.

I need to convince my audience that ...
Growth in the market is coming from consumers who are hungry for cloud-based services, are younger, and are more technically savvy than my audience believes them to be.
Directing the Audience’s Attention

Visual Differentiators

Data can be made to stand out using simple ways of differentiating.

Visual differentiators can be layered to emphasize the areas you most want your audience to pay attention to. As we explore these techniques, pay attention to how they affect you as a viewer.

How do differentiators change the experience of visualized data?
**Preattentive Attributes**

In the same way that visual differentiators can help direct the way your audience experiences your data displays, preattentive attributes can help direct the way your audience experiences your use of text.

**Bold text** signals important concepts, topics, or main ideas.

**Color** can signal importance but also provide identification or convey a certain feeling or mood.

**Italics** grab attention but also add emphasis or signify supplemental information.

Increased text size can make important concepts or types of text (e.g. headings) stand out from the rest.

**Underlining** is an alternative to bold or italics.

**Outlining** text can make a bolder statement than underlining.

**Spatial Separation:**

The use of white space (e.g. a spatial separation between a heading and the body text that follows) is another effective way to help your audience slow down and pay attention to a key idea.

---

**Contrast directs attention.**

Increased data and increased variety of data can make it harder to emphasize key points.

Using attributes such as color and size to create contrast is one way to make the most important points stand out.
DAY 1 REFLECTION

What did you get out of this training workshop today?

________________________________________

________________________________________

________________________________________

Was there anything from today’s methods, models, or best practices that stood out for you?

________________________________________

________________________________________

________________________________________

What’s one thing that you could change about what you do, or how you do it when you return to work?

________________________________________

________________________________________

________________________________________

Did you get what you expected?

________________________________________

________________________________________

________________________________________
SELF-DIRECTED ASSIGNMENT

Continue working with the subject and data that, with the guidance of your manager, you selected prior to beginning this course. During the remaining weeks of this class, you will work on developing a presentation to be given in the last half of the day on Day 3.

Your presentation will include …

- Your data analysis and insights
- The use of storytelling methods (introduced on Day 2 of the class)
- A chart
- An infographic
- The beginnings of a dashboard

Homework

- Watch two videos shared with you from the Storytelling with Data blog: (1) Declutter and (2) Contrast
- Complete the assigned reading on Identifying KPIs