



***Putting the Science  
in Data Science:  
Fundamentals of  
Research Methods***

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## SC-04: Putting the Science in Data Science: Fundamentals of Research Methods

### **Module 0. About the Course (4 min)**

### **Module 1. Introduction to The Scientific Method (23 min)**

- *Defining Research*
  - Why Research Matters to Everyone
  - Why Research Matters to You
  - Research Definition
  - Research Examples Across Sectors
  - Assumptions about Research
  - The Scientific Method
  - What is the Scientific Method
  - Planning Your Route
- *Key Features of the Scientific Method*
  - Key Features of the Scientific Method
  - Research Questions
  - Asking the Right Questions
  - Hypothesis
  - What Do You Think Is Going to Happen?
  - Collect Data
  - Getting Started with Data
  - Education Sector Example
  - Analyze Data
  - Data Analysis
  - Make Conclusions
  - Making Conclusions
  - Generalizations
  - Sharing Findings

### **Module 2. Designing an Experiment (34 min)**

- *What Do We Mean by “Experiment”?*
- *Designing an Experiment: A “How To” Approach*
  - A How To Approach
- *Identify the Gap*
- *Ask the Question*
  - What Makes a Good Research Question?
  - Sample Question: COMPLEXITY
  - Sample Question: FOCUS
  - Sample Question: CLARITY
  - How to Write Your Research Question
- *Choosing the Right Design*
  - Choosing the Right Design
  - Quantitative Study
  - Quantitative Study: Design
  - Quantitative Study: Survey
  - Qualitative Study Design
  - Mixed Methods Design
- *Research Variables*
  - Definitions to Get Started
  - Research Variables in Action
- *Hypothesis*



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- *Finding Participants*
  - Who is Going to Help Answer Your Question?
  - Types of Sampling Methods
  - Random Sample
  - Systematic Sample
  - Convenience Sample
  - Purposive Sample
- *Now What?*
- *Analyze Your Data*
  - Analyze Your Data: Planning It Out
  - Quantitative Study Design
  - Qualitative Study Design
  - Mixed Methods
- *Make Conclusions*
- *Share Findings*

### **Module 3. Executing an Experiment (52 min)**

- *Collecting Data*
  - What is Data?
  - Forms of Data
- *Surveys*
  - Survey Questions
  - Break it Down
  - Avoid Leading Questions
  - Focus on One Idea Per Question
  - Building Your Survey
  - Test it Out!
  - Standardized Assessments
- *Conducting Observations*
  - Making it Happen
  - Types of Observations
  - Making Sense of Observations
- *Interviews*
- *Open Data*
- *Data Collection Tips*
  - Plan Enough Time
  - Be Prepared
  - Test Your Tools
  - Be Ethical
- *Readiness Checklists*
  - Survey Design
  - Experimental Design
  - Assigning Participant Groups
  - Experimental Design
  - Qualitative Design
  - Mixed Methods – Special Considerations
  - Examining Your Results

### **Module 4. Communicating the Results (31 min)**

- *Getting Started*



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- *Work Backwards*
- *How to Give Life to Your Numbers*
- *Know Your Audience*
- *Use Appropriate Language*
- *Making the Most of Data Visualization*
  - *Less Is More: Examples 1 & 2*
  - *Use Color Intentionally*
- *Charts to Visualize Data*
  - *Visualization Examples*
  - *Examining Fitness Member Data*
  - *Bar Charts*
  - *Pie Charts*
  - *Area Charts*
  - *Pivot Table*
  - *Infographic*
- *Writing Your Report*
  - *Writing Your Report*
  - *Presenting Your Results*
- *Digital Storytelling*
  - *Digital Storytelling: Part 1 & 2*
  - *Crafting Stories*
  - *Digital Storytelling Example*

### **Module 5. Case Study (34 min)**

- *Setting the Scene*
- *Returning to the Scientific Method*
- *Identify the Gap*
- *Ask the Question: Write Your Research Question*
  - *Remember What Makes a Good Research Question?*
  - *Research Question Criteria*
- *Multi-Phase Approach*
- *Evaluating Impact: Experimental Design*
- *Collect Data: Data Collection Tools*
- *Key Data To Measure*
- *Recruiting Participants*
- *Experimental Design Overview*
- *Qualitative Research Design*
- *Analyze Data: Data Analysis Approach*
- *Results—What Did We Find?*
  - *Demographics*
  - *Spending Habits*
  - *Meals in our Household*
  - *Qualitative Findings*
  - *Making Conclusions & Decision Making*
- *Visualizing the Results*
  - *Line Chart*
  - *Pie Chart*
  - *Highlighting Qualitative Findings*
  - *Digital Storytelling*



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