INVESTIGATING LEARNING OUTCOME IMPROVEMENTS WITH SOFA PAIRED T-TESTS

1. Overview

Client:

A professional development firm offering employee training workshops across the U.S. and U.K., focused on upskilling in digital literacy and communication

Objective:

To assess whether participants demonstrated statistically significant improvement in knowledge after attending a 2-week virtual training course. SOFA was selected for its simplicity and visual output capabilities to run paired-sample t-tests and present the results to the corporate sponsor.

2. Background

The client piloted a new interactive curriculum for 60 employees across four departments in a mid-sized firm. Each participant completed a standardized pre-test and post-test. The firm needed statistical evidence of learning effectiveness to justify further rollout of the program.

3. Data Summary

Dataset:

60 matched participant records with two score columns

Key Variables:

Variable	Type	Description
Participant_ID	Nominal	Unique identifier for each employee
Pre_Test_Score	Continuous	Score out of 100 before the training
Post_Test_Score	Continuous	Score out of 100 after the training
Department	Categorical	Sales, HR, IT, Operations
Prior_Experience	Binary	Yes = Had prior exposure to topic, No = New

4. Methodology

Software Used:

SOFA Statistics (v1.5.3)

Statistical Workflow:

1. **Data Entry and Validation:**
    - Imported CSV file into SOFA
    - Verified correct pairing of pre- and post-scores
    - Created a new variable for score improvement
2. **Descriptive Statistics:**
    - Computed mean, median, and standard deviation of both test scores
    - Created histograms to visualize score distribution before and after training
3. **Paired T-Test in SOFA:**
    - Used **Paired Samples T-Test** from the SOFA GUI
    - Tested for significant difference in pre- vs. post-test means
    - Checked effect size (Cohen's d approximation) and confidence interval

5. Key Results

Metric	**Value**
Mean Pre-Test Score	62.3 / 100
Mean Post-Test Score	78.5 / 100
Average Improvement	+16.2 points
Paired T-Test p-value	< 0.001
95% Confidence Interval	[+12.9, +19.4]
Effect Size (Cohen's d)	1.21 (large effect)

Subgroup Insight:

- Participants **without prior experience** improved more on average (+18.5) than those with prior exposure (+12.4)

6. Visual Outputs (via SOFA):

- Boxplots: Pre vs. Post score distributions
- Bar chart: Average improvement by department
- Line plot: Individual score changes (spaghetti plot style)
- T-test summary output with confidence interval graph

7. Deliverables

- .db database file and clean .csv dataset
- Analytical report (11 pages), including:
    - Paired t-test results with interpretations
    - Department-wise improvement breakdown
    - Recommendations for improving weak module areas
- Slide brief (2 slides):
    - Training effectiveness scorecard
    - Justification for scale-up investment

8. Application & Outcome

- Client secured funding to run the course across five more locations
- Curriculum was adjusted to better support participants with prior exposure (less improvement observed)
- Sponsor used visuals from SOFA outputs in a quarterly performance review

9. Strategic Value Delivered

- Validated **quantifiable knowledge gains** using an open-source tool
- Demonstrated **training ROI** with high statistical confidence
- Provided **clear, board-ready insights** using SOFA's report-friendly output