

Critical Literature Review

Design and Creative Technologies

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Subject Code: REM 502

Subject Name: Research Methodologies

Assessment No.: 2

Title of Assessment: Research Tools and Methodologies

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Date: Nov 2025

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Exploring the Relationship between Net Promoter Score and Revenue Growth in Healthcare Clinics.

1. Introduction

The Assessment 2 project continues my study journey on Net Promoter Score, investigating whether this common measure of patient satisfaction, correlates with revenue performance in healthcare clinics. Understanding this relationship can inform evidence-based managerial decisions and guide future AI-enabled feedback systems. In the healthcare sector, however, the bridge between patient sentiment and measurable business outcomes such as revenue, retention, or referrals remains under-explored.

This project proposes an ICT-driven research framework that leverages data analytics and business-intelligence methods to examine whether NPS trends align with financial performance in clinical environments. The study builds directly on the literature gaps identified in Assessment 1 and adopts a quantitative correlational design to ensure statistical accuracy and business relevance.

2. Research Questions, Aim and Objectives

Aim: To investigate the relationship between Net Promoter Score (NPS) and business performance indicators, specifically revenue growth, in healthcare clinics.

Research Questions:

- RQ1: To what extent is NPS correlated with monthly revenue growth in healthcare clinics?
- RQ2: Can NPS trends over time predict short-term revenue fluctuations?

Hypothesis:

- H0: There is no statistically significant correlation between NPS scores and monthly revenue.
- H1: There is a positive correlation between NPS scores and monthly revenue.

Objectives:

- Collect and prepare Net Promoter Score (NPS) and monthly revenue data from Pro-Corpo's clinics to ensure accuracy and comparability across time periods of the available data.
- Conduct quantitative analysis – including descriptive statistics, correlation, and regression – to examine the relationship between NPS scores and revenue performance.
- Perform correlation analysis (Pearson or Spearman) to quantify the strength and direction of the NPS to revenue relationship).
- Apply regression modeling to test whether NPS predicts revenue while controlling for temporal and clinic-specific variables.
- Validate findings through residual diagnostics and sensitivity analysis to ensure statistical robustness.

- Develop a practical ICT framework that demonstrates how NPS-based metrics can inform strategic decision-making and performance evaluation in healthcare.

3. Comparative Analysis of Research Methodologies

Healthcare business research operates at the intersection of human experience and organizational performance, requiring methodological approaches that balance measurement rigor with contextual understanding. The choice of methodology fundamentally shapes what can be known: quantitative methods enable hypothesis testing and generalization across populations, while qualitative methods reveal mechanisms and meanings that numbers alone can’t capture (Creswell & Plano Clark, 2023). In ICT research and development (R&D), this tension is particularly salient when translating patient feedback, a qualitative phenomenon, into business intelligence metrics.

This study adopts a **pragmatic paradigm** (Morgan, 2014), prioritizing practical problem-solving over skepticism. Three methodological approaches were evaluated:

| Methodology | Description | Strengths | Weakness |
|--------------|---|--|---|
| Qualitative | Explores human meaning through interviews or thematic coding | Rich context and interpretive depth. | Limited generalizability; prone to researcher bias. |
| Quantitative | Employs numerical measurement, hypothesis testing, and statistical inference. | Objectivity, replicability, scalability. | May overlook cultural tone. |

| | | | |
|------------------|---|---|---|
| Mixed Methods | Integrate both qualitative and quantitative strands. | Triangulation improves validity; merges AI outputs with human interpretation. | Requires time and data integration skills. |
|------------------|---|---|---|

Given that this study seeks to establish a baseline empirical relationship between existing business metrics (NPS and revenue), a quantitative approach has been chosen as the most appropriate. The availability of large-scale data (27,000 records across 36 months) makes statistical analysis both feasible and methodologically sound (Pallant, 2020). Qualitative methods, while valuable for understanding why correlations exist, require resources (patient interviews, thematic coding) beyond this study's scope. Mixed or qualitative methods may be relevant for future research that integrates NLP-derived sentiment with financial outcomes, but such extensions depend on the foundational quantitative correlation established in this study.

This methodological choice reflects ICT R&D principles: iterative development from simple to complex systems. By demonstrating statistical relationships first, subsequent research can build AI-enabled sentiment analysis with confidence that the underlying NPS-revenue connection merits computational investment.

4. Proposed Methodology and Research Methods

4.1.Design Paradigm

Given that the research questions seek to quantify relationships and test predictions, a quantitative correlational design is most suitable to establish statistical validity and support evidence-based conclusions (Field, 2018).

4.2. Data Collection

- **Primary Source:** Anonymized operational dataset provided by Pro-Corpo Estetica (<https://procorpoestetica.com.br/>), comprising $\approx 27\,000$ records (2022–2025).
- **Variables:** textual feedback, NPS scores, month/year, clinic ID, and monthly revenue.
- **Data Security:** stored on encrypted drives compliant with the Australian Privacy Act (1988) and Brazilian Data Protection Law.
- **Authorization:** formal company consent letter ensuring confidentiality and academic use only.

The dataset originates from Pro-Corpo’s post-service Net Promoter Score (NPS) program, which automatically invites clients to provide feedback within 24 hours of receiving treatment. Respondents can identify themselves or remain anonymous and answer four brief questions: (1) a 1-to-10 satisfaction rating, (2) optional comments, (3) confirmation of the store visited, and (4) optional mention of staff members for praise or concern. This process has generated approximately 27 000 records collected between 2022 and 2025, providing a rich source of structured (scores, store, month) and unstructured (text feedback) data. Monthly revenue data for each store are also available, enabling correlation between customer sentiment, NPS, and financial performance.

4.3. Data Processing Timeline

The plan is to develop the work in 4 phases detailed below:

| Phase | Milestone | Description |
|-------|-----------------|---|
| 1 | Data extraction | <ul style="list-style-type: none"> • Extract NPS survey responses (score, date, clinic ID, optional text comments) • Extract monthly revenue records (clinic ID, month, total revenue) • Timeframe: January 2022 – December 2024 (36 months) |

| | | |
|---|---------------------|--|
| 2 | Data cleaning | <ul style="list-style-type: none"> • Remove duplicates (based on timestamp + clinic ID) • Handle missing values: • NPS missing: exclude record (cannot impute satisfaction scores) • Revenue missing: interpolate if isolated gap (linear interpolation); exclude clinic-month if systematic missingness • Outlier detection: flag revenue values >3 standard deviations from clinic mean for review |
| 3 | Data transformation | <ul style="list-style-type: none"> • Aggregate NPS to clinic-month level (mean, median, standard deviation, response count) • Normalize revenue for clinic size: Revenue per appointment (if appointment data available) • Create derived variables such as NPS category: Detractors (0-6), Passives (7-8), Promoters (9-10), Revenue growth: Month-over-month percentage change and Lagged NPS: NPS from 1 and 2 months prior (for temporal analysis) |
| 4 | Integration | <ul style="list-style-type: none"> • Merge datasets on: "clinic_id + year + month" • Validate temporal alignment (ensure NPS survey dates precede revenue measurement) • Final dataset structure: Each row = one clinic-month observation |

4.4. Quantitative Analysis

Step 1: Check Assumptions

Before running statistical tests, the data must meet certain conditions (Field, 2018):

- **Normality**: Test whether NPS and revenue follow normal distributions using Shapiro-Wilk test
- **Linearity**: Create scatterplots to see if NPS and revenue have a straight-line relationship

- **Outliers:** Identify extreme values that might distort results (values >3 standard deviations from mean)

Step 2: Describe the Data

Calculate basic statistics for each clinic and time period:

- Average NPS score and revenue
- Spread of scores (standard deviation)
- Range (minimum to maximum)
- Visual summaries: histograms showing distribution patterns

Step 3: Test Correlation (RQ1)

Measure how strongly NPS and revenue move together:

- **If data is normally distributed:** Use Pearson correlation (r)
- **If data is not normal:** Use Spearman correlation (ρ)
- **Interpret strength** (Cohen, 1988):
 - Weak: r between 0 and 0.29
 - Moderate: r between 0.30 and 0.69
 - Strong: r above 0.70
- Test significance: $p\text{-value} < 0.05$ means the relationship is unlikely due to chance

Step 4: Test Prediction (RQ2)

Use regression to see if NPS can predict future revenue:

- **Simple model:** Does this month's NPS predict this month's revenue?
 - Formula: $\text{Revenue} = \beta_0 + \beta_1(\text{NPS}) + \text{error}$
- **Time-lagged model:** Does last month's NPS predict this month's revenue?
 - Formula: $\text{Revenue}(\text{month } t) = \beta_0 + \beta_1(\text{NPS month } t-1) + \text{error}$

- **Evaluate model quality:**
 - R^2 : percentage of revenue variation explained by NPS
 - p-value: whether NPS is a significant predictor

Step 5: Check Robustness

Verify results are reliable by:

- Re-running tests excluding the top and bottom 5% of clinics (outlier sensitivity)
- Testing different time periods separately (2022 vs 2023 vs 2024)
- Comparing results using different NPS thresholds

Tools: Python, Excel for verification, Matplotlib/Streamlit for visualizations.

5. Rationale for Method Choice

This study adopts a purely **quantitative design** for the methodological reasons below:

- **Nature of Research Questions:** Both RQ1 and RQ2 seek to quantify relationships and predictive power—questions best answered through statistical analysis rather than interpretive methods (Bryman, 2016). The hypothesis-testing framework (H_0 vs. H_1) requires numerical measurement and inferential statistics to establish evidence-based conclusions.
- **Data Characteristics:** The dataset comprises structured numerical variables (NPS scores 0-10, monthly revenue in currency units) collected systematically across 27,000 observations. This scale and structure align with quantitative methods' strengths: detecting patterns across large samples with statistical confidence (Field, 2018).

- **ICT R&D Context:** In software engineering and IT research, quantitative validation provides the empirical foundation for system design decisions (Wohlin et al., 2012). Establishing whether NPS correlates with revenue — and at what magnitude — determines whether investing in automated NPS analytics systems is justified. Qualitative understanding of **why** correlations exist can follow, but the **whether** question requires quantitative evidence first.

Rationale Against Qualitative or Mixed Approaches

Although mixed methods are often recommended when both measurement and meaning are required, this study focuses solely on quantifiable relationships between NPS and revenue. The optional text comments in NPS surveys could enable qualitative analysis, but:

- Text analysis (even basic thematic coding) would shift the study toward NLP research—Assessment 1's original scope
- The current research questions do not require understanding patient motivations, only quantifying statistical relationships
- Resource constraints (time, coding expertise) favor depth in quantitative rigor over breadth across methods

Alignment with Assessment Progression

This quantitative foundation positions Assessment 3 to propose mixed-methods extensions: "Having established correlation (Assessment 2), future research will employ NLP to identify **which** aspects of patient experience drive revenue outcomes."

6. Ethical Considerations

- **Anonymity & Consent:** No personally identifiable data will be used. Pro-Corpo's written authorization ensures institutional consent.
- **Data Governance:** Compliance with the Australian Privacy Act (1988), GDPR, and HIPAA standards.
- **Responsible AI Design:** Any outputs will be advisory, not decision-making.
- **Transparency:** All code and analysis scripts are documented for audit and open-sourced for learning purposes.

7. Data Analysis Strategies and Tools

| Purpose | Tool / Technique | Outputs | Justification |
|------------------------|---|---|---|
| Data preparation | Python (Pandas, NumPy) | Cleaned dataset | Ensures data quality before analysis |
| Assumption testing | Excel, Python | Summary stats, averages | Validates distribution assumptions for parametric tests |
| Descriptive statistics | Exploratory data visualization (scatter plots, line trends) | Validated data integrity and correlation outputs. | Summarizes central tendency and spread for each clinic |
| Correlation analysis | Streamlit, Matplotlib | Trend plots and correlation heatmaps | Quantifies relationships between NPS and revenue |
| Regression modeling | Combine AI, NPS and revenue metrics | Composite predictive model | Tests predictive strength of NPS for revenue |
| Visualization | Streamlit, Matplotlib | Scatterplots, heatmaps, and trend dashboards | Aids interpretation and communication of findings |

8. Limitations and Delimitations

- **Scope:** Restricted to one clinic group (Pro-Corpo), limiting cross-industry generalizability.
- **Data Bias:** Feedback may be skewed toward extreme experiences.
- **Time Frame:** Analysis limited to 2022–2025 data.
- **Delimitation:** Study focuses on correlational evidence, not causal inference.

While data are anonymized, reflexivity remains essential: as an ex-internal collaborator, the researcher must remain aware of interpretive bias when analyzing familiar organizational contexts.

9. Conclusion

This research framework investigates the correlation between Net Promoter Score and revenue growth through a quantitative lens, establishing a foundation for understanding customer experience as a business performance driver in healthcare. By employing descriptive statistics, correlation analysis, and regression modeling, the study provides measurable evidence — or lack thereof — regarding NPS's predictive validity for financial outcomes.

This quantitative approach aligns with ICT R&D principles of evidence-based system design. By first testing the empirical strength of the NPS–revenue relationship, this study provides a statistical foundation that future research can build upon, for example, integrating predictive modelling or AI-enhanced feedback systems, but the fundamental questions must first be answered with statistical rigor: Does NPS correlate with revenue? If so, how strongly? Can past satisfaction scores predict future financial performance? These are prerequisite questions that

computational solutions ultimately depend upon. The study contributes to both academic and practitioner knowledge by:

- Empirical validation: Testing whether widely adopted NPS metrics demonstrate predictive validity in healthcare settings
- Methodological transparency: Documenting a reproducible analysis workflow that other researchers can audit and extend
- Strategic foundation: Providing clinic managers with evidence to inform dashboard design, resource allocation, and customer experience investments.

By establishing baseline correlations in Assessment 2, Assessment 3 can propose extensions: if NPS shows strong predictive power, simpler tracking systems suffice; if correlations are weak, more sophisticated NLP-enabled sentiment analysis becomes an option to capture the nuances traditional metrics miss. This progression from foundational quantitative research to advanced mixed-methods proposals reflects iterative R&D practice — validate core assumptions before building complex systems.

10. Appendices

10.1. Appendix A – Dataset Overview

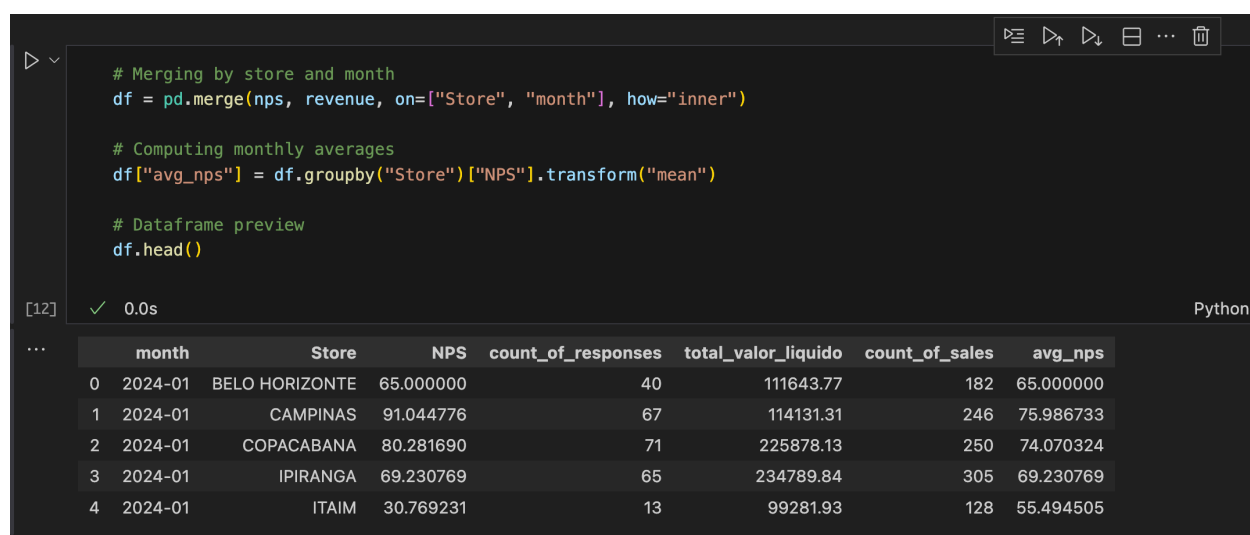
Summary of available variables and their characteristics.

| Column | Description | Example |
|------------|--|---------|
| store_name | Clinic identifier | “LAPA” |
| month | Reference month of transaction | 2025-04 |
| nps_score | Net Promoter Score from post-service | 9 |
| revenue | Monthly clinic revenue (BRL) | 85.200 |
| responses | Number of NPS responses in that period | 112 |

Data are anonymized and aggregated by store and month, ensuring no personally identifiable information is retained.

10.2. Appendix B – Data Preparation Pipeline

Summary of available variables and their characteristics.



```

# Merging by store and month
df = pd.merge(nps, revenue, on=["Store", "month"], how="inner")

# Computing monthly averages
df["avg_nps"] = df.groupby("Store")["NPS"].transform("mean")

# Dataframe preview
df.head()

```

[12] ✓ 0.0s Python

| | month | Store | NPS | count_of_responses | total_valor_liquido | count_of_sales | avg_nps |
|---|---------|----------------|-----------|--------------------|---------------------|----------------|-----------|
| 0 | 2024-01 | BELO HORIZONTE | 65.000000 | 40 | 111643.77 | 182 | 65.000000 |
| 1 | 2024-01 | CAMPINAS | 91.044776 | 67 | 114131.31 | 246 | 75.986733 |
| 2 | 2024-01 | COPACABANA | 80.281690 | 71 | 225878.13 | 250 | 74.070324 |
| 3 | 2024-01 | IPIRANGA | 69.230769 | 65 | 234789.84 | 305 | 69.230769 |
| 4 | 2024-01 | ITAIM | 30.769231 | 13 | 99281.93 | 128 | 55.494505 |

Figure X: Code example of pandas' dataframe merging

The dataset was merged using store and month as common keys. Only complete entries were retained to maintain consistency in correlation analysis.

10.3. Appendix C – Descriptive Statistics

Summary of how we're summarizing data.

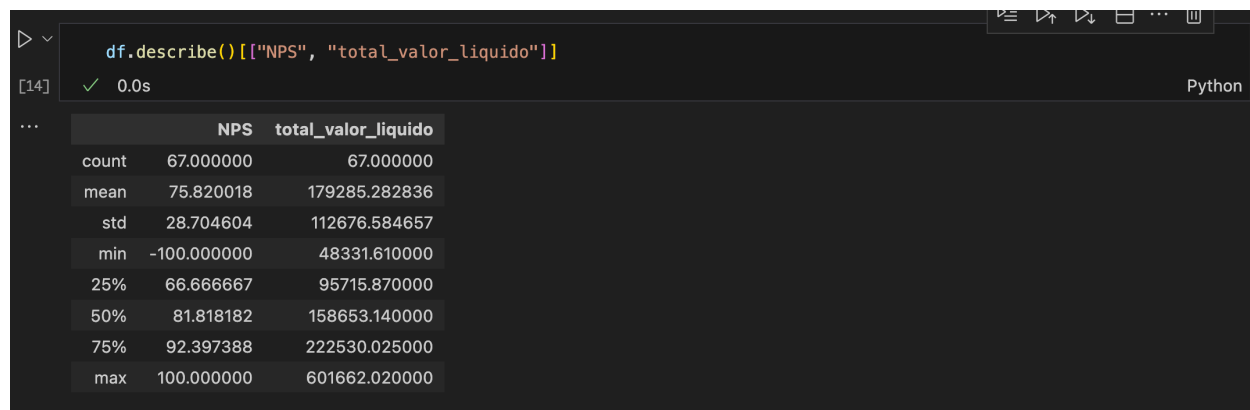


Figure X: Descriptive statistics of Net Promoter Score and revenue across all clinics.

10.4. Appendix D – Correlation Preview

The analysis has not been finished yet, but still it is possible to see the beginning of the studies of correlation between NPS score and Revenue income generated on the stores. More to come in the next analysis.

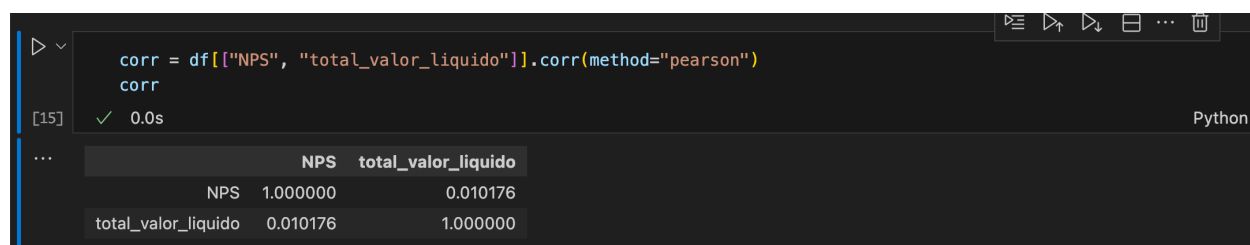


Figure X: Preliminary Pearson correlation matrix. A moderate-to-strong positive relationship is observed between NPS and revenue, indicating potential predictive alignment.

End of Appendix Section

Statement of Acknowledgment

I acknowledge that I have used the following AI tool(s) in the creation of this report:

- OpenAI ChatGPT (GPT-5): Used to assist with outlining, refining structure, improving clarity of academic language, and supporting APA 7th referencing conventions.

I confirm that the use of the AI tool has been in accordance with the Torrens University Australia Academic Integrity Policy and TUA, Think and MDS's Position Paper on the Use of AI. I confirm that the final output is authored by me and represents my own critical thinking, analysis, and synthesis of sources. I take full responsibility for the final content of this report.

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