Integrating QR into Non-STEM Disciplines: Examples from Barnard’s Empirical Reasoning Initiative

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QR has two distinct connotations

• Formal mathematical/logical analysis
• Empirical reasoning or “critical thinking with data (evidence)”
  – Not simply statistical methods
  – Akin to research design: formulating and refining empirical hypotheses, collecting-evaluating evidence, descriptive statistics, interpretation and presentation of results, etc.

Barnard’s Initiative Focuses on Empirical Reasoning

• Two sample assignments from non-STEM classes
  – Comparative study of Four Asian Tigers in Critical Approaches to East Asia in the Social Sciences
  – The history of mortality in five U.S. cities in Urban Studies Junior Colloquium
• “Introductory” classes teaching “novices” the fundamentals of empirical research
  – “Truth table” analysis with qualitative evidence to identify salient (“explanatory”) factors
  – Graphical analysis with quantitative data with Excel in research design

“Truth Table” Assignment (from the Syllabus)

• Based on Castells’s article “Four Asian Tigers with a Dragon Head” (esp. pp. 50-55), construct a truth table of the common and uncommon factors in the economic development of Hong Kong, South Korea, Taiwan, and Singapore (emphasis added)

“Truth Table” Assignment for the ERL Workshop

• The continued stability of small relatively isolated communities is dependent on the younger generation’s choice to remain in them. The majority have experienced economic and cultural shifts as larger proportions of youth leave them. It is important to understand the common and uncommon factors involved in their exodus. This “paper” will focus on five small towns (Sunnydale, CA, Bluffington, IN, Arcadia, WA, Leadworth, KS, and Victoriaville, ME) that have experienced an exodus of their younger generation, with at least 50% of people who had lived there for at least 10 years before age 18 moving out of the town between the ages of 18 & 29

“Truth Table” Workshop Assignment: A Sample Scenario

• Arcadia is a little town in northeastern Washington, sitting very close to the Canadian border on the north and the Montana state line to the east
  – Many state and national parks in Washington and Montana are easily accessible from Arcadia
  – Arcadia is 2.5 hours from Spokane which is the nearest large city
  – There are no colleges or universities in or near the city. The closest college is Wenatchee Valley College, a small two-year college about 1.5 hours away
“Truth Table” Workshop Assignment: A Sample Scenario (cont.)

- Arcadia has about 3,000 residents; the median income is relatively low, at $34,000
  - Most economic activity centers around the local Air Force base and relatively new eco-tourism ventures that attract “green” seatleites
  - Many of the eco-tourism ventures are small, family businesses which rent out rooms in their homes and offer tours and excursions to the parks
  - There are few apartments for rent, but a three bedroom can cost about $70,000
  - The low cost of living makes living in Arcadia fairly comfortable

Exploratory Analysis of Historical Mortality Data (from assignment)

- Data: mortality data for five U.S. cities from the early 19th to the early 20th centuries
- Three key components
  - Analyze the mortality data using Excel
  - Interpret the data in a short paper (using graphs to aid in interpretation and presentation)
  - Describe a plan for future research, explaining HOW you might go about finding more historically accurate explanations for the data

Analysis of Historical Mortality Data, Step 1: Download Data

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<thead>
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Analysis of Historical Mortality Data, Step 2: Data exploration

- What do crude death rates exactly mean? What do they measure? How do historians compile this indicator? And what are the possible limitations of using this indicator?
- What kind of historical sources may have been used to compile these data? What are the potential biases and sources of error introduced into the data by the historical sources used?

Analysis of Historical Mortality Data, Step 3: Data Analysis

- After completing the Excel workshop, draw graphs charting mortality rates and trends in the five cities over time.
- How did mortality rates change over time? Are there years with unusually high or low mortality? What trends/patterns do you observe?
- Compare the five cities. Do they demonstrate similar or different mortality trends? Does any city stand out as having unusually high or low mortality? Can you identify specific groupings of cities with similar trends?

Analysis of Historical Mortality Data, Step 4: Interpretative Paper

- 6-8 page (plus graphs) analytical paper
- Four objectives:
  - Critical assessment of the data
  - Comparative analysis of urban mortality trends and patterns
  - Alternative historical interpretations of these trends and patterns
  - Possible directions/hypotheses for future research
Sample Work

- “crude death rate refers to the number of deaths in a given year per thousand people (based on a mid-year population estimate).”

Questions

- What caused spikes in mortality rates? Were they common across cities?
- Why were mortality rates higher in New York than in Boston?
- Why did rates tend to increase in the early 1800s but then decline (slightly) by mid-century?

By the Numbers

- ~300 students (or 13% of FTE) attended an ERL workshop in the fall
  - Repeat visits: 43%
  - Undergraduate: 90%
  - Thesis visits: 28%
  - Average visit duration: 20 min. Ranging from 2-100 min
Sample Questions

• How do I change the legend on my chart
• How to generate new variables in STATA
• How to find a location and measure different variables in Social Explorer
• Which measures of central tendency should I report for each of these variables; How should I report them
• How do I frame questions for thesis

Example summaries of questions

• Find historic dataset for US sugar consumption and creating line charts in excel displaying multiple data for a thesis
• Find a dataset about video crime surveillance in the 1990s to support argument that video surveillance CCTV in the mid-90s contributed to the decline of crime
• Find newspaper articles containing a specific term and create a statistically meaningful chart showing trends in the use of the search term

Disciplines of Patrons’ Questions

- History
- Human Rights
- Physics & Astronomy
- Women’s Studies
- Education
- Biological Sciences
- Environmental Science
- Political Science
- Economics
- Chemistry
- Unmarked
- Urban Studies
- Psychology
- Sociology

Diagram showing disciplines of patrons' questions with various topics connected and labeled.