

Quantitative Reasoning and
Informed Citizenship:
An activity-based course for
non-science majors

Alicia Sevilla and Kay Somers
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This Talk

- What quantitatively literate students should be able to do
- What students study in our course
- What students do in our course
- What students say about our course

What quantitatively literate students should be able to do

1. Exhibit a positive, or at least a non-negative, association with anything quantitative.

Students should be able to . . .

2. Read news reports and think critically about the quantitative information reported there.

Students should be able to . . .

3. Estimate with very large or very small numbers.

Students should be able to . . .

4. Know when quantitative analyses might be useful for an argument or a discussion.

Students should be able to . . .

5. Think about the
“reasonableness” of quantitative
results.

Students should be able to . . .

6. Use technology appropriately and wisely.
 - Be critical users of the Web.
 - Be able to carry out basic computations without technology.

Students should be able to . . .

7. Use quantitative analyses in their own studies and research in various fields, and explain the results of quantitative analyses.

What Students Study

Section I: Numerical Reasoning

Section II: Logical Reasoning

Section III: Statistical Reasoning

. . . in the context of real data

Numerical Reasoning

Topic 1: Organizing Information

Pictorially Using Charts and Graphs

Topic 2: Bivariate Data

Topic 3: Graphs of Functions

Topic 4: Multiple Variable Functions

Topic 5: Proportional, Linear, and
Piecewise Linear Functions

Topic 6: Modeling with Linear and Exponential Functions

Topic 7: Logarithms and Scientific Notation

Topic 8: Indexes and Ratings

Topic 9: Personal Finances

Topic 10: Introduction to Problem Solving

Logical Reasoning

Topic 11: Decision Making

Topic 12: Inductive Reasoning

Topic 13: Deductive Reasoning

Topic 14: Apportionment

Topic 15: More on Problem Solving

Statistical Reasoning

Topic 16: Average and Five-Number Summary

Topic 17: Standard Deviation, z-Score, and Normal Distributions

Topic 18: Basics of Probability

Topic 19: Conditional Probability and Tables

Topic 20: Sampling and Surveys

Topic 21: More on Decision Making

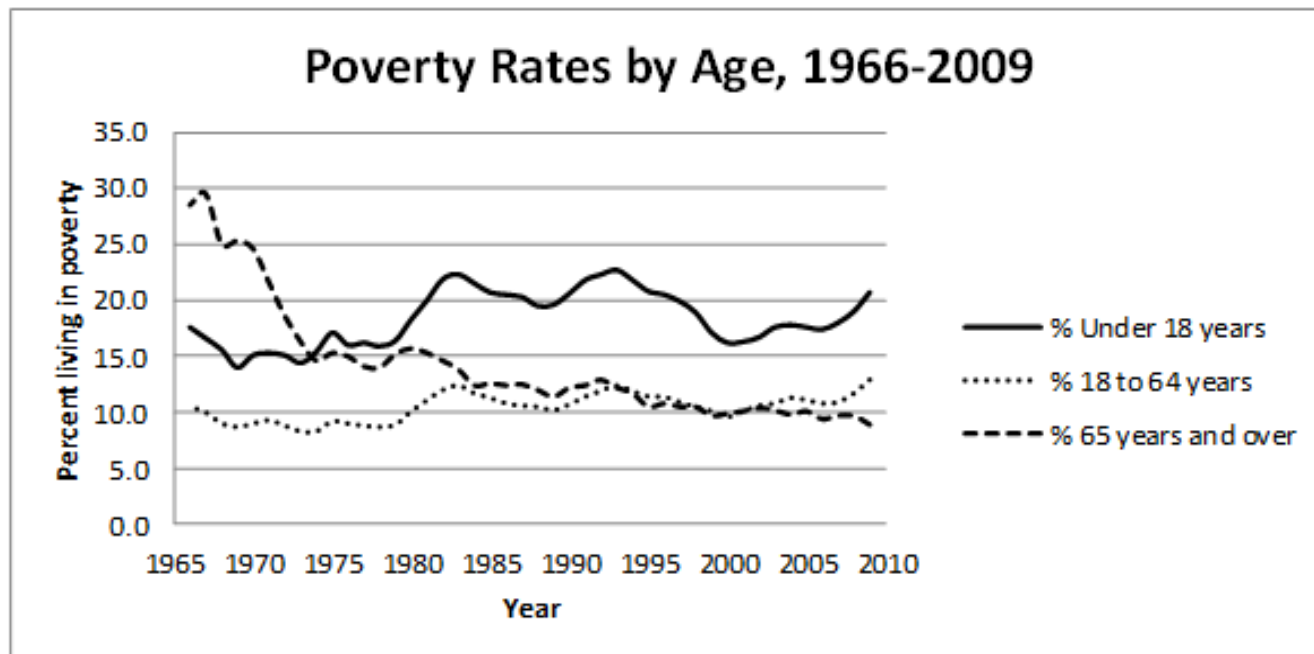
What Students Do

- Background reading, worked-out examples
- In-class examples to investigate
- Explorations for homework
- Activities
- Projects

Explorations

Topic 3 Graphs of Functions

The graph below shows the percent of people in the U.S. living in poverty in three different age groups over the years 1966 to 2009. Write a clear explanation of the story this graph tells. (Source: *U.S. Census Bureau*, www.census.gov)



Activity 3.2

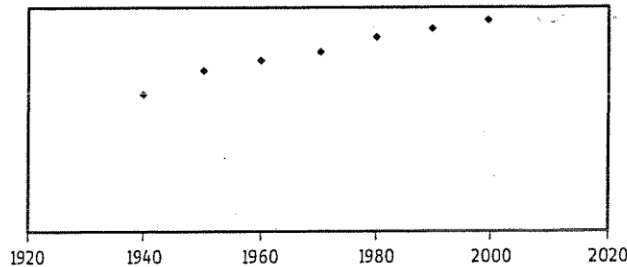
Rate of Change and Concavity

In this activity, students investigate the link between the rate of change and the graph of a function by looking at data on cases of tuberculosis, life expectancy, and military personnel.

- iii. Explain how these rates of change confirm that the graph is concave upward.

The rates of change confirm that the graph is concave upward because the rates of changes are getting less negative, which is an indication that the graph is concave upward.

b.



Year	Life Expectancy at Birth
1940	62.9
1950	68.2
1960	69.7
1970	70.8
1980	73.7
1990	75.4
2000	77.0

- i. Use the table to find the average rate of change in life expectancy at birth per year.

From 1940 to 1950:

$$\begin{array}{l} 1940 \rightarrow 62.9 \\ 1950 \rightarrow 68.2 \\ \frac{68.2 - 62.9}{1950 - 1940} = \frac{5.3}{10} = 0.53 \end{array}$$

From 1950 to 1960:

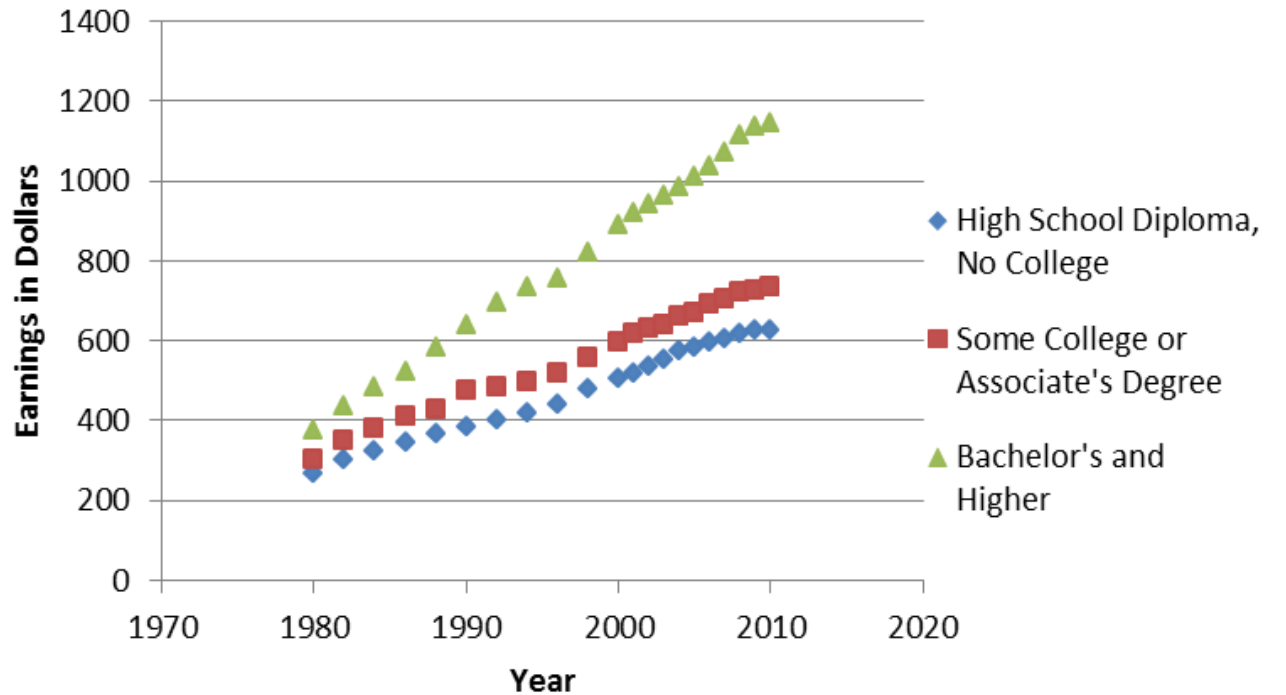
$$\begin{array}{l} 1950 \rightarrow 68.2 \\ 1960 \rightarrow 69.7 \\ \frac{69.7 - 68.2}{1960 - 1950} = \frac{1.5}{10} = 0.15 \end{array}$$

Activity 8.2

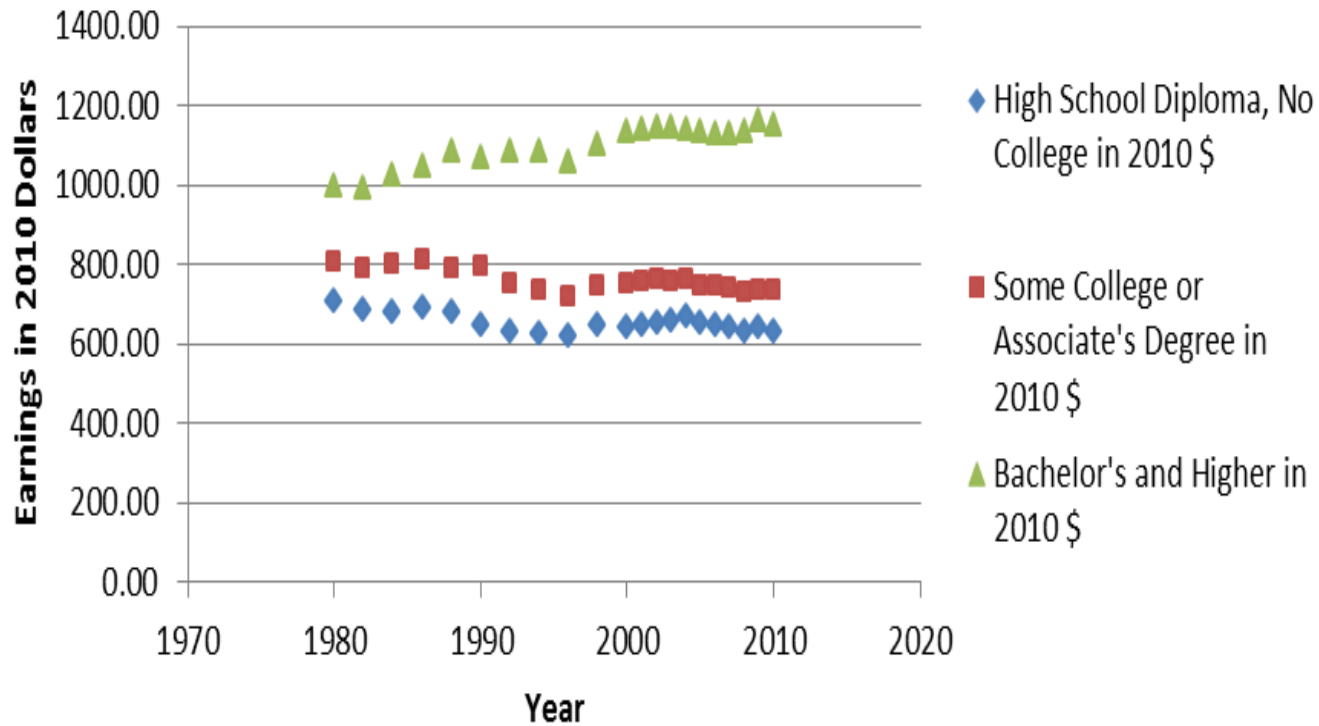
Consumer Indexes

In this activity, students look at median weekly earnings, in dollars, of full-time wage and salary workers, 25 years and over, by educational attainment over the years 1980 to 2010.

Median Weekly Earnings



Median Weekly Earnings in 2010 \$



Project 1

Students were asked to choose an issue related to **poverty and inequality**, find data on the web, evaluate the website(s), and create 3 different graphs with explanations to help understand their issue.

Sample Student Topics

- *Poverty Hitting our Schools*—States' poverty rates and high school graduation rates
- *What does your child really mean to America?*—public school spending in various states
- *Families in poverty in New York*
- *The income and wealth gap between rich and poor*

Context for Applications

- Social and economic issues
- Ecological Issues
- Education
- Health
- History
- Sports and games
- Weather

“I really struggle in Math especially on tests. The graded class assignments allowed me to do well by not being only graded on tests but I could prove I knew the information on a daily basis.”

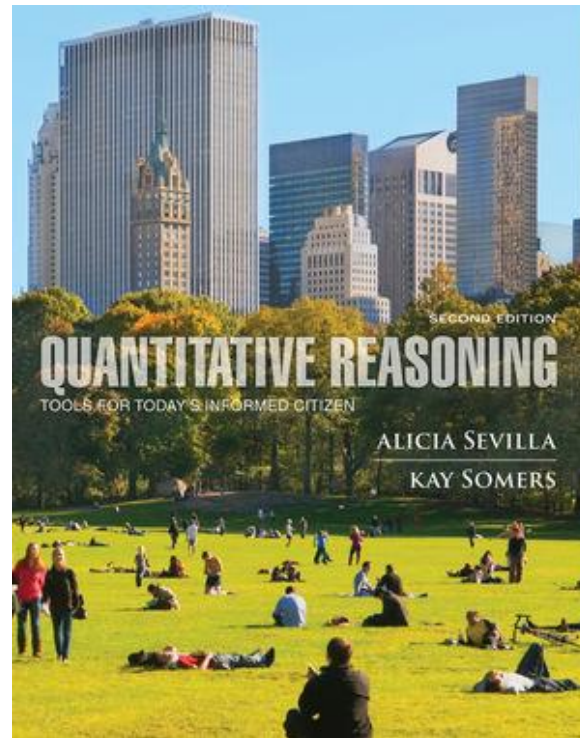
“Interesting course material. Enjoyed incorporation of Excel.”

“The lab assignments were great; however, I believe the instructions in our book made the labs too easy. Make it a bit more challenging so the class learns the material instead of just following instructions.”

“Give more steps and instructions for assignments.”

“Working with Excel was beneficial. I believe it informed many of the basics, especially me. The professor coordinated our excel activities very well with what we were learning at the time. She also varied classes, with group activities.”

Sevilla and Somers, *Quantitative Reasoning: Tools for Today's Informed Citizen*, 2nd ed, November, 2012 Wiley Publishing Co.



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Contact Information

- Alicia Sevilla: sevillaa@moravian.edu
- Kay Somers: somersk@moravian.edu