Count Me In: Exploring the Relationship Between Quantitative Reasoning and Civic Engagement

Louis M. Rocconi
Amber D. Lambert
Alexander C. McCormick
Shimon A. Sarraf

National Numeracy Network Conference
New York, NY
13 October 2012
Outline

• A few words about NSSE
• Quantitative Reasoning (QR) on NSSE
• Where we find differences in QR
• What we mean by Civic Engagement
• The relationship between QR and Civic Engagement
What is NSSE?

- National Survey of Student Engagement
- NSSE gives a snapshot of college student experiences in and outside of the classroom
- NSSE items represent good practices related to desirable college outcomes
- Indirect, process measures of student learning and development
NSSE Purpose

- NSSE annually gathers valid, reliable information on the extent to which students engage in and are exposed to proven educational practices that correspond to desirable learning outcomes.

- Results indicate how students spend their time and what they gain from college.
Rationale for adding QR to NSSE

- Emphasize importance of QR/QL activities during college
- Address bias towards Arts and Humanities majors
- Existing problem set items lacked psychometric properties
Importance of QR

• National Assessment of Adult Literacy

• QR skills are needed for effective democratic participation (Steen, 2001)
Development of QR Items

• Review literature to develop 10 items related to QR activities
• Vetted items with experts in field
• Cognitive interviews and focus groups with students
• Quantitative analyses on items (EFA, CFA, IRT, etc.)
• Chose 3 best items to represent QR activities in college
Pilot 2012 Survey

- Used to update NSSE. New NSSE launches in 2013
- New “Engagement Indicators” like Quantitative Reasoning
- New “Modules” including Civic Engagement
Sample

- 4,807 students at 14 institutions
- 68% Female
- 45% First-year / 55% Senior
- 33% STEM majors
- 96% Full-time
- 73% White, 10% African-American, 8% Asian, 6% Hispanic, 3% Other/Multiracial
Students’ reported frequency of QR activities
\( (\alpha = .86; \text{Range}: 0 \text{ to } 100; \text{FY: } \bar{X} = 45, s = 26; \text{SR: } \bar{X} = 48, s = 28) \)

How often have you done the following? [Very often, Often, Sometimes, Never]

- Reach conclusions based on your own analysis of numerical information (numbers, graphs, statistics, etc.)
- Used numerical information to examine a real-world problem or issue (unemployment, climate change, disease prevention, etc.)
- Evaluated what others have concluded from numerical information
Where we see differences in QR

• Gender
  ▪ Males report more frequent QR activity than females (almost a quarter standard deviation more among seniors)

• Academic Major
  ▪ Differences in academic majors account for 17% of the variability in QR activities
Frequency of QR Activity by Gender

<table>
<thead>
<tr>
<th>Year</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-year</td>
<td>49.6</td>
<td>43.4</td>
</tr>
<tr>
<td>Senior</td>
<td>52.6</td>
<td>45.1</td>
</tr>
</tbody>
</table>
Frequency of Senior QR Activity by Major Category

- Engineering: 62.4%
- Physical sciences: 61.5%
- Biological sciences: 59.6%
- Business: 55.3%
- Social sciences: 50.5%
- Professional (other): 48.5%
- Education: 37.3%
- Arts & humanities: 31.8%
## Majors where students report the most and least QR activities

<table>
<thead>
<tr>
<th>Top 10</th>
<th>Bottom 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Civil Engineering</td>
<td>1. Art</td>
</tr>
<tr>
<td>2. Marine (life) Science</td>
<td>2. English</td>
</tr>
<tr>
<td>3. Chemical Engineering</td>
<td>3. Music or Art Education</td>
</tr>
<tr>
<td>4. Finance</td>
<td>4. Theater or Drama</td>
</tr>
<tr>
<td>5. Economics</td>
<td>5. Music</td>
</tr>
<tr>
<td>7. Mechanical Engineering</td>
<td>7. History</td>
</tr>
<tr>
<td>8. Earth Science</td>
<td>8. Therapy (occupational, physical, speech)</td>
</tr>
<tr>
<td>9. Physics</td>
<td>9. Theology or Religion</td>
</tr>
<tr>
<td>10. Mathematics</td>
<td>10. Secondary Education</td>
</tr>
</tbody>
</table>
Selected Characteristics by QR Quartiles for Seniors

(overall percentages in parentheses)
What is Civic Engagement?

- Working to make a difference in civic life and developing the knowledge, skills, values, and motivation to make that difference (Ehrlich, 2000).
Civic Awareness

How often have you done each of the following either in or out of the classroom?
[Very often, Often, Sometimes, Never]

- Informed yourself about {local; regional or national; international or global} issues
- Discussed {local; regional or national; international or global} issues with others
Civic Leadership/Competence

Select the response option that best represents your ability to do the following [1=poor, 2⋯5, 6=Excellent]:

• Help people resolve their disagreements with each other

• Resolve conflicts that involve bias, discrimination, and prejudice

• Lead a group where people from different backgrounds feel welcomed and included

• Contribute to the well-being of your community
Civic Activism

How often have you done each of the following either in or out of the classroom? [Very often, Often, Sometimes, Never]

- Raised awareness about {local; regional or national; international or global} issues
- Identified others who could help address {local; regional or national; international or global} issues
- Organized others to work on {local; regional or national; international or global} issues
Majors where students report the most and least Civic Engagement

<table>
<thead>
<tr>
<th>Top 10</th>
<th>Bottom 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Political Science</td>
<td>1. Earth science</td>
</tr>
<tr>
<td>2. Social work</td>
<td>2. Electrical/electronic engineering</td>
</tr>
<tr>
<td>4. Sociology</td>
<td>4. Physics</td>
</tr>
<tr>
<td>5. Secondary Education</td>
<td>5. Therapy (occupational, physical, speech)</td>
</tr>
<tr>
<td>7. Environmental science</td>
<td>7. Art</td>
</tr>
<tr>
<td>8. Anthropology</td>
<td>8. Chemistry</td>
</tr>
<tr>
<td>9. Theology or religion</td>
<td>9. Computer science</td>
</tr>
<tr>
<td>10. Special Education</td>
<td>10. Mechanical engineering</td>
</tr>
</tbody>
</table>
Average First-Year Civic Engagement by QR Activities

- **Civic Leadership**: 1st Quartile of QR, 2nd Quartile of QR, 3rd Quartile of QR, 4th Quartile of QR
- **Civic Activism**: 1st Quartile of QR, 2nd Quartile of QR, 3rd Quartile of QR, 4th Quartile of QR
- **Civic Awareness**: 1st Quartile of QR, 2nd Quartile of QR, 3rd Quartile of QR, 4th Quartile of QR
Average Senior Civic Engagement by QR Activities

- Civic Leadership
- Civic Activism
- Civic Awareness
Regression Results

- Controlling for student characteristics (gender, race/ethnicity, ACT/SAT scores, enrollment status, age, transfer status, parental education, STEM/non-STEM major, hours spent volunteering, service-learning) and institutional characteristics (enrollment size, control) frequency of QR activity was positively associated with all three Civic Engagement indicators.
## Regression Results

<table>
<thead>
<tr>
<th></th>
<th>QR - B</th>
<th>QR - $\beta$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civic Awareness</td>
<td>.22</td>
<td>.24</td>
<td>.22</td>
</tr>
<tr>
<td>Civic Activism</td>
<td>.22</td>
<td>.26</td>
<td>.15</td>
</tr>
<tr>
<td>Civic Leadership</td>
<td>.11</td>
<td>.17</td>
<td>.06</td>
</tr>
</tbody>
</table>

All significant at the $p<.001$ level
Implications

• Programs to increase students’ QR activities also gives students the tools to become more productive and active citizens.

• Given the gap in QR activities across majors, it is important for all disciplines to incorporate QR activities.
Questions

Louis Rocconi
lrocconi@indiana.edu

Amber D. Lambert
alamber@indiana.edu