A Virtue-Based Responsible Conduct of Research (RCR) Curriculum: Pilot Test Results

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Overview

**Motivation:** why Scientific Virtues (SV)?

**Background:** the SV Toolbox approach

**Preliminary Results:** what we found

**Conclusions:** what we think
Motivation: Why the Scientific Virtues?

SCIENTIFIC MISCONDUCT

• Fabrication, Falsification, and Plagiarism (FFP) & Questionable Research Practices (QRP)
• Obscures *truth*, degrades *trust*, and wastes *time and resources*

TRADITIONAL RCR TRAINING

• Legalistic (rules-based)
• Not very effective

(Pennock 2006, 2015)
The Scientific Virtues Approach

Reframe standard approaches to RCR in terms of the scientific virtues:

• Identify the scientific virtues
• Illustrate their role in exemplary science
• Promote their development and transmission
Background: the SV Toolbox approach

Instrument
• Prompts crafted to elicit reflection around the role of a particular virtue in science
• Likert scale scoring (pre and post discussion)

Discussions
• Small groups
• Provided prompts orient focus
• Lightly moderated, participant-driven

A biased scientist is not a curious scientist.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>Don’t Know</td>
</tr>
</tbody>
</table>
Background: the SV Toolbox Approach

We have developed and administered SV Toolbox Modules around core scientific virtues, including:

- Purpose of Science
- Curiosity
- Honesty
- Courage
- Humility to Evidence
- Perseverance

(Pennock & O’Rourke 2017)
Types of Data Collected

1) **Quantitative**: Likert-scale scores Pre- and Post-discussion

2) **Qualitative**: The discussion itself [recorded]

3) **Evaluative**: Follow-up survey of participants
Preliminary Results

(1) **Quantitative Data**: Likert Responses
Quantitative Data: Pre/Post Scores

**Curiosity**

*Core Question: How does the virtue of curiosity shape a scientist’s behavior?*

1. A curious scientist will not fabricate data.
   - Disagree
   - Agree
   - I don’t know
   - N/A
2. Exemplary scientists are motivated primarily by curiosity.
   - Disagree
   - Agree
   - I don’t know
   - N/A
3. Satisfaction of one’s curiosity is one of the greatest sources of happiness in life.
   - Disagree
   - Agree
   - I don’t know
   - N/A
4. A biased scientist is not a curious scientist.
   - Disagree
   - Agree
   - I don’t know
   - N/A
5. Curiosity without application has no value.
   - Disagree
   - Agree
   - I don’t know
   - N/A
6. A curious nature motivates a scientist to value truth over career advancement.
   - Disagree
   - Agree
   - I don’t know
   - N/A

**Discussion**

**Pre-Discussion Responses**

**Post-Discussion Responses**
## Quantitative Data: Pre/Post Scores

<table>
<thead>
<tr>
<th>Type of Change</th>
<th>Number of Occurrences</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Change to/from “Middle-of-the-Road”</td>
<td>47</td>
<td>13.78%</td>
</tr>
<tr>
<td>Either 2 ↔ 3 or 3 ↔ 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Change within same valence</td>
<td>39</td>
<td>11.44%</td>
</tr>
<tr>
<td>Either 1 ↔ 2 or 4 ↔ 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Change to/from “Middle-of-the-Road”</td>
<td>9</td>
<td>2.64%</td>
</tr>
<tr>
<td>Either 1 ↔ 3 or 3 ↔ 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive to/from Negative</td>
<td>19</td>
<td>5.57%</td>
</tr>
<tr>
<td>(1 or 2) ↔ (4 or 5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Committal to/from Position</td>
<td>15</td>
<td>4.40%</td>
</tr>
<tr>
<td>(Don’t Know or N/A) ↔ Any #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Substantial Change</td>
<td>212</td>
<td>62.17%</td>
</tr>
<tr>
<td>No Change or (NA ↔ Don’t Know)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 51 Respondents providing 341 total Prompt Responses from the Curiosity module
Quantitative Data: Pre/Post Scores

After participating in the module, some participants alter some of their responses to prompts.

Encouraging Pilot Results: suggests that participation may change views, though

Further investigation needed to assess
(1) whether the discussion alters participants’ views
(2) if views are altered in the ‘right’ sorts of ways
Preliminary Results

(3) **Evaluative Data**: Follow-Up Surveys
Evaluative Data: Participant Surveys

**Question:** Explain whether you think appreciation of the Scientific Virtues can contribute to the development of RCR.

<table>
<thead>
<tr>
<th>Response</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>40</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
</tr>
<tr>
<td>Neutral</td>
<td>1</td>
</tr>
<tr>
<td>No Response</td>
<td>3</td>
</tr>
</tbody>
</table>
Evaluative Data: Participant Surveys

**Question**: Based on your experience, would you prefer the Scientific Virtues Approach to RCR training a more a traditional approach?

<table>
<thead>
<tr>
<th>Approach</th>
<th>Number of Respondents (n=45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefer SV Approach</td>
<td>29</td>
</tr>
<tr>
<td>Prefer Mixed Approach</td>
<td>6</td>
</tr>
<tr>
<td>Prefer Traditional Approach</td>
<td>1</td>
</tr>
<tr>
<td>No Response or N/A</td>
<td>9</td>
</tr>
</tbody>
</table>

Number of Respondents (n=45)
Evaluative Data: Participant Surveys

Explain what you found valuable about the Scientific Virtues Toolbox approach

“I really like thinking about RCR in a positive way - virtues, rather than things to avoid. I think it's a great way to get people to frame their own thoughts in a productive way.”

“The exercise was much more motivating than traditional RCR. It made me want to be a better scientist immediately.”

“These exercises inspire me to be an ideal scientist instead of making me worry about what not to do wrong.”
Evaluative Data: Participant Surveys

Explain whether you think appreciation of the scientific virtues can contribute to the development of an RCR curriculum.

“Definitely. I would love if virtues became the focus of RCR instead of the traditional model.”

“Yes, I think seizing scientific virtues at their core can produce more agreement than simply discussing a set of situational rules derived from them.”

“Absolutely. I intend to use this approach when I teach professional ethics next spring.”
Conclusions

Our preliminary results show that ...

(1) Participants *alter some of their initial views* after the SV Toolbox discussion

(2) Participants *find the modules engaging and valuable*

**Motivation** to continue developing a Scientific Virtues-based approach to RCR training.
Future Plans

Forthcoming:

• Formal study of the modules’ effects on views and behaviors
• Create modules for the remaining Scientific Virtues
• Development of full RCR curriculum supplement based upon Scientific Virtues
Acknowledgements

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• James Foster (University of Idaho)
• Workshop participants
References


Quantitative Data: Pre/Post Scores

Shifts in Views After SV Toolbox Discussion

Participants (P#)

BEACON Congress 2013: Curiosity Group 1

- No Shifts
- Minor Shifts
- Major Shifts
## Quantitative Data: Pre/Post Scores

<table>
<thead>
<tr>
<th>Career Stage</th>
<th>No Change (# of Prompts)</th>
<th>Minor Change (# of Prompts)</th>
<th>Major Change (# of Prompts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>4.2</td>
<td>1.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Students</td>
<td>3.8</td>
<td>2.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Early Career</td>
<td>5.3</td>
<td>1.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Mid-Career</td>
<td>3.9</td>
<td>2.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Late Career</td>
<td>5.3</td>
<td>0.8</td>
<td>1.0</td>
</tr>
</tbody>
</table>