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

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THE SCIENTIFIC VIRTUES PROJECT

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Overview

Motivation: why Scientific Virtues (SV)?

Background: the SV Toolbox approach

Preliminary Results: what we found

Conclusions: what we think

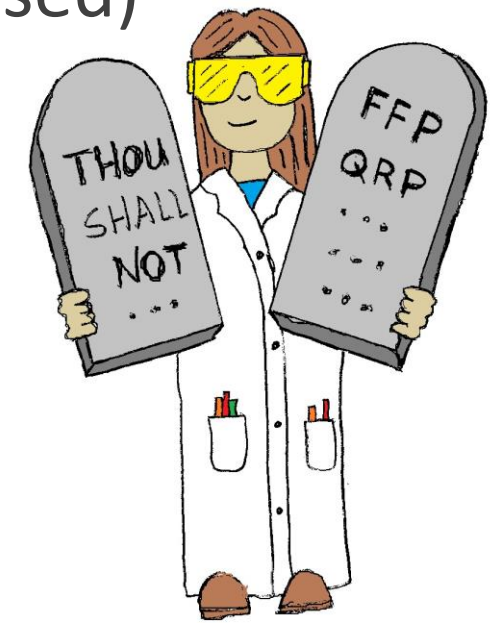
Motivation: Why the Scientific Virtues?

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

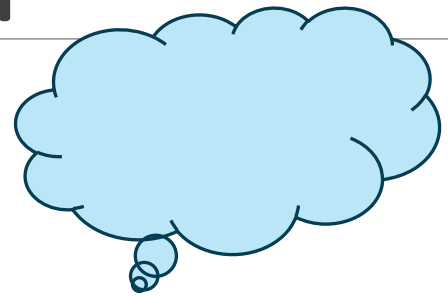
Reframe standard approaches to RCR in terms of the **scientific virtues:**

- **Identify** the scientific virtues
- **Illustrate** their role in exemplary science
- **Promote** their development and transmission

THE SCIENTIFIC VIRTUES PROJECT

Background: the SV Toolbox approach

TOOLBOX DIALOGUE INITIATIVE ™ (O'Rourke and Crowley, 2013)



Instrument

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

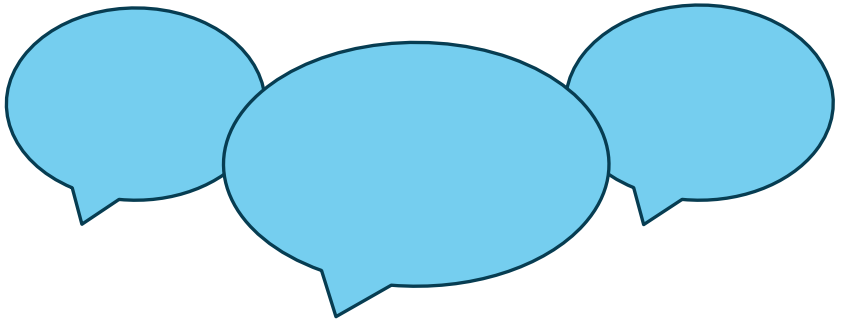
A biased scientist is not a curious scientist.

Disagree *Agree*

1 *2* *3* *4* *5* *Don't Know*

Discussions

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



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)

Curiosity

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

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

Types of Data Collected

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

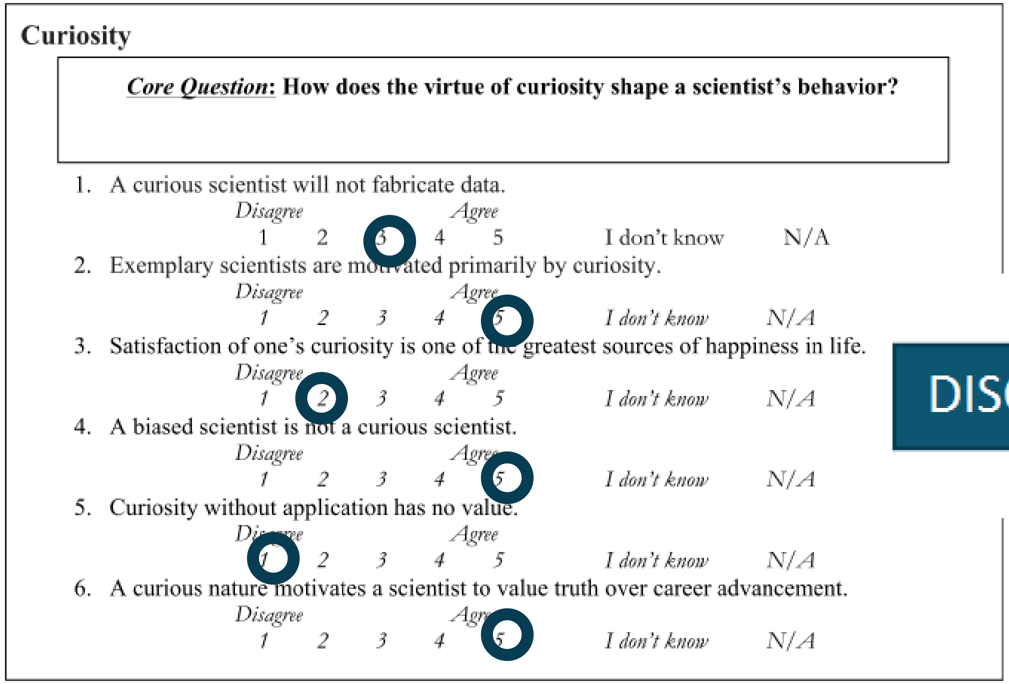
2) Qualitative: The discussion itself [recorded]

✓ **3) Evaluative:** Follow-up survey of participants

Preliminary Results

(1) **Quantitative Data**: Likert Responses

Quantitative Data: Pre/Post Scores



Curiosity

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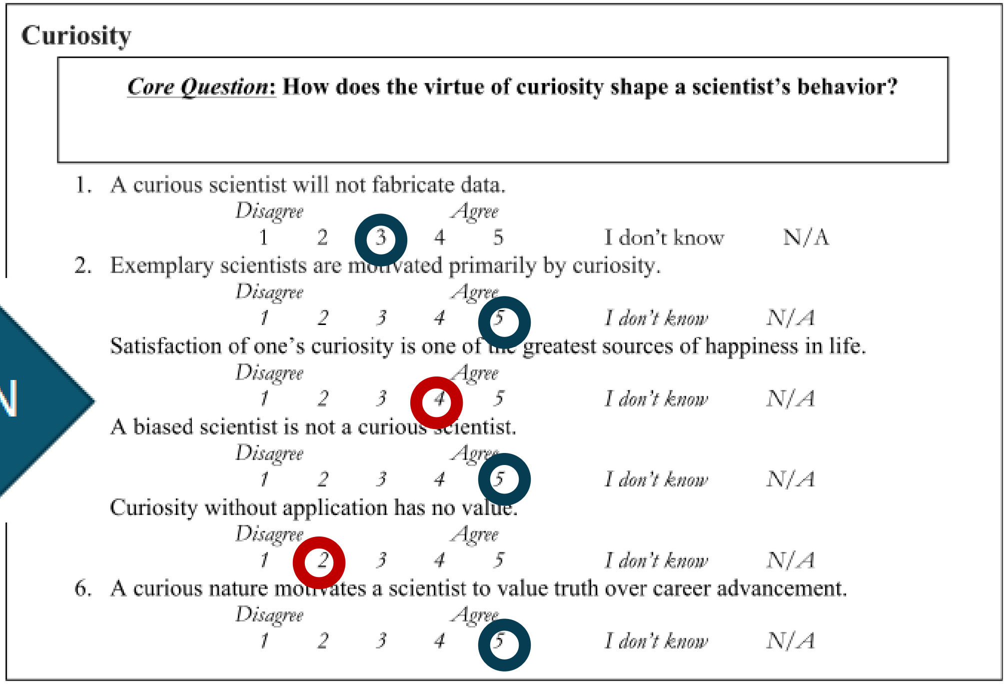

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6. A curious nature motivates a scientist to value truth over career advancement.
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Pre-Discussion Responses

Post-Discussion Responses

Quantitative Data: Pre/Post Scores

Type of Change	Number of Occurrences	% of Responses
Small Change to/from "Middle-of-the-Road" Either 2⇔3 or 3⇔4	47	**13.78%**
Small Change within same valence Either 1⇔2 or 4⇔5	39	**11.44%**
Large Change to/from "Middle-of-the-Road" Either 1⇔3 or 3⇔5	9	**2.64%**
Positive to/from Negative (1 or 2) ⇔ (4 or 5)	19	**5.57%**
Non-Committal to/from Position (Don't Know or N/A) ⇔ Any #	15	**4.40%**
No Substantial Change No Change or (NA ⇔ Don't Know)	212	**62.17%**

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

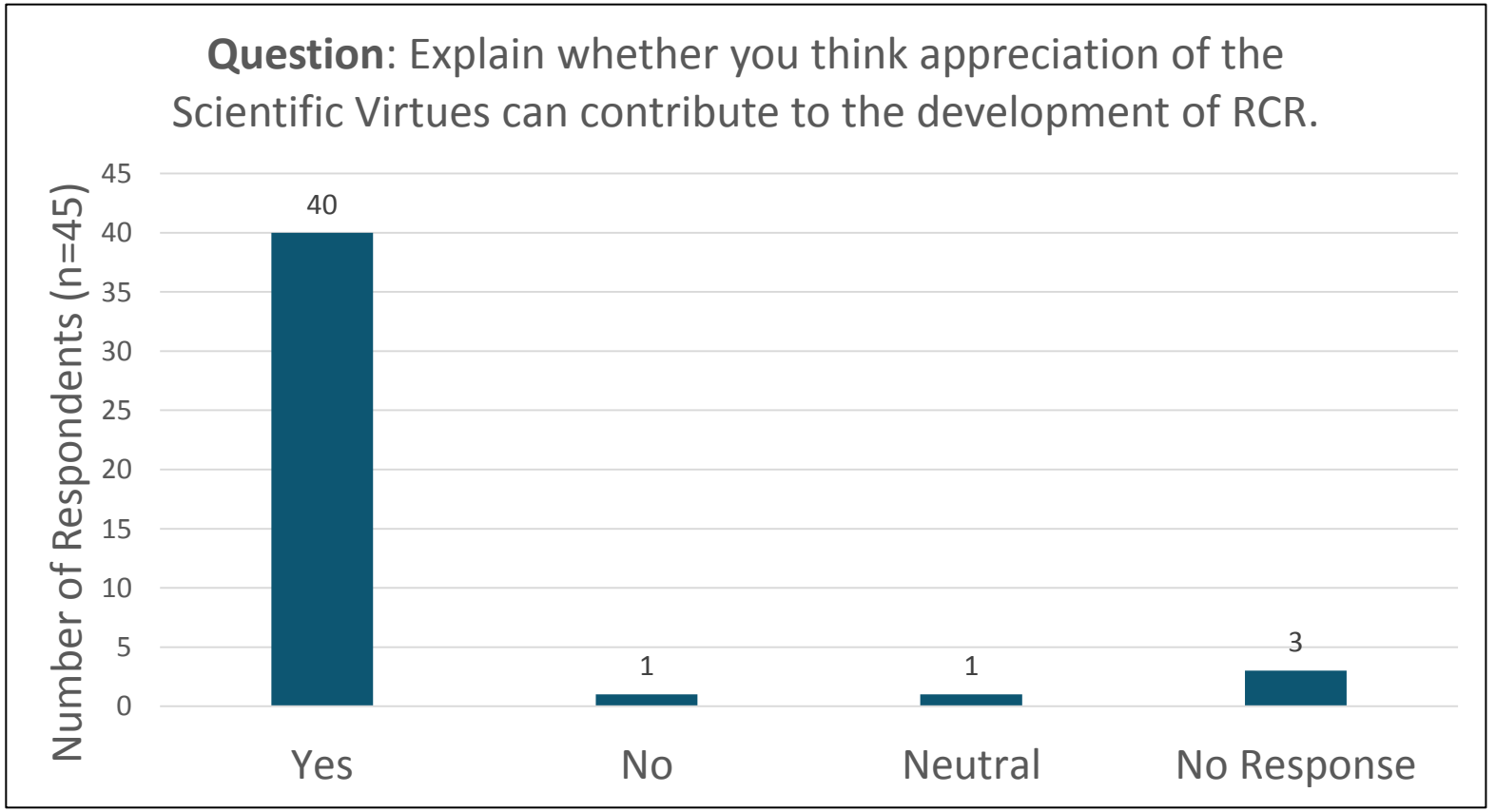
(1) whether the discussion alters participants' views

(2) if views are altered in the 'right' sorts of ways

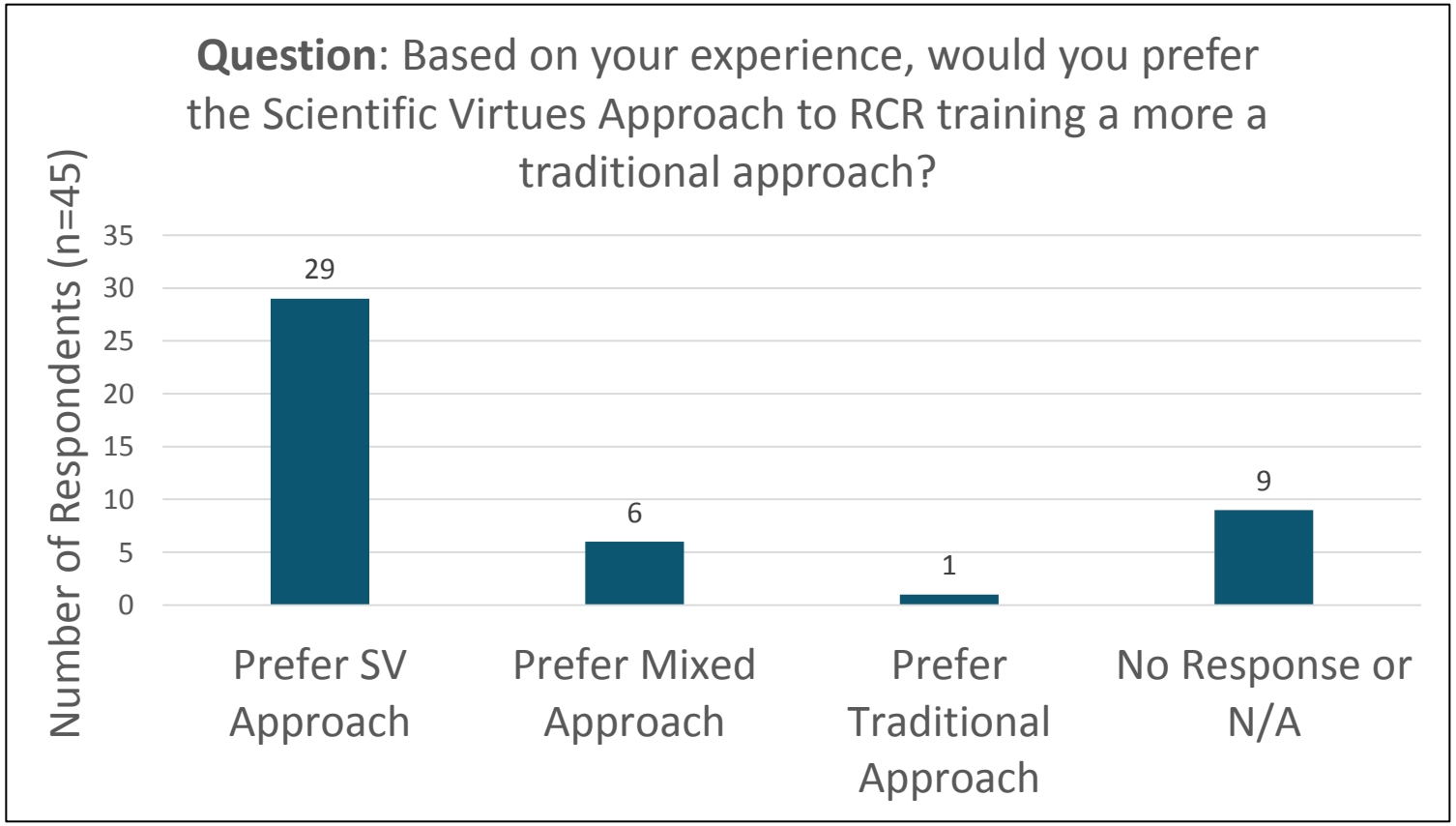
Preliminary Results

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

Evaluative Data: Participant Surveys



Evaluative Data: Participant Surveys



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

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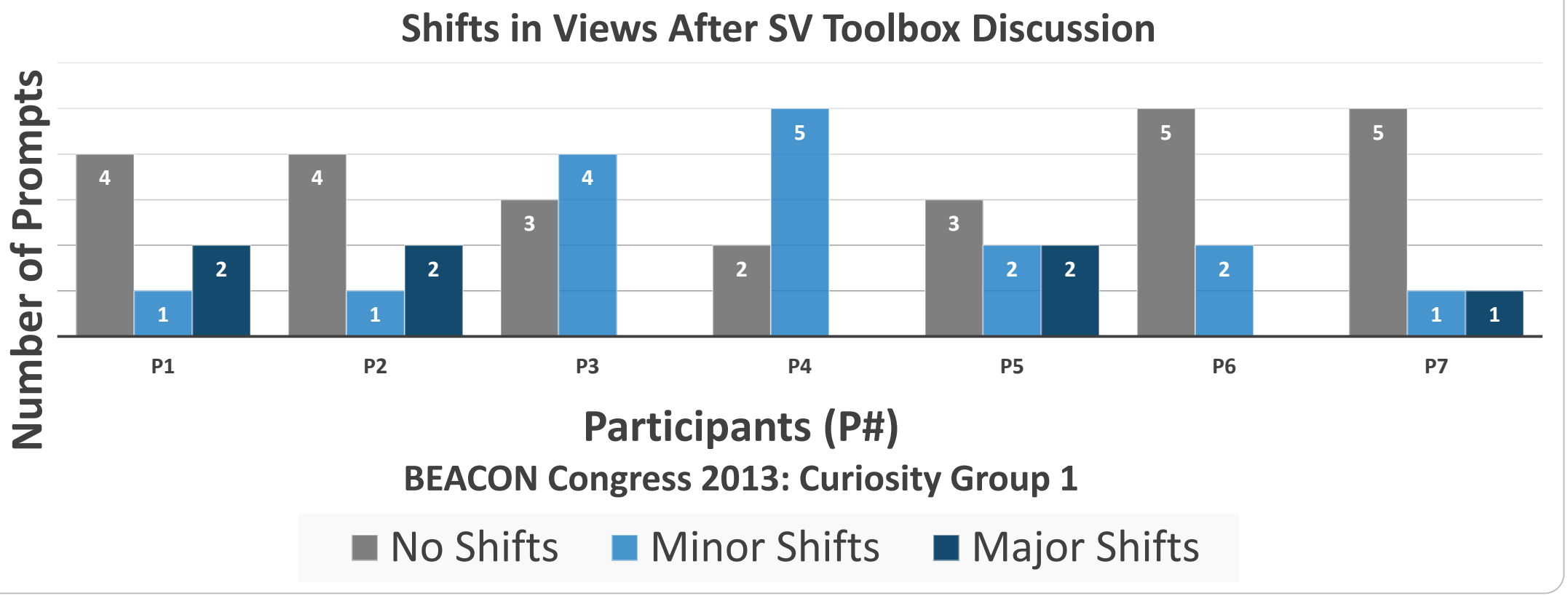
Quantitative Data: Pre/Post Scores



Quantitative Data: Pre/Post Scores

Career Stage	No Change (# of Prompts)	Minor Change (# of Prompts)	Major Change (# of Prompts)
Overall	4.2	1.9	0.9
Students	3.8	2.4	0.8
Early Career	5.3	1.3	0.5
Mid-Career	3.9	2.0	1.1
Late Career	5.3	0.8	1.0