# Responsible Conduct of Research Education (What, Why, and Does it Work?)

**Michael Kalichman, PhD**

Director, Research Ethics Program, University of California, San Diego

Responsible conduct of research (RCR) education is often required and described as important.[1,2] One of the major reasons is concern about research misconduct, but arguably even more important is simply the desire to foster good research practices. In either case, providing RCR education is not only good for science but consistent with an obligation to the society served by science.

## What is RCR?

RCR is often considered synonymous with the list of topics recommended by the National Institutes of Health (NIH) for researchers supported by NIH training or career development awards, although the scope of that requirement has varied over time.[1]

| Current NIH guidelines list nine RCR topics: | Depending on research domains and experience, additional topics of as much or more importance to RCR might include: | |
|---|---|---|
| 1   Conflict of interest | •   Conflicts of conscience | •   Difficult conversations |
| 2   Human and animal subjects | •   Sabotage | •   Big data |
| 3   Mentoring | •   Use of statistics | •   Embryonic stem cells |
| 4   Collaboration | •   Image manipulation | •   Dual use technology |
| 5   Peer review | •   Reproducibility | •   Weapons research |
| 6   Data management | •   Censorship | •   Managing a research group |
| 7   Research misconduct | •   Scientists as activists | •   Managing budgets … etc. |
| 8   Authorship and publication | •   Deception | |
| 9   Scientists and society | | |

## Why teach RCR?

Without explicit goals for teaching RCR, questions such as, *"How should educators teach RCR?"*—much less, *"Is RCR teaching effective?"*—are impossible to answer. Unfortunately, no easy answers as to what the goals are, or even what they should be, exist. A nominal answer is that RCR should be taught because it is required, at least for some people by federal agencies. However, that begs the question, *Why should RCR education be required?*

Author contact: mkalichman@ucsd.edu.

## Examples of the range of possible outcomes for teaching RCR include[2]

- Decrease research misconduct
- Decrease RCR disputes or misunderstandings
- Increase particular areas of RCR knowledge

- Develop or improve skills that will promote RCR
- Foster positive attitudes about RCR and continued RCR learning
- Promote a culture of RCR

## Does teaching RCR work? It depends on the desired outcome

| Outcome | Effectiveness |
|---------|---------------|
| Decreased research misconduct | No evidence,[1] but access to data is limited by what information becomes public. Even if more data were available, a significant impact is unlikely since the classroom appears to be less important than the research environment.[3] |
| Decreased RCR disputes or misunderstandings | No evidence, but it is plausible that increased awareness of issues will diminish the risk of disputes and misunderstandings. |
| Increased knowledge and/or skills | Evidence is nominal. Although statistically significant improvements have been reported (e.g., for ethical decision-making), the magnitude of the impact of teaching RCR on knowledge and skills is typically modest, absent, or negative.[1,4] |
| Positive attitudes, continued learning, and culture of RCR | *Individual impact:* Evidence is promising, but must allow for different individuals experiencing different impacts (e.g., improved ethical decision-making skill or increased awareness of authorship standards).[5] *Group impact:* Some evidence suggests successful fostering of a culture of integrity based on the extent to which trainees continue conversations outside the classroom (Kalichman and colleagues, unpublished observations). |

Evidence is unclear; some evidence for effectiveness.

## References

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