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Editorial: Does RCR Education Make Students More Ethical, and Is This the Right Question to Ask?

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In response to growing concerns in the 1980s about ethical problems in the conduct of federally-funded research, federal agencies began requiring education¹ in responsible conduct of research (RCR) for students and trainees supported research or training grants. In 1989, the National Institutes of Health (NIH) implemented RCR educational requirements for graduate students supported by training grants (Steneck and Bulger, 2007). Over the years, the NIH has extended its requirements to include all students, trainees, fellows, and scholars supported by NIH funds, as well as NIH intramural researchers (National Institutes of Health, 2009). In 2009, the National Science Foundation (NSF) required that institutions provide RCR education for all undergraduate students, graduate students, and postdoctoral researchers supported by NSF funds (National Science Foundation, 2009). U.S. research institutions have complied with these federal mandates, and more than half have developed RCR programs that go beyond them; 23.6% require all students in selected programs, such as engineering or medicine, to receive RCR education; 12.5% require all students participating in externally-funded research (regardless of the source of funding) to receive RCR education; and 11.1% require all graduate students to receive RCR education (Resnik and Dinse, 2012).

The government's rationale for mandating RCR education has been—and continues to be—to promote ethical behavior in research, i.e., research integrity (Steneck and Bulger, 2007). While most people would endorse this as a worth-while goal, research has produced little evidence that RCR education actually helps to achieve it (Steneck, 2013). For more than a decade, the Office of Research Integrity (ORI) has funded research on the effectiveness of RCR education, and a growing literature on this topic has emerged (Steneck and Bulger, 2007). Some studies have shown that RCR education can enhance knowledge and understanding of ethical concepts, norms, and rules; promote awareness of ethical issues and problems; improve ethical reasoning abilities; and shape ethical attitudes; but no studies have shown that RCR education has a positive impact on ethical behavior (Plemmons et al., 2006; Powell et al., 2007; Antes et al., 2009; May and Luth, 2013). Moreover, some studies have shown that RCR education may be associated with certain of unethical attitudes or misbehaviors (Anderson et al., 2007; Antes et al., 2010).

A moment's reflection will help us understand why determining whether RCR education is effective at changing behavior is no easy task. The gold standard for assessing the effectiveness of an intervention is the randomized controlled trial (RCT) (Strauss et al.,

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¹I use the term "education" in this essay because it has more of an academic connotation than other terms that are sometimes used in the literature, such as "instruction," and "training." Training seems to imply mastery of a pre-determined set of materials or skills by rote memorization or practice, whereas "education" seems to imply active participation in an open-ended, evolving learning process. Education includes formal courses, seminars, lectures, online modules, and mentoring.

2010). To conduct an RCT concerning RCR education, one would need to define one or more experimental interventions (such as a clearly defined programs of RCR education), and a control (such as receiving no RCR education), and randomly assign students to different groups. One would also need to define a measure for behavior and assess behavior before the intervention and at different times afterwards. To demonstrate that the intervention has a long-term effect, one would need to assess behavior at a sufficient length of time post-intervention, such as five and ten years. To minimize confounding factors, neither group should have prior exposure to RCR education, and the control group should not receive RCR education during the conduct of the trial. To date, no one has conducted an RCT to assess the impact of RCR education on behavior. May and Luth (2013) used an experimental design to assess the efficacy of two different RCR education programs, as compared to a control group. However, their study did not involve randomization nor did it measure behavioral outcomes. They assessed ethical knowledge and reasoning skills.

There are some significant practical difficulties with implementing an RCT to measure the impact of RCR education on behavior. First, it will be difficult to ensure that students in the experimental and control groups have no prior exposure to RCR education, since most students and trainees now receive some form of RCR instruction, and it would be difficult to require that the control group receives no RCR education. Second, it will be difficult to accurately measure long-term behavioral outcomes. The best way of doing this would be to gather data on confirmed ethical transgressions of participants (such as misconduct findings), but this is not a viable option, due to the confidentiality of ethics investigations. As an alternative, one could ask participants to self-report ethical vs. unethical behaviors. For example, one could ask whether they have fabricated data, plagiarized research, and so on, during a time period. The problem with self-reporting is that participants may not want to admit to violating ethical (or legal) standards, even if they are guaranteed that confidentiality will be protected. They will tend to under-report unethical or illegal behavior. Third, it will be difficult to follow participants for a significant time interval, since students are likely to move to another institution and may not provide contact information. Fourth, it probably will not be possible to randomize students to different groups, because institutions will likely not allow students to be randomly assigned to different RCR programs or a control group.

If an RCT to assess the impact of RCR education on behavior is not viable, other methods may be. For example, one could conduct a prospective, observational study of a cohort that receives an RCR intervention. The study should also include a control group that does not receive the intervention, but is similar to the cohort in terms of educational and demographic factors (Strauss et al., 2010). Behavioral outcomes could be measured at the onset of the study and at different time periods. One difficulty with this method is that it may not be possible to find a suitable control group, since, as noted previously, most students receive some form of RCR education. However, one might deal with the issue by allowing students to serve as their own controls. Their behavior could be measured at baseline and post-intervention. One difficulty with allowing individuals to serve as their own controls is that confounding factors, such as maturity, could affect the outcomes. Some students may become more ethical (or unethical) as result of maturation, irrespective of exposure to an educational intervention. Another problem with this study design is that behavioral outcomes would need to be measured in terms of self-reported behavior, which tends to under-report misbehavior. A final issue is that it might be difficult to follow participants long-term.

An alternative to a prospective, longitudinal cohort study would be a retrospective case-control study in which one collects data on individuals who have self-reported that they have committed ethical transgressions (i.e., cases), and compares them to a group who have not

committed ethical transgressions but are similar in terms of education and demographics (i.e., controls) (Strauss et al., 2010). One would also ask the groups if they have received RCR education, in order to determine whether RCR education is positively or negatively associated with ethical or unethical behavior. Anderson et al. (2007) performed a study with a retrospective design. They surveyed 1,479 early-career and 1,768 mid-career scientists on a variety of ethical misbehaviors, ranging from data fabrication and plagiarism to poor record-keeping and inappropriate authorship assignment. They also asked participants whether they had received RCR education, and they compared the groups that had received RCR education and those that had not. They found that RCR education was associated with some types of ethical behaviors as well as some types of misbehaviors, but that RCR education had no overall positive effect on ethical behavior.

The retrospective method of assessing the effectiveness of RCR education, like the others, has some difficulties. The most significant problem is that exposure to RCR education is not likely to be uniform (Kalichman and Plemmons, 2007; Steneck, 2013). Participants in a study are likely to receive different forms of RCR education, ranging from online training, to workshops, to semester-long courses, with different topics and texts. It could be the case that different types of RCR education have different effects on behavior, but this type of study would not be able to demonstrate this. Another problem with this type of study is that it relies on participants to recall what type of RCR education they have had (if any) and their memory may be unreliable. Participants may forget that they have had any RCR education, how many hours they have had, and so on. Finally, this type of study, like the others, relies on self-reported behavior, which tends to underestimate misbehavior.

Another way of assessing the impact of RCR education on behavior would be to collect data about institutions rather than individuals. While it might not be possible to conduct an RCT involving institutions, a prospective cohort study might be feasible. For example, a group of institutions could collect data on ethical violations (such as misconduct findings) prior to and after initiating RCR educational programs. However, this method also has some problems. First, it probably would not be possible to include a control group of institutions that do not have an RCR program, since most institutions now require RCR education (Resnik and Dinse, 2012). However, this problem might be overcome by allowing institutions to serve as their own controls. The incidence of ethical violations could be measured at baseline and at different times after the intervention. Second, the sample of institutions would need to be large enough to draw statistically significant conclusions. Since misconduct findings are relatively rare events—most institutions have only a few cases a year and some have none (Steneck, 2006)—the study might need to include dozens of institutions to yield statistically significant results. It might not be possible to get this many institutions to agree to participate in the study. Third, the institutions would need to implement the same type of RCR program to prevent factors related to different educational formats from confounding the results. Institutions might not be able to all agree to use the same type of RCR education. Finally, the relationship between reported cases of misconduct at an institution and the effectiveness of RCR education would be unclear. An increase in the number of misconduct cases following implementation of an RCR program might indicate that more people are recognizing and reporting misconduct, not that ethical conduct at the institution is deteriorating (Kornfeld, 2012).

A final problem that affects all studies of the relationship between RCR education and ethical behavior is that ethical behavior is influenced by a variety of factors other than the education one receives, including pressures to produce results, oversight of students and trainees, the institution's commitment to ethics, institutional policies that protect whistleblowers and encourage reporting of misconduct, ethical leadership, and the individual's overall moral character and development (Kalichman, 2007; Shamoo and

Resnik, 2009; Kornfeld, 2012). All of these different factors may confound studies of the impact of RCR education on behavior, because they can affect an individual's attitudes, motivations, decision-making, and ultimately, behavior. Studies of the relationship between RCR education and behavior should attempt to control for these different factors, which may be an impossible task.

Given all of these different problems with proving that RCR education can change behavior, it behooves us to ask whether this is an appropriate standard for judging the effectiveness of RCR education (Steneck, 2013). Studies of the relationship between RCR education and ethical knowledge, understanding, awareness, reasoning, or attitudes face far fewer problems than studies of the relationship between education and behavior. Some of these studies have been conducted already, with mixed results (Antes et al., 2009). While promoting ethical behavior should be a key goal of RCR education, progress can be made toward this goal by enhancing knowledge, understanding, awareness, reasoning, and attitudes, which may lead to improvements in behavior (Kalichman, 2007). Assessments of the impact of RCR education should focus on these outcomes, rather than behavioral ones.

Thinking about these issues from a larger perspective, we should also ask the philosophical question, "What is the purpose of ethics education?" Philosophy and religion departments have traditionally taught ethics to promote understanding, critical reflection, and dialogue, not necessarily to shape behavior. Under this rationale, the study of ethics has value for its own sake, not just to achieve some behavioral outcomes. Since the 1980s, professional programs in business, medicine, engineering, and other disciplines have taught ethics courses with behavioral goals in mind. Professional programs have required students to take ethics classes in order to prepare them to be competent and responsible members of the profession. Though professional ethics education has intrinsic value, it is usually valued as a means of promoting adherence to professional standards of behavior and public trust in the profession. RCR education is similar to professional education in many ways, but there is still a sense in which one could value for its own sake. Of course, funding agencies, academic administrators, and some scientists may not appreciate this rationale for RCR education, but it still has considerable merit, especially among academics.

Given the problems with proving that RCR education promotes ethical behavior, it is time to rethink this rationale for RCR education. Funding agencies, institutions, scientists, and university administrators should focus on implementing educational programs that have a positive impact on ethical knowledge, understanding, awareness, reasoning, and attitudes. Additionally, the idea that RCR education is worth pursuing for its own sake should not be dismissed as overly idealistic.

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