Supplemental Material

CBE—Life Sciences Education

Diaz-Martinez *et al*.

Appendix 1. RECR national survey.

Note that the consent form was first presented to participants; it is excluded here to increase clarity.

What is a CURE?
Course-based undergraduate research experiences (CUREs) offer a platform to engage students at all levels in the process of conducting authentic scientific investigations. In contrast to traditional laboratories, which have historically been confirmatory and "cookbook" in nature, students enrolled in CUREs are actively involved in developing their own research questions, identifying methods (including identification of appropriate protocols) suitable for conducting their experiment(s), analyzing resultant data, and communicating their findings. Furthermore, Auchincloss *et al.* (2014) note that CUREs should be designed with the following five dimensions in mind:

1. **Scientific practices:** questioning, analysis, and communication
2. **Discovery:** conducting an investigation in which the outcome of that investigation is unknown to both the students and the instructor
3. **Broader relevance:** the notion that results generated in a CURE environment have implications outside of the classroom context alone
4. **Collaboration:** working as a collective provides CURE students with the opportunity to share opinions, contribute knowledge, and learn from each other as they strive to address their research question(s) of interest
5. **Iteration:** CUREs should provide students with ample time to refine and repeat studies, as well as ask new questions as the opportunity arises

While these dimensions will be present in different CUREs to varying degrees, the essence of the CURE experience is (ideally) to promote students' development as researchers and scientific thinkers, in turn enhancing their success, affect, and persistence in their chosen field of study.

Questionnaire Items
1. Please enter your cell phone number in the space below to confirm your identity.

2. Please provide the number of years you have been teaching at the college level. Please specify what fraction of that time was spent serving as a graduate teaching assistant, if applicable.

3. What is your race/ethnicity?
   a. American Indian or Alaska Native
   b. Asian
   c. Black or African American
   d. Native Hawaiian or Other Pacific Islander
   e. Latino/Hispanic
   f. Caucasian (White)
   g. Multiracial/Multiethnic or Other
   h. I prefer not to indicate

4. With what gender do you identify?
   a. Male
   b. Female
   c. Non-binary
   d. I prefer not to indicate

5. Please select all applicable descriptors for your university or organization.
   a. Public University
   b. Private University
   c. 4-year College
   d. 2-year College
   e. Liberal Arts College

     f.   Research University
     g. Comprehensive University (i.e., an institution that primarily works with students at the undergraduate/master's levels and has few, if any, Ph.D. program)
     h. Hispanic Serving Institution
     i.   Minority Serving Institution (non-Hispanic)
     j.   Tribal College

6. Please provide a brief description of the CURE you are teaching /are involved with. If you are involved with multiple CUREs, please select **only one** to describe, as this will serve as the contextual basis for all remaining questions.

7. How would you define your role(s) within the CURE? Examples: instructor, workshop support, program administrator, lab coordinator, developer, PI, etc.

8. Please provide the number of semesters you have been teaching or facilitating the CURE described above.

9. For what academic level was the CURE designed? (Please select all applicable responses)
     a. Freshman
     b. Sophomore
     c. Junior
     d. Senior
     e. Undergraduate/graduate cross-listing

10. Who primarily delivers instruction in the CURE? (Please select all applicable responses)
     a. You
     b. A secondary instructor (faculty/staff)
     c. A graduate teaching assistant (GTA)
     d. An undergraduate teaching assistant (UTA)
     e. Guest faculty
     f.   External individuals or organizations not affiliated with the university
     g. Other

11. On average, how many students are enrolled in each laboratory section of the CURE?
     a. < 15
     b. 15 - 20
     c. 21 - 25
     d. 26 - 30
     e. > 30

12. What is the expected level of *prior training* in ethics and responsible conduct of research among students enrolled in the CURE?
     a. None
     b. Moderate (a required workshop or seminar)
     c. High (multiple workshops and/or seminars)
     d. Extensive (a full-semester course on ethics in research)

13. Beyond institutionally-mandated ethics and responsible conduct of research (RCR) training, have you participated in any of the following? (Please select all that apply)[1]
     a. Institutionally-sponsored training seminars, workshops, or training modules (non-mandated)
     b. Online training modules (not offered through your institution)
     c. Workshops/seminars (not offered through your institution)
     d. None of the above

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[1]Please note that these answer choices are represented as "Institutional," "Online," "External," and "None," respectively, in Figure 3A.

14. In the CURE that you are teaching/facilitating, have you had to resolve ethics/RCR issues with respect to the following potential, general aspects of a CURE?

	Yes	No	N/A
Collaboration (including professional conduct and communication)	☐	☐	☐
Ownership (including project data)	☐	☐	☐
Authorship (including responsible communication, author order)	☐	☐	☐
Research misconduct (including falsification of data, fabrication of data, issues in record-keeping, or other protocol-specific diligence)	☐	☐	☐

15. In the CURE laboratory course that you are teaching/facilitating, do you provide specific training in the following topics?

	Yes	No	N/A
Data management (including sharing, acquisition, preservation, and ownership)	☐	☐	☐
Mentor/trainee responsibilities	☐	☐	☐
Data sampling practices, verification, and use in statistics	☐	☐	☐
Privacy and protections (IRB, HIPAA, IACUC considerations)	☐	☐	☐
Research design consideration	☐	☐	☐
Bias and objectivity in design and analysis	☐	☐	☐
Reporting and publications	☐	☐	☐
General lab safety	☐	☐	☐
Peer review	☐	☐	☐

16. When, with respect to the CURE that you are teaching/facilitating, do you introduce students to ethics/RCR topics? (Please select all that apply)
    a. The topic of ethics is introduced at the beginning of the CURE (or CURE module).
    b. A specific ethics/RCR topic is introduced when it is relevant to the lab activities.
    c. Ethics/RCR topics are introduced at the end of the CURE (or CURE module).
    d. Not applicable.

17. To what extent do the following approaches describe how ethics/RCR training takes place with respect to the CURE that you are teaching/facilitating?

	DNU*	OU	FU	EU	N/A
A separate didactic portion associated with the lab course	☐	☐	☐	☐	☐
A workshop, seminar, or class separate from the lab course	☐	☐	☐	☐	☐
Practical, context-	☐	☐	☐	☐	☐

based instruction in the CURE					
Corrective instruction as need arises	☐	☐	☐	☐	☐

*Please note that "DNU" = Do Not Use; "OU" = Occasionally Use; "FU" = Frequently Use; and "EU" = Exclusively Use.

18. To what extent do you employ the following practices in your CURE ethics/RCR instruction?

	N	S	HT	MT	A	N/A
Role-play or "choose your own adventure" exercises involving ethical issues	☐	☐	☐	☐	☐	☐
Case study or current event discussions	☐	☐	☐	☐	☐	☐
Practical application (learning by doing)	☐	☐	☐	☐	☐	☐
Lecture-based workshop or seminar	☐	☐	☐	☐	☐	☐
Online training or game (simulation or other)	☐	☐	☐	☐	☐	☐
Presentation or debate assignment	☐	☐	☐	☐	☐	☐
Written assignment	☐	☐	☐	☐	☐	☐

*Please note that "N" = Never; "S" = Sometimes; "HT" = About Half the Time; "MT" = Most of the Time; and "A" = Always.

19. If you assess the ethics/RCR comprehension of your students, please briefly describe how you do so and how often you do so. If this does not apply, please state "Not applicable."

20. To what extent are you interested in the following activities?

	NI	SI	MI	VI
Discovering effective instructional interventions for ethics and responsible conduct of research (E/RCR) in CURE contexts	☐	☐	☐	☐
Learning how to evaluate student comprehension with respect to E/RCR	☐	☐	☐	☐
Establishing a core set of principles for CURE E/RCR	☐	☐	☐	☐
Establishing a network of colleagues for idea-sharing	☐	☐	☐	☐
Establishing a framework for E/RCR instruction	☐	☐	☐	☐
Generating data and publications regarding CURE E/RCR topics	☐	☐	☐	☐

*Please note that "NI" = Not Interested; "SI" = Somewhat Interested; "MI" = Moderately Interested; and "VI" = Very Interested.

21. We are interested in learning more about your perceptions of the role of ethics/RCR in CURE contexts and would therefore like to invite you to participate in a brief, semi-structured interview. If you would be willing to participate in the interview process, please enter your e-mail address in the box below.

Appendix 2. Semi-structured interview prompts.

1. Please briefly describe an example of how you integrate ethics/RCR into your CURE and for what purpose(s).
2. What do you believe are the potential benefits related to introducing ethics/RCR education within CUREs, and why?
3. What do you believe are the potential obstacles related to introducing ethics/RCR education within CUREs, and why?
4. One of the goals of our network is to serve the needs of the community with respect to integration of ethics/RCR education within CUREs. What recommendations do you have in terms of initiatives or specific needs that our network should address to assist the community in achieving better integration of ethics/RCR within CUREs?