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Entering Research Online: Developing a Virtual Course to Support Experiential Education for Undergraduate Research Assistants

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Abstract

This evidence-based paper describes the development and implementation of a fully online, entirely asynchronous course designed to introduce undergraduates to engineering research. In its first offering, this course enrolled 32 first-year, first-semester undergraduates who were paired with faculty mentors in part-time, paid research experiences at a large university in the Midwest. The course structure was designed to reinforce two of the key learning goals for the class: (1) developing students' independence and problem-solving skills, and (2) developing students' time management and organizational skills. All of the course materials for the entire semester were available to students on the first day of class, and there was a recommended schedule of activities that allowed students to comfortably complete the course well in advance of finals. These learning goals and course activities were informed by decades of research into best practices for supporting research trainees, in particular the "Entering Research" curriculum developed with support from the National Institutes of Health and the National Science Foundation.

Students in the course were paired with faculty research mentors from various engineering disciplines, and the context of their research varied considerably. Some students were part of large, established experimental laboratories while other students worked individually or in small groups on computational or theoretical projects. As this course was launched in Fall 2020, students in this class experienced the additional challenge of starting college (and undergraduate research) remotely during a global pandemic. The design and content of this course were evaluated using anonymous feedback and a review of reflective discussion posts in order to determine whether the course supported the stated learning goals. This evaluation indicates that students found the course material helpful in understanding their role as undergraduate research assistants and in learning the professional skills (communications, teamwork, organization, etc.) necessary for success. While most students opted to follow the suggested schedule, about 15% of students instead chose to delay course participation until later in the semester. This varying pace of participation had an unexpected impact on some of the most dedicated students, who found it difficult to engage in productive discussions online when not all of their classmates were working as quickly through the materials.

Introduction

Successful engineering programs often integrate experiential learning experiences throughout the curriculum. Cooperative education or internship programs may be the most familiar approach to experiential learning in engineering; in these approaches students spend extended time (often multiple semesters) working with engineering professionals outside the classroom [1]. These "co-op" experiences can have positive impacts on engineering students' academic performance and future compensation [2], [3], as well as strengthening self-efficacy, career development and practical engineering skills [4]–[6]. Undergraduate research is another form of experiential learning that allows students to engage in problem solving and investigative processes in a

laboratory or with a research group. Undergraduate research is a "high impact" learning experience [7], [8], although its value depends in part on how well students are integrated with and supported in the research setting [9]–[12].

At a large research institution in the Midwest, high-achieving first- and second-year undergraduate students are invited to participate in a part-time, paid undergraduate research internship during the academic year. This program traditionally relies on individual faculty mentors to provide appropriate training to these undergraduates, complementing the University's Responsible Conduct of Research (RCR) training that is required for student research assistants. This institution has a separate summer program that offers full-time, paid research internships to students during a 10-week summer semester, which includes a substantial professional development program and activities [13]–[18] that leverage curricula [19], [20] from the National Research Mentor Network [21] and the Center for the Improvement of Mentored Experiences in Research [22]. During Fall 2020, a significantly adapted version of this professional development program was offered as a new course (EGR 193: Introduction to Engineering Research) for the first-year, first-semester students newly admitted to academic year research program.

The decision to deploy this new course in the Fall of 2020 was in part an effort to provide additional supports during the global pandemic. Under normal (in-person) circumstances, first-year college students can struggle to understand course expectations, manage the workload, and balance personal and academic goals [23]–[25]. High-quality programs that support students' social, emotional and physical wellbeing can assist undergraduates in making a successful transition to college [26]–[28]. These traditional challenges still existed for first-year students beginning college during the COVID-19 pandemic, and wide-spread restrictions on in-person learning during Fall 2020 added to the stress and uncertainty of starting college [29]–[31]. Thus, the overarching goal of the new EGR 193 course was to support first-year, first-semester undergraduates in successfully engaging in faculty-mentored research while recognizing the unique context of a fully-remote research experience due to the pandemic.

Course Design

EGR 193 was a 1 credit, Pass/Fail, seminar course taught in an online, asynchronous format. This methodology was selected to provide flexibility for students, who were studying and conducting research from locations in time zones around the globe. The learning goals for this course were developed such that students who participated in the course would:

- Learn about research mentoring styles and build skills for communicating about goals and expectations with research mentors
- Examine and apply time management skills for balancing academic, research and personal goals during college
- Gain an understanding of the structure of research literature and develop skills for identifying and organizing appropriate references within their field of research
- Explore methods for documenting and disseminating research results in engineering
- Learn about ethical practices for research, and be able to articulate key principles for conducting research responsibly within engineering domains

- Gain experience in working in research teams and communicating with individuals from different backgrounds, cultures, and research disciplines
- Reflect on their initial research experience and develop goals for the remainder of their undergraduate research appointment

All course materials were available via the university's online learning platform on the first day of the semester, and students had until the last day of final exam week to submit assignments and earn points for the course. Students were able to "build their own course" by selecting assignments and activities that best fit their academic, research and personal goals. This flexibility was by design and in recognition of the fact that there are a range of student experiences: for instance, some students had already started communicating with their faculty mentor before the beginning of the academic year, while others were not matched with faculty members until several weeks into the semester. (This variation in placement timelines is common for this academic year program, as some students know what research they wish to pursue while others take several weeks to explore disciplines, projects, and potential faculty mentors.)

While students had flexibility in selecting which assignments and activities to complete during the semester, a suggested schedule was provided (see Table 1). This recommended schedule allowed students to complete course requirements by Thanksgiving (approximately 2/3 of the way through the semester), while also providing flexibility at the end of the semester for students to "catch up" on activities or assignments as needed. The course was graded Pass/Fail based on an accumulation of points. Students needed at least 250 points to pass the course, which could be earned in the following ways:

- **Discussion Forums (135 points available)**: 11 discussion forums were posted in the online learning management system, and students could earn up to 10 points per discussion. A bonus of 25 points could be earned by participating in at least 8 different discussion forums during the semester.
- **Assignments (110 points available):** 11 assignments were posted in the online learning management system, and students could earn up to 10 points per assignment.
- **Research Group Meetings or Research Seminars (125 points available):** students could earn 5 points for attending a research group meeting or a STEM (science, technology, engineering, math) research seminar and completing a brief reflection form. Students could earn a bonus of 25 points for participating in at least 8 different meetings/seminars during the semester.
- **Weekly Update Email (125 points available):** students could earn 5 points per week for sending a brief email update to their research mentors (or to the instructor, for students not yet matched with mentors) outlining their progress, questions, and plans. 25 bonus points could be earned by submitting 8 or more weekly updates during the semester.

The opportunity to earn bonus points was designed to encourage students to make a sustained effort in developing the professional skills and work habits necessary for success in research. Since EGR 193 was designed to support experiential education, it was important for students to engage in and reflect on their research activities beyond the course.

Table 1: Suggested Timeline for Course Activities and Assignments

Week	Topic	Assignments
1	Welcome	Introduction Survey
2	Introduction to Research	Mentoring Styles Worksheet
3	Establishing Goals and Expectations with your Mentor	Mentor-Mentee Contract
4	Time Management	Time Log / Timeline
5	Library Resources & Citation Management Systems	Install Citation Management Software
6	Tools and Techniques for Literature Reviews	Article Review Worksheet
7	Developing Research Abstracts and Posters	Poster Review Worksheet
8	Responsible Conduct of Research (RCR)	CITI Module 1 (RCR Training)
9	Understanding Graduate School	CITI Module 2 (RCR Training)
10	Academic Resumes	CITI Module 3 (RCR Training)
11	Planning the Rest of Your Research Experience	CITI Module 4 (RCR Training)
12	Nothing. Happy Thanksgiving!	
13-15	Wrap Up / Catch Up	Final deadline to submit assignments and/or earn points: 5:00pm Eastern (GMT -5) on Friday of exam week

Feedback on the Course Structure

A number of optional evaluation processes are available for students to provide anonymous feedback about their experiences in courses at this university. These types of surveys and other evaluations of course content are considered part of normal educational practices at this institution, and are thus exempt from Institutional Review Board (IRB) requirements. (While this paper describes a course evaluation process rather than a formal research study, the authors are trained in ethical practices for research with human subjects and have received IRB approval for other studies of undergraduate research experiences.) Midway through the semester, some students used anonymous feedback mechanisms to express frustration that not all of their peers were keeping pace with the suggested schedule of course activities. This meant that there was not always a robust discussion taking place online during the "scheduled" weeks for each forum. In response to this feedback, the instructor experimented with offering additional bonus points as an incentive for completing discussion activities according to the suggested timeline. Unfortunately, this did not prove to be a substantial incentive: while students who were already following the suggested timeline were able to earn a few extra points, the incentive was not sufficient to encourage other students to speed up their course progress.

While all students ultimately earned a passing grade, they took the opportunity to "create their own course" seriously and their completion dates varied quite a bit. By Thanksgiving, which was the "end" of the course for students following the recommended schedule, nine students (28%) had earned 250+ points and a passing grade – but an equal number of students had earned fewer than 100 points. One student did not submit any work in the course until final exam week, but did manage to complete enough assignments within about 72 hours to pass the course. Exploring students' motivations for following different schedules is an area for follow up study; it might also be interesting to try and conduct a more detailed assessment of how students' learning experiences were impacted by their choices about how and when to earn points.

Review of Discussion Boards

The course included 11 different discussion boards, where students could respond to the original prompts/questions from the instructor as well as to their peers' comments. The discussions were informed by the "Entering Research" curriculum [19] and by the Responsible Conduct of Research training offered by the Collaborative Institutional Training Initiative (CITI Program) [32], which students were required to complete by the university. These discussion activities were designed to help students reflect on research as experiential education, and several case studies were used to help students consider both their own experiences and scenarios they might encounter in the future. All of these discussions were asynchronous, and students earned points both for posting original content (a "new thread") and for responding to others' posts. Table 2 summarizes the topics, number of unique threads within each discussion board, and total number of replies (posts) across all threads.

Table 2: Summary of Online, Asynchronous Student Discussions in EGR 193

Discussion	Topic	Threads	Replies
1	Introduce Yourself!	40	128
2	Understanding Undergraduate Research	30	93
3	Recommendation Letters	27	83
4	Case Study: Frustrated (student experiences in research)	25	71
5	Case Study: Overwhelmed (student experiences in research)	29	82
6	Case Study: The Selection of Data (research ethics)	26	81
7	Case Study: Credit Where Credit is Due (research ethics)	26	78
8	CITI Introduction to RCR (research ethics)	24	66
9	CITI Authorship (research ethics)	22	62
10	CITI Research Misconduct (research ethics)	21	61
11	CITI Plagiarism (research ethics)	17	45

After the conclusion of the semester, the instructor downloaded and organized the discussion posts by thread and topic, and then invited a colleague who worked with the (separate) summer program for undergraduate researchers to review the posts to help identify recurring themes related to students' experiences as undergraduate research assistants in their first semester of college. The choice to engage a set of "fresh eyes" in this evaluative process was designed to help reduce bias from the instructor, who created the discussion posts with particular learning goals in mind. The overarching goal of this review was to understand whether the structure and content of these discussion boards supported the learning goals of the course. Overall, students' discussions were appropriate to the topic and their (novice) level of research experience. A few interesting themes did emerge, as described in the next section, which may be fruitful areas for future study.

Emerging Themes from Student Discussions

The first discussion board invited students to introduce themselves, which sparked a number of "me too" type connections related to hometowns, hobbies, etc. This was the most active

discussion board, with nearly all students opting to participate and most threads receiving multiple replies – which was not surprising given that nearly all students participated at the beginning of the term, when they were still eager to make connections with peers and engage in college courses online. Participation levels in subsequent discussions declined at a fairly consistent rate, as shown previously in Table 2.

The second discussion board encouraged students to broaden their understanding of undergraduate research and begin to develop habits and skills for self-reflection. Students' responses demonstrated growing understanding of the breadth of research opportunities. For example, one student commented that they initially imagined research as "someone sitting in a lab with a test tube, but it is clear that research is much broader than that and can be conducted in any field, relevant to any interest." Other students noted differences in their expectations of and experiences with faculty mentors, with some receiving step-by-step guidance and other students expected to work more on their own. One student who was surprised to be given significant independence noted that the experience "offers an incredibly valuable opportunity for personal growth, and really learning how to forge my own path in this field." This theme of research providing opportunities for growth and self-discovery was reflected across a number of students' posts, ranging from discussions of how to build technical skills and how to prepare for grad school, to exploring which research topics, methods, and settings they most enjoy.

Moving on to the third discussion board, students were asked to imagine what they might want their research mentor to say about them in a future recommendation letter. This exercise was adapted from the Entering Research curriculum [19], and was included early in the semester to help students reflect on and clarify their goals. While the instructor has successfully integrated this activity as part of small group activities during in-person research skills courses, it proved to be more challenging for students in an online, asynchronous setting. Although some students were able to identify concrete skills they hoped to develop through their undergraduate research assistantship (e.g., computer programming, laboratory procedures, analytical skills), many expressed feelings of inadequacy or a lack of expertise. While a level of uncertainty is to be expected in novice researchers, the asynchronous setting of this course meant that neither the instructor nor classmates were immediately available to provide feedback and encouragement as students considered how they might contribute and what they might gain from undergraduate research. This is an area where further study might be beneficial to explore ways to better support students in navigating these feelings. Perhaps an introduction to and discussion of imposter syndrome [33], [34] would be helpful, or an alternative activity that offers more structure and guidance as students consider both their strengths and areas for growth.

In the fourth discussion, students were provided with a case study ("Frustrated," see Appendix) that describes a student's frustration with not being assigned "interesting" work early in their undergraduate research experience. Two strong themes emerged in students' discussions about this situation. First was the idea that even seemingly trivial or uninteresting tasks can be essential components of a larger research project – and that doing these tasks well can lead to more interesting roles and responsibilities. Second was that students should work to establish strong communications and clear expectations with their mentors. Overall, these discussions reflected a level of maturity and patience that is important for new undergraduate researchers, particularly those in their first year of college, who often need to spend time developing background

knowledge and skills before they are able to engage in research activities that seem interesting or impactful. However, the case study format asks students to consider the situation from an outside perspective, rather than exploring their personal experiences. This can lead to a disconnect between how students feel "others" should act in a situation and how they would respond in real life. This might be an area where further study could provide valuable insights about how to best prepare undergraduate researchers to take knowledge from the classroom and actually put it into practice – which is a key component of experiential learning.

Discussion 5 was also a case study ("Overwhelmed," see Appendix), which described an undergraduate new to research who was feeling overwhelmed by their lack of knowledge and uncertain about how to move forward. Interestingly, the strongest theme that emerged from students' discussion about this case study was that email was the preferred approach to contacting the mentor or asking for help. Email was described as a way to ask questions without interrupting the mentor – even though the case study described the student working in-person with a research group. While one student did point out the potential benefit of asking questions in real-time, which could allow the mentor to assist the student with their current work, overall the discussions focused on email and its time-shifting qualities. This is perhaps an artifact of the students' experiences working and learning remotely during their first research experience; while many students did have live videocalls with their mentors periodically, most of their research work was done independently. If students were working in-person in a more typical first semester experience, perhaps their responses to this case study would have differed.

Week 6 featured a case study about data management ("The Selection of Data," see Appendix), posing questions for students to consider related to ethical practices for collecting, analyzing and reporting data. Students seemed to understand the importance of including all results (or, if excluding outlying data, making that decision clear in the report). Opinions were quite strong in this discussion at times, with repeated remarks that it would be unethical to remove data points – in the future, it might be interesting to examine whether students' responses in an asynchronous format differ from those generated through other interactions. While positive peer pressure was evident in this discussion, with subsequent posts re-emphasizing the (ethical) solutions previously proposed, students might not be as vocal during in-person classroom activity.

Week 7 posed the final case study in this course ("Credit where Credit is Due," see Appendix), which described an undergraduate research assistant whose work was included in a manuscript without the student's knowledge or consent – and without appropriate attribution. Students were asked to consider whether research should be shared openly, or "protected" until it is formally published. The consensus in the online discussion was that collaborative work is important, but that it is also important to have clear expectations in advance for authorship and other acknowledgements of significant contributions. There was less uniformity in response to the question of what the student in the case study should do next. Some students suggested contacting the author directly, while others preferred to go through a research misconduct process at the institution, to contact the ombudspersons office, or even to get legal advice. Other students suggested that the issue might be more nuanced, especially given the limited knowledge and experience of the individual described in the case study.

Beginning in week 8, the discussions shifted to focus on students' experiences completing online RCR (Responsible Conduct of Research) training through citiprogram.org (CITI). Four introductory modules within CITI are required for all research assistants at the university. EGR 193 added a discussion component to complement this required training, allowing students to share their experiences and ideas as they learned about issues like authorship, plagiarism and research misconduct. Overall, students' discussions of this RCR training were unremarkable: they demonstrated an appropriate understanding of the RCR training, and an emerging understanding that ethical issues are often complex. For example, when asked to consider the criteria that should be used to determine authorship, several students acknowledged the limited contributions they had made to research so far – but noted that they could see how their work could become significant in the future. The discussion about plagiarism was also robust, with students noting that this ethical lapse can be a result of stress, pressure, or lack of knowledge about when and how to cite sources appropriately (an introduction to citation management systems was included in the course).

Concluding Discussion and Future Work

Overall, the student feedback and review of discussion posts indicate that the design and implementation of this course was effective in meeting the established learning goals and supporting students' experiential education experiences in research. Although we hope to incorporate some in-person activities into future offerings of EGR 193, the bulk of the course will likely remain online to provide flexibility for students who are pursuing a wide range of research experiences. One important adjustment to future online offerings of this course will be to integrate more opportunities for students to receive encouragement and positive reinforcement from their peers and the instructor. As noted in the discussion of week 3's recommendation letter exercise, the asynchronous nature of this course meant that students who expressed feelings of inadequacy about their technical skills or uncertainty about their ability to contribute in a research setting were not able to discuss these concerns in real time. While online discussion boards can be good places for reflection and synthesis, activities that may spark feelings of vulnerability might be better suited for real-time interactions (whether in-person or online). This approach could help balance the value of students' recognizing the limitations of their knowledge and skills with the positive encouragement available through real-time engagement with faculty and peers.

There are also several areas where further study might yield interesting results. For instance, during the discussions in week 4 of the "Frustrated" case study, students felt quite strongly that it was important to establish clear expectations and strong communication channels between students and their research mentors. However, this focus on communicating with their mentors during week 4 was somewhat at odds with the strong preference for not "interrupting" their mentors that students discussed in week 5. There seemed to be lack of recognition of the potential positives of asking for help during a research activity rather than waiting for an email response. These inconsistencies may be at least partially an artifact of these students' entirely remote introduction to undergraduate research, so it will be interesting to see if students' responses vary in future offerings of the course when students are conducting research in-person.

Authorship was another area where students' discussions highlighted some interesting inconsistencies that might be worthy of further exploration. The discussions showed that students had gained an understanding that authorship was a significant "currency" in academic research contexts, and they were (reasonably) focused on ensuring that they received appropriate benefits from their work as undergraduate research assistants. Interestingly, even though these students were being paid to conduct research there were no conversations about whether being hired to complete a task might be sufficient remuneration in some cases. In future offerings of the course, it might be relevant to include a more detailed discussion of common structures in research groups – for example, paid technicians and research staff members often assist in setting up and conducting experiments, but may not receive authorship credit for these contributions. It would be interesting to see if broadening students' understanding of how research is conducted influences their perspectives on what types of compensation or recognition are appropriate for different types of contributions.

Data collection is another topic that generated vibrant discussion during EGR 193 and would be interesting to revisit as part of in-person or hybrid (a mixture of online plus in-person) activities. During in-person classes, the instructor often pairs the "Selection of Data" case study with a hands-on activity that puts students into situations where they need to make rapid decisions about data selection, use and analysis [35]. No online, asychronous alternative was available for that activity, so the instructor focused on the case study in EGR 193 instead. In future work, it might be interesting to consider how to extend the discussion of data ethics with the data collection and manipulation tasks that many undergraduates find themselves engaging in as early research assignments.

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Appendix: Case Studies

Week 4: Frustrated

Jamal has been in his research group for almost three weeks and is disappointed with his project so far. When he interviewed with Professor Stanley, she described a molecular biology project that he would work on. However, his graduate student mentor, Roxanne, has not given him any molecular biology experiments, but instead tasks such as making media and growing bacteria. Other undergraduates in the lab seem to be doing things like cloning and sequencing genes. Jamal is getting frustrated, but doesn't want to complain or look ungrateful. What can he do?

Discussion Questions

1. To whom should Jamal go to discuss his frustration?
2. What strategies might he use to avoid appearing as though he is complaining?
3. How might having established specific goals and expectations with his mentor helped to avoid this situation?

(**Frustrated** was adapted from Branchaw, Pfund and Rediske (2010) Entering Research: A Facilitator's Manual. W.H. Freeman and Company, New York. pp. 89-90.)

Week 5: Overwhelmed

Ashley, a sophomore majoring in chemistry, has found an undergraduate research position at the Center for NanoTechnology. She started a couple of weeks ago and is excited about her research project, which involves working on the development of an automatic gene synthesizer, but she doesn't really understand it. She is a shy person and was completely overwhelmed at the first lab meeting. It was like nothing she had ever experienced and she understood very little of what was discussed. She won't take Introductory Biology until next year. At the meeting, she just nodded whenever they asked if she understood, because she didn't want to look stupid. Now she is terrified to talk to the scientists for fear that they will realize how little she really understands. Her mentor Sam, a biomedical engineering graduate student, is really nice, but also very busy. He told her to ask questions when she didn't understand something, but he is always engrossed in his work and she doesn't want to interrupt him. She has to write a one-page summary of her research project for the undergraduate research seminar class by the end of next week, and has no idea where to begin. What should she do?

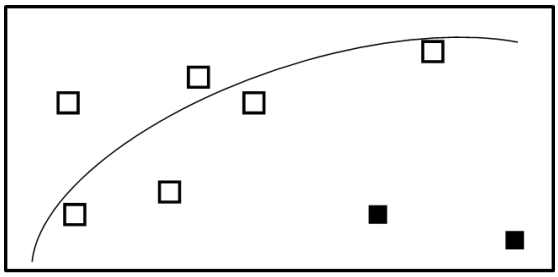
Discussion Questions

1. Is there a way for Ashley to approach her mentor to ask questions that respects his busy schedule?
2. Who else beside her mentor could Ashley turn to for help?
3. What resources might she use to help herself better understand the research on her own?

(**Overwhelmed** was adapted from Branchaw, Pfund and Rediske (2010) Entering Research: A Facilitator's Manual. W.H. Freeman and Company, New York. pp. 89-90.)

Week 6: The Selection of Data

Seniors Deborah and Kathleen have made a series of measurements on a new experimental semiconductor material using an expensive neutron sources at a national laboratory. When they get back to their own lab and examine the data, they get the following data points. A newly proposed theory predicts results indicated by the curve.



During the measurements at the national laboratory, Deborah and Kathleen observed that there were power fluctuations they could not control or predict. Furthermore, they discussed their work with another group doing similar experiments, and they knew that the group had gotten results confirming the theoretical prediction and was writing a manuscript describing their results. in writing up their own results for their senior research project and hopefully for publication, Kathleen suggests dropping the two anomalous data points near the abscissa (the solid squares) from the published graph and from the statistical analysis. She purposes that the existence of the data points be mentioned in the paper as possibly due to power fluctuations and being outside the expected standard deviation calculated from the remaining data points. “These two runs,” she argues to Deborah, “were obviously wrong.”

Discussion Questions

1. How should the data from the two suspected runs be handled?
2. Should the data be included in tests of statistical significance and why/why not?
3. What sources of information could Kathleen and Deborah use to help decide?

(**The Selection of Data** was adapted from Branchaw, Pfund and Redishke (2010) Entering Research: A Facilitator's Manual. W.H. Freeman & Co, New York. pp. 194-195. Their original source is “On Being a Scientist: Responsible Conduct in Research,” 2nd ed., National Academy Press, 1995).

Week 7: Credit Where Credit is Due Case Study

Bea, a junior, was working on a research project that focused on developing a new experimental technique. To present her work at the Undergraduate Symposium, she prepared a poster outlining her new technique. During the poster session, Bea was surprised and pleased when Dr. Freeman, a leading researcher on campus, engaged her in a conversation. Dr. Freeman asked extensively about the new technique, and she described it fully, happy to be confidently discussing her work with a fellow scientist. Bea’s faculty advisor had encouraged his students to openly share their research with other researchers, and Bea was flattered that Dr. Freeman was so interested in her work.

Six months later Bea was leafing through a journal when she noticed an article by Dr. Freeman. The article described an experiment that clearly depended on the technique that Bea had developed. She did not mind, in fact, she was somewhat flattered that her technique so strongly influenced Dr. Freeman’s work. But when she turned to the citations, expecting to see a reference to her abstract or poster, her name was nowhere to be found.

Discussion Questions

1. Does Bea have any way of receiving credit for her work?
2. Should she contact Dr. Freeman in an effort to have her work recognized?
3. Is Bea’s faculty advisor mistaken in encouraging his students to be open about their work?

(**Credit Where Credit is Due** was adapted from Branchaw, Pfund and Redishke (2010) Entering Research: A Facilitator's Manual. W.H. Freeman & Co, New York. pp. 199. Their original source is “On Being a Scientist: Responsible Conduct in Research,” 2nd ed., National Academy Press, 1995).