TEACHING AND LEARNING PORTFOLIO

by

Alexandra Chesney

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Delta Certificate in Research, Teaching, and Learning.

Delta Program in Research, Teaching, and Learning
University of Wisconsin-Madison
The Delta Program in Research, Teaching, and Learning is a project of the Center of the Integration of Research, Teaching, and Learning (CIRTL—Grant No. 0227592). CIRTL is a National Science Foundation sponsored initiative committed to developing and supporting a learning community of STEM faculty, post-docs, graduate students, and staff who are dedicated to implementing and advancing effective teaching practices for diverse student audiences. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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The Delta Program (www.delta.wisc.edu) is the University of Wisconsin-Madison’s local project of the Center for the Integration of Research, Teaching and Learning (CIRTL; www.cirtl.net), a National Science Foundation-sponsored center. The Certificate in Research, Teaching and Learning recognizes a student’s accomplishments in teaching, participation in the conversation of higher education, promoting learning amongst diverse audiences, and application of pedagogical practices and research skills to improve student learning.

Delta Pillars
Delta is centered on three foundational ideas (pillars): learning communities, learning through diversity, and teaching as research. These pillars are the foundation of CIRTL, and national project and network of which Delta is a founding member. My reflections from my experience that I present throughout this portfolio will use these pillars and my intention is to convey my understanding for how each contribute to my philosophies of mentoring, scholarship, and teaching.

Teaching-as-Research
By applying research methods—idea, experiment, observation, analysis, improvement—to the challenge of teaching, the Delta Program:

- Brings the skills of research faculty to the ongoing investigation of student learning
- Promotes innovation in teaching and measurement of student learning
- Advances the role of instructors in the ongoing improvement of teaching practices

Learning Communities
Through collaborative activities and programs, the Delta Program creates a community of graduate students, postdoctoral researchers, and faculty that will:

- Support and validate growth in teaching and learning
- Create a foundation for institutional change

Learning-through-Diversity
Recognizing the common challenges in teaching and learning and the strength in bringing together diverse views, the Delta Program is:

- Interdisciplinary—serving all science, engineering, and mathematics departments
- Cross-generational—bringing together graduate students, postdocs, and both new and experienced faculty
- Comprehensive—providing knowledge, practice, and community
- Responsive—reflecting the broad range of responsibilities that face today's faculty
- Inclusive—welcoming for a multifaceted and diverse group of people
The requirements for candidacy of a Delta Certificate have been met in the following ways:

1. Completion of two graduate courses on teaching and learning, including at least one full-semester course offered by the Delta Program:
   - Teaching Transitional Students
   - Diversity in the Classroom: Bridging the Achievement Gap

2. Active participation in the Delta Learning Community, including participation in a semester-long Delta Program:
   - CIRTL Coursera MOOC “An Introduction to Evidence-Based Undergraduate STEM Teaching” and local weekly discussion group
   - Delta Roundtables (*helped facilitate):
     - Using Data Analytics to Support Students’ Academic Success
     - Getting the Most Out of Career Conversations with Your P.I. or Mentor*
     - Active Learning: Challenges and Possibilities for the Large Classroom
   - CIRTL webcasts:
     - The Academic Job Search:
       1. Where Do I Want to Teach? Faculty Careers at Different Types of Institutions
       2. The Academic Interview: What to Expect and How to Prepare
       3. Thriving in Your First Year as Faculty
       4. Pulling It All Together: Getting Started with Your Job Search
     - Educational Innovation and the Active Classroom
       1. Hybrid/Flipped Teaching With In-Class Design and Build Activities
       2. Developing Active Learning Activities for Your STEM Course
       3. Scientific Writing in STEM Classes as a Cognitive Apprenticeship
       4. Team-Based Learning (TBL): Active Learning and Differences in Learners
       5. Conducting Assessments During Your STEM Course
     - Thriving as a Faculty Member
       1. Achieving a Healthy Work-Life Balance
       2. Mentoring Through the Tough Stuff: Effective Mentoring of Graduate Students
       3. Faculty Careers at Community Colleges
       4. Women in STEM: Navigating Academic Careers

3. Completion of the Delta Internship, including the Internship Seminar, Reflective Statement, Internship Summative Report, and related presentation slides
   - See Reflection 1, page 12 and appendix 1.a, page 31
   - Summary of Delta Internship:
Pre-Research Workshops:
The effectiveness of pre-research workshops in increasing preparedness of bioscience undergraduates starting involvement in research.

Ali Chesney$^{1,2}$, Aaron Miller$^3$, Janet Branchaw$^{3,4}$


Abstract: The University of Wisconsin-Madison is well equipped to be a leader in undergraduate research participation; however, there appears to be barriers that prevent undergraduate students interested in participating in science research to reach that objective. Anecdotal evidence also indicates that minority and underrepresented students may be at increased risk for these barriers, increasing the chance that they will be unsuccessful in participating in research during their undergraduate career. The intention of this intervention was to increase the number of students participating in research on the UW-Madison campus. A cohort of students from the BioHouse learning community was followed over the course of a year. In a baseline assessment, Biohouse students who attended the pre-research workshops had slightly lower (p <0.05) confidence perceptions in three out of fourteen identified barriers and significantly lower (p <0.01) confidence perception in one barrier as compared to their peers who chose not to attend. At the post-assessment given at the end of the year, these gaps had been minimized and there were no statistically significant difference between BioHouse students who attended the workshops compared to those who didn’t (p >0.05). Importantly, the perceptions of confidence in over 70% (10) of the identified barriers significantly improved over the course of the year regardless of workshop attendance (p <0.05) and 35% (5) of the total number of barriers had dramatic improvements in confidence levels (p <0.001). This could indicate that perceived barriers decrease as students advance in their academic career, and that interventions such as pre-research workshops or one-on-one mentoring/advising could eliminate the achievement gap in research participation.

Full report in appendix: 1.a, page 31
As a researcher, it is my obligation to share research experiences with those training to become scientists. An opportunity to be immersed in a research environment is transformative for students with enthusiasm, motivation and visceral inquisitiveness. The research enterprise (be it academia, industry, government, etc.) values innovation and creativity and we as mentors are responsible to help our clever students realize their potential. The skills acquired as a member of a research group are translatable to job requirements across disciplines and career paths. With this in mind, there are four distinct considerations when a student joins our group:

**The moment mentoring begins is when we meet.** The pairing of mentor to mentee must be advantageous to both parties; I need to know how my student’s interests, motivations, and career goals will fit into the skills and opportunities I can give them in my lab. In the same sense, I need to know if their working style and schedule will fit into the type of projects I can offer them. Sometimes it just doesn’t work. I have had to tell multiple students I cannot offer them a project simply because their busy schedule would not work with learning the techniques I need them to use to accomplish their goals. For example, one of my students had a 18 credit semester with a part time job and extracurricular activities; it would have been very challenging to help her design a full project. She asked to shadow in our lab between her classes, and I believe because of that intrinsic motivation to be involved, Karla was able to get a sense of what academic research was like, even if she didn’t get a chance to get her hands dirty in a project.

I must recognize that my mentee’s goals and career ambitions might differ from my own. When identifying a project and place for them in the group, it is my responsibility to make sure their project is interesting and enables them to develop skills to work toward their future. Regardless of the project or student, students working in my lab learn the scientific method, how to collect and keep data, communicate their results and ideas in written work and verbally in the form of professional presentation as well as casual conversation. Most students excel in a few areas, and it is my responsibility to identify the weaker areas and give them opportunities to practice developing those skills. Undoubtedly, over the course of a mentee’s time in my group, new skills will be learned, in-depth knowledge of the project topic will be obtained, and a network will be built of contacts that will aid in their future aspirations.

As I work with a student, my supervision steps aside and they develop independence. One way I encourage independence is to introduce them to resources that can help them thrive on their own or when I’m not around. Often, I find this is the first time they are introduced to reading primary research literature and the cognitive appreciation of how research is disseminated can be overwhelming. Although my graduate advisor does not participate in journal clubs, this is a component I’d like to initiate if someday I have my own research group. Additionally, my students are encouraged to present their work at weekly lab group meetings and at local research conferences. This allows them to share their work and explore other avenues of research, serendipitously introducing them to potential future collaborators and mentors.

The benefits far exceed the inconveniences of mentoring. Mentees bring fresh perspectives and a new energy to a team. They learn skill sets that they can put to use in a career within the scientific community and that they may even apply as graduate students themselves. A successful mentoring relationship is ultimately rewarding and fulfilling for both parties. Although not every mentor-mentee pair will be a prosperous match, undergraduate research as a high impact educational practice should be encouraged, incentivized and rewarded.
As a science educator, it is my obligation to create a classroom environment where critical thinking is promoted through student engagement and active learning, connection to real world applications, and adaptation to fluctuating classroom environments and various learning styles. A sample of my experience highlights my commitment to utilizing these pedagogies and incorporation of high impact practices in undergraduate education;

- Adapted graduate-level toxicology curriculum to include international and cultural connections
- Designed and implemented workshops to address barriers to undergraduate participation in research
- Helped lead a group of undergraduates to Sri Lanka to integrate science concepts in nutrition, agriculture, global health, and toxicology for a service learning trip.

I have found that effective teaching fundamentally relies on classroom management, clear expectations, consistent policies, organization, and instructor passion. Knowing this, my philosophy to educate in the field of science relies on engaging my students, connecting the content to relevant experiences, and adapting my methods as new challenges arise.

**My goal is to engage my students from day one.** A classroom learning community sets the stage for knowledge acquisition. My intention in focusing on classroom engagement is to build a community of confidence and open interaction. All too common in the science classroom is a tendency to succumb to passive learning. Facts are necessary, but the inclination to limit classroom communication to knowledge accumulation is disadvantageous to the active learner. Withdrawal from active engagement can block curiosity and creative thinking so critical to science education. In my experience, intentional engagement in the classroom makes the instructor more approachable, increases confidence to contribute and ask questions, and bridges the gap between instructor and students.

**I believe connection to world cultures, events, and issues creates important connections to scientific content.** Just as an engaged classroom community is crucial to active learning, a connection to the rest of the world is crucial to make science relevant, especially to non-science major students. I emphasize the rich conceptual issues that define science by incorporating world events and popular news that foster conversation and develop intercultural competencies. As a TA in a graduate level environmental organic chemistry class that taught the modeling of the fate of contaminants in the environment, I wanted to encourage interest in partitioning coefficients (a constant calculated that gives a ratio of a chemical’s concentration between two media phases), so I applied them to the 2004 dioxin poisoning of the former President of Ukraine, Viktor Yushchenko. Both the toxicity and the partitioning character of a chemical were conveyed and the course content was made relevant to semi-historical political events. Additionally, visual examples and demonstrations are also useful methods to engage the visual learner; science that is observable and relatable eliminates some of the ambiguity that comes with equations and textbook facts alone.

**My teaching methods are plastic and I intend to modify them as I grow in my career to accommodate new challenges.** I recognize the challenge of teaching in the college classroom; not only will a variety of learning environments require adaptation of my teaching and methods of assessment, but there are also as many different learning styles as there are students.

**Learning environments.** I have experience in leading graduate level discussions and teaching first and second year undergraduate biology, physiology, and environmental science lab sections. The instruction in each environment is vastly different due to class size, available equipment and education level of the students. I have successfully adapted my teaching style in each situation. One of the notable courses I have taught was a first year environmental science class where every lab section was outdoors or on a field trip off campus. The ability to adapt to new physical environments as well as unexpected circumstances while still ensuring engagement and active learning is a strength that I have developed through these experiences.

**Learning styles.** A teaching approach that works for one student may not work for another. We learn by auditory, visual, and tactile assimilation as well as from anecdotes, evidence, experience, and independent investigation. Although it’s practically impossible to cater to each individual student’s style of learning, I try to employ as many different methods
as I can within an inquiry-based learning framework. In order to reach the brightest students, the limit of human knowledge may be reached – and that’s okay; seeing that gaps exist in scientific knowledge can be transformative for students, and an introduction to the idea of a research career. At lower levels of learning, grades may be a greater motivation than critical thinking. I have found that dedicating no more than fifteen minutes to a new concept before practicing problems in groups or using a case study example helps students integrate difficult material. Building community in small groups to develop competencies within a large classroom seems to increase individual student’s intrinsic motivation compared to learning in isolation.

**Student assessments.** A variety of assessment methods are required to accommodate these different learning environments and learning styles. The assessment of a student’s level of cognition should not be reliant on a handful of exams. With the assistance of the course instructor in the contaminant fate graduate class, I developed a semester-long project with weekly or biweekly reflective reports that culminated in a thorough evaluation of a chosen chemical’s fate in a hypothetically contaminated environmental system. Not only did the report function as a way to tie course material into a potentially real-world scenario, but the reports and final evaluation functioned as additional criteria for assessment that buffered against the course’s famously difficult exams. Integrating writing in science classes is undoubtedly a challenge, but effective communication is an essential learning outcome regardless of major, and should be practiced in STEM courses. Reflections during class can act as non-graded feedback in the form of “minute papers” to probe for background knowledge or “muddiest point” papers in which misconceptions can be identified and cleared up. In order to comprehensively develop science communication skills, I would like to integrate a “popular controversy” paper into an introductory science class where students would research primary literature on a science topic that has multiple viewpoints and analyze the data to draw their own conclusions.

My teaching philosophy has been cultivated through multiple semesters as a TA in undergraduate laboratories, field trips, and graduate-level discussions in addition to out of class efforts such as an international service-learning trip leader and a student representative in a department curriculum revision. I’ve learned to establish course goals and make them pronounced in the syllabus and provide learning objectives for every module or assignment, referring to both course goals and objectives frequently during lesson planning and implementation. Transparency in the purpose of my instruction allows learning to focus on content and progression to higher cognitive aims – not a focus on the test.
Application of Philosophies: Teaching Artifacts & Incorporation of the Delta Pillars:

An important balance exists between scholarship, teaching and mentoring in academia and I have structured the artifacts within my portfolio into themes to address these professional requirements.

The first theme is “Mentoring as a high impact practice” where I highlight the importance of supporting high-impact teaching practices such as undergraduate participation in research. Included in this theme are the following artifacts:

- My Delta internship where I worked with the Wisconsin Institute for Science Education and Community Engagement (WISCIENCE) to create and facilitate workshops to help undergraduate students get involved in research groups on campus.
- The experiences I’ve had mentoring nine undergraduate students in my lab, and three through the “Bonding Undergraduate and Graduate Students” (BUGS) program through Greater University Tutoring Services (GUTS).

The second theme is “Scholarly connections across campus and cultures” where I share experiences of interdisciplinary and cross-cultural learning, and adapting my teaching style to meet the needs of a diverse audience. Included in this theme are the following artifacts:

- Slides and pictures from an outreach presentation to a diverse audience at the UW/Native Nations Research Summit. Feedback from presentations I’ve given in my department seminar.
- Pictures and student reflections from a service learning trip I co-lead to Sri Lanka through Sarvodaya, an international non-governmental organization I work with.

The third theme is “Teaching with engagement, relevance and flexibility” where I illustrate examples of incorporating my teaching philosophy into my teaching as well as innovations to current curricula. Included in this theme are the following artifacts:

- Scores from my teaching evaluations and rubrics for an active-learning project that demonstrate dedication to engagement and innovation in the college classroom.
- A successfully funded grant that proposed to create relevant case studies to be incorporated into toxicology core courses. This was a collaboration between UW-Madison, Sarvodaya in Sri Lanka, and the University of Otago in New Zealand.
Students easily can get lost on campus. I almost did. Had it not been for the rowing team at Ithaca College and the advice and guidance from upperclassmen oarsmen, I may not have found my way to research. In addition to this personal anecdote, I think of rowing as a great analogy to mentoring undergraduate students. We learn together as a group in a lab or a classroom, just like oarsmen work and learn together in a rowing shell. Although we are all individuals with different needs and concepts of success, our goal is the same. As a “coach,” I can follow my students around with a megaphone giving suggestions and tips, but they need to figure out their own way while keeping their boat balanced and moving forward.

I am an advocate for undergraduate experiences in research as well as personal one-on-one mentoring and inclusiveness within a community of practice. Research participation is a known high impact practice by the Association of American Colleges and Universities (AACU; www.aacu.org/leap/hips), and I contend that the mentorship gained from belonging to a group is just as important to student success as the actual research investigation.

With this in mind, for my Delta internship I proposed and conducted a Teaching-As-Research project with Dr. Janet Branchaw at WISCIENCE (Wisconsin Institute for Science Education and Community Engagement) to design and facilitate workshops aimed at underrepresented undergraduate students interested in participating in research. The summative report is my first artifact and listed in the appendices is the pre- and post-intervention survey that measured self-perceived confidence levels and a sample facilitator guide for one of the workshops. Additionally, I share a picture of two of my mentees presenting their work and an email from a former student my second artifact and listed in the appendices is my research contract and expectations guide for undergraduate mentees.
I credit the Delta course “Diversity in the College Classroom: Bridging the Achievement Gap” with reexamining my perception of diversity and inclusiveness. From discussions in and outside of the classroom, I learned that the facilitators of BioBootcamp (introduction to Biology program at UW-Madison that occurs the summer before freshman year) had begun to notice that an achievement gap existed between minority students who participated in their program and their majority peers when it came to student involvement in research in subsequent years. Anecdotally, students gave reasons that we decided could be surmounted with guidance in the form of a workshop designed to address those barriers. Although intended to help underrepresented minority, first generation, and low income students, the workshops were made available to the entire campus. As a teaching as research project, a cohort of students from the BioHouse learning community were followed longitudinally to investigate if participation in these pre-research workshops helped students increase their self-reported confidence and perception of preparation in surmounting identified barriers to research. We established a baseline with a pre-survey with the 2014-15 BioHouse cohort of students. Then, using learning objectives from each workshop, we assessed if they were met by all workshop participants, and compared post-survey results from students who attended workshops to those who did not attend. The summative report for the internship is included as appendix 1.a. Interestingly, by following the cohort from BioHouse, we learned that less confident students are more likely to attend the workshops and the workshops may help address this confidence gap. The objectives in the workshops that were offered during the year (blue and red lines, next page) had increased average confidence levels within the BioHouse cohort compared to those objectives that weren’t offered (green lines, next page). WISCIENCE is institutionalizing these workshops and plans to continue to follow this cohort.

The workshops were designed with a variety of learning styles incorporated, the workshop objectives included multiple levels of cognition, and I used a variety of examples for research at UW. If the workshops are designed to accommodate and benefit everyone, diversity becomes an asset, not a burden. This is the concept of learning through diversity. Teaching in a workshop format was probably the largest single challenge of this project. Each session was between 60 and 90 minutes long and it was difficult fitting the content I wanted to cover and the readiness I wanted the students to gain into such a short, constrained timeframe. Furthermore, I faced the dilemma of addressing students in a variety of stages of preparedness; some students were ready to dive in and were expecting to be matched up with a
mentor on the spot, others had never thought of doing research and wanted to belabor the benefits vs. challenges of research as a student.

Unique to workshops, as opposed to a traditional classroom, is that the students that attended the workshops are exhibiting a large degree of intrinsic motivation. Although the workshops were advertised to large introductory classes, through biology advisors, and through Steenbock library (the future home of BioCommons), they were not specifically targeted to any groups with minority status. This approach is reflected in the attendees for the first four times each workshop was offered; with little exception, the attendees were Caucasian and Asian.

I used pedagogical methods learned from Delta and CIRTL to incorporate interactive learning; students searched for and drafted emails to potential mentors. Although brief, small learning communities developed as students shared their observations about the challenges of reaching out to a professor and discussed what elements should be included in, and how long an email to a prospective mentor should be. Peers provided feedback to common “interview” questions that a research group might ask a prospective student (shown in the picture below). In these small ways, shared learning is validated and common experiences are shared. In each workshop, participants formed a transient community where they learned from each other and progressed toward their individual goals. In future workshops, it would be beneficial if this shared experience was capitalized on, such as sharing contact information, exchanging copies of the letters drafted to faculty for peer feedback, or creation of a social media hub for pre-research workshop participants.

The learning community that developed as part of the Delta internship seminar was invaluable in this project’s development and success. The ideas generated as an organic part of our weekly discussions were integrated and became the most crucial portions of the intervention and its assessments. Especially important to the internship was the community that developed and the mutual shared experiences with IRB protocol approvals, working with faculty mentors, and diversions from our PhD research projects. A large benefit of the internship was learning to balance teaching within the scope of the project with my discipline research and outside commitments. This experience was a fantastic opportunity to work with administration from WISCIENCE and draw on their knowledge of research activities and resources on campus.
Reflection 2: Undergraduate mentoring in the lab and beyond

"Knowing how to think empowers you far beyond those who know only what to think.”

- Neil deGrasse Tyson

The jump from a student primarily learning in a classroom to the investigative, problem-based atmosphere of research is truly monumental. The cognitive leaps between the two formats are a struggle but yet enormously satisfying to watch evolve in a student. I am continued to be amazed in the changes I see over the course of a semester in my students; especially when their questions change after realizing that all of the answers to their questions aren’t known (yet). They start to ask: “Why?” “How?” They start to dig into the literature to satisfy their curiosity. Beginning with what they already know, I help them approach the question using their intuition and logical reasoning.

One of the most gratifying moments as a mentor came when one of my students, Gabe, came in one day and proposed a new experiment. It was not far off from what we had already been doing; it would not stop the presses nor win any prize; but after being in lab for only two months, he had a question that had not been answered and an experimental plan to start investigating. Small, yet mometous occasions such as this—when I can see the “researcher” begin to develop—make the training and the initial investment in a student worthwhile.

One of my first mentees, Kaila (pictured left), is now in graduate school at the University of Kansas, and likely training her own students.

Learning communities develop in a lab and serve as a space on campus where students can find a “home” or sense of belonging besides their dorm or apartment. My office has three empty desks and my undergraduate mentees regularly fill those seats whether they’re scheduled to be there or not. In this space we talk about science, but we also often discuss their goals (academic, professional, personal), what it’s like to be a graduate student (publishing, classes, teaching), and issues we face as a collective group. Sharing my experiences and hearing their ambitions allows continuous informal mentoring. Furthermore, bringing students together to study or relax in my office allows them to learn from each other; what classes to take/avoid, where the best pizza place is, when to take the MCATs or GREs, and which library has the best study-spot selection.

I usually mentor between two to five students at any given time between lab-based mentoring and working with BUGS (Bonding Undergraduate and Graduate Students) through GUTS (Greater University Tutoring Services). To manage the projects coordinated between the students in lab, working together is a requirement. Group-work is sometimes controversial in classrooms because of allocation of individual grades, but teamwork is critical in research groups and I make it imperative that my students understand that they must work together and learn from each other when conducting experiments. Included as an appendix (2.a) is an example of a protocol two of my mentees were working on. Gabe and Riley were not in the lab at the same time and so had to communicate through notes and texts to tell each other where in the clay preparation protocol they left off and what
the next step was for the other person. This working style is not always ideal, but often forces my students to begin to think on their own. For example, Riley didn’t have the rotations per minute that he needed for a step. Although he texted me multiple times to ask, he was able to find an online protocol to calculate the rpm from the diameter of the centrifuge rotor and the gravitational force. This independence is critical to nurture and encourage confidence at this stage in a mentee’s education.

Different working styles, career interests and majors, in addition to a variety of backgrounds, all contribute to the diversity of our group. By participating in my lab’s research my mentees are also learning through diversity. The picture at the top of page 13 shows two of my students presenting their lab research at the UW Undergraduate Research Symposium in 2014. Dania (left) and Hannah (right) worked cohesively and made substantial progress. Although Dania decided a non-science major was the right fit for her, Hannah went on to complete a senior capstone project with me and is currently looking at graduate schools for wildlife studies.

When I took on two chemistry students for the first time, I wanted to check in with the course instructor for their paired “entering research” class. I was both anticipating helping the students much more with their work (research proposal, presentation on their project, etc.) as I normally do with the biology students in my lab, and also secretly nervous that as a bioscience scientist myself, I was woefully inadequate as a mentor for chemists. The instructor, Cheri Barta, wrote back a reassuring email (included as appendix 2.b) that reminded me having a mentor and the experience in asking innovative questions is just as important as matching disciplines with one’s mentees.

An artifact I included for this reflection is an email from a former student, Stephanie. She had a job offer after graduation, but felt like her career goals weren’t at the bench. We talked about different career paths, including graduate school and other ways to use her degree. When we breached the idea of science outreach and science writing, I could sense a change in her; she emerged from a state of resignation to one of enthusiasm. These conversations are so important for students to explore their options, I still keep in contact with her and other former students. The email I included here is in response to a quick, casual check-in email where I forwarded her some information about her future boss (Cargill CEO, Harry Gwinnell) coming to Madison. I strive to make mentoring relevant for every student and I’m very pleased Stephanie found her passion in science outreach.

Also included as an appendix (2.c) is a copy of the research contract and expectations guide that I go over with all my students. Although not numbered, the expectations are listed in order of importance and refer to this document often throughout a student’s time in our group. For example, a summer student who plagiarized and was consistently absent
was dismissed from our group. Although given multiple opportunities to improve and fix his mistakes, he was not committed to the research project and repeatedly cheated and falsified results. This experience, while very unfortunate, was an incredible learning experience. I now make sure to emphasize truthful data collection, storage and analysis and my mentees meet with me at least once a week to discuss their project any issues or concerns they may have. Importantly, I also included in this document a list of opportunities for my mentees to pursue at the university related to their time doing research. I also explicitly state my support for their development and often encourage and help them seek out other non-university awards, fellowships and positions.
Theme 2: Scholarly connections across campus and cultures

The picture above was taken by Voyager 1 in 1990 as it was 3.7 billion miles away from earth. The “pale blue dot” just lower and right of center is Earth and was poignantly reflected on by Carl Sagan in his 1994 book “Pale Blue Dot: A Vision of the Human Future in Space.” To condense his eloquent thoughts:

“Consider again that dot. That’s here. That’s home. That’s us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives... on a mote of dust suspended in a sunbeam...

We are all space travelers on that pale blue dot and Sagan’s musings above truly speak to the (much) larger picture of our world. Our differences are our strength; our diversity requires tolerance but even more so, it requires appreciation. The Delta program has been instrumental in fostering discussions about how diversity is an asset in the classroom and beyond. Everyone brings a unique perspective and past experience that forms their identity; we must incorporate safe opportunities for sharing these identities while maintaining a culture of acceptance.

I embrace opportunities to learn about different cultures: labs on opposite sides of campus, sovereign nations within Wisconsin, countries on opposite sides of the world. The artifacts I incorporated into this theme, “Scholarly connections across campus and culture,” include slides and images from an outreach presentation I was asked to give at the UW/Native Nations Research Summit, feedback from my presentations at my department seminar, and pictures and reflections from a service learning trip I co-led to Sri Lanka. All of these experiences not only provided an opportunity to learn across cultures (across the world or in our own corner of that mote of dust), but also to establish collaborations and networks of scholarship.
Reflection 3: Diversity in teaching and learning

“Everyone you will ever meet knows something you don’t.”
-Bill Nye

I was the only graduate student asked to share my research at the UW/Native Nations Summit on Environment and Health in March of 2015. The summit provided an opportunity for Wisconsin tribal and community leaders to join with UW researchers and educators to participate in focused conversations. This summit was the first of its kind in over one hundred years (1914 summit pictured below, left). The overwhelming feeling at the summit was one of collaboration, shared goals moving forward, appreciation for cultural heritage and support for mutually beneficial action plans and projects. I believe my presentation was relatable, relevant, and raised discussions within an audience with very diverse backgrounds (slides on page 18). After my presentation, I was approached by a policy analyst from the Great Lakes Indian Fish and Wildlife Commission to work with them to help spread awareness of chronic wasting disease (my dissertation focus) to tribal communities in Wisconsin.

The experience presenting my research at such a significant event went far beyond “science outreach.” The summit instilled an appreciation for learning through diversity, and especially an appreciation for Native culture, values, and history. I was privileged to connect and learn from elected leaders from ten sovereign nations (pictured above, top). I have included my slides from the presentation; although brief and without oral context, they exemplify outreach to a diverse audience. These attributes of a relevant and relatable presentation are evidence of the principle of teaching with engagement I support in my teaching philosophy and that I learned through my experience in the Delta program.

I try to incorporate these ideas into my presentations for my department seminar. The toxicology department asks the audience to evaluate presentations, and I’ve graphed my feedback from 2012, 2014 and 2015 (top graph, page 19) to demonstrate that I continuously try to improve upon my presentation skills (although the improvement in feedback may be due to increased enforcement of peer feedback over the years, see “no response”). Digging in to the evaluation criteria from my 2015 presentation (bottom graph, page 19), I am usually more preoccupied with the first three evaluation metrics and it seems I should focus more on the organization of my seminars. Although these department seminars are a much more homogenous audience, I do my best to create a sense of relevancy and relatability to my research.
In this slide, I tried to limit the amount of text while still having great visuals to tell critical information for someone to understand the disease and how it differs from more traditional infections.

Here, I show the counties in Wisconsin affected by CWD in orange and overlap them with the green map showing the seats of government from the 11 federally recognized American Indian Nations in the state.

Finally, I wanted to share what my project involves, but I didn’t want to get bogged down in the details.
Toxicology Seminar Overall Evaluation

Toxicology Seminar Evaluation Criteria
Artifact 4: Service Learning

“Buddha’s first admonition to the bhikkus or monks was to go forth into the world and work for the welfare of the people.”
- Dr. A. T. Ariyaratne

The non-governmental organization I work with began in the 1950s when a school teacher took his upper-class students to an isolated rural outcaste village and, together with the residents, built a road to connect the village to a main road. From this first service learning trip, the adage of the organization was born:

“We build the road and the road builds us”

Since that first shared labor experience, Sarvodaya has become an international nonpartisan, nongovernmental, Buddhist-based organization that transcends religions and social statuses to empower individuals and communities. I joined and co-led a trip to Sarvodaya in Sri Lanka in 2014 where we brought five University of Wisconsin students and helped a community build a preschool—a community-identified and self-financed need.

From discussions with UW faculty and staff at the Morgridge Center for Public Service, service learning is a high impact practice in undergraduate education, but only when done with conscious consideration for both the student and the community. In my opinion, Sarvodaya program trips to both Sri Lanka and Nepal are fantastic examples of service-learning done correctly; the community identifies a need and organizes the action and the students come to bring a catalyst of energy and enthusiasm. I hesitate to claim the catalyst comes from the students, but the community plans for us as international visitors for weeks and the excitement is infectious—especially from the children. The village could easily accomplish the work themselves—in fact; sometimes I felt more in the way. The preschool we built was not the lasting product of our stay; the connections and cultural appreciation are what truly lasts.

I consider service learning successful when students’ reflections say how they felt and discuss the broader impacts of their work rather than simply what they did. Bonds formed between the people of Bogahapitiya (the village where we stayed) and the students. Two of the five students on our trip have been placed in the Peace Corps (Bonnie in Cameroon and Holly in Senegal). These and other students from this and other trips have stayed connected with Sarvodaya; we hosted the Sarvodaya Director of International Programs in Madison (top, page 21) and met the Ambassador for Sri Lanka, Mr. Prasad Kariyawasam (bottom, page 21). When the Nepal earthquake hit, the Sarvodaya student alumni rallied to raise money to send to the Sarvodaya branch in Nepal (middle, page 21). The lasting impacts on these students from working with Sarvodaya are obvious. I intend to not only continue working with Sarvodaya and other NGOs but to incorporate the idea of service learning in the classroom as well as through trips.
“What I will remember most of Sri Lanka are the people, and their ever-present warm and generous spirit. I met people who I now consider to be my sisters and brothers, and my fathers and mothers. Friendships and relationship were made that I think will last the rest of my life; and I will forever have a family 9,000 miles away on the other side of the world.

Sri Lanka will always have a special place in my heart – and I cannot wait to spread word of this amazing place. I will be back one day!”

- Holly

“The strongest of friendships were formed and we became the daughters/son, sisters/brother, aunties/uncle of our host families and neighbors. We are the most excellent home-cooked meals, tea, and snacks - we haven’t had a chance to experience hunger.”

-Rachel

"I always envisioned Sri Lanka as a mysterious paradise on the other side of the world. After this trip I realized it was true-except it’s no longer mysterious. The villagers during our stay in Bogahapitiya became family I never knew I had and the experience and memories we made together will last a lifetime."

-Bonnie
One of the first times a non-scientist friend asked me about my research, I related the proteins I study to Oreo cookies (specifically how they can clump together to form giant cookies or “aggregates” if you change their shape/remove one of the chocolate wafers). Seeing how these individuals—who knew little of proteins beyond that they’re in our food—responded to a cookie analogy was inspiring and I continue to use this and other analogies to share the complex work I do at the bench.

Having a connection to a concept makes material relevant and more likely to be retained. People need buy-in. If they are imagining stacking cookies, it’s easier to talk to them about aggregated proteins; if they are imagining trying to eat a giant stacked Oreo tower in one bite, it is easier to explain how protein degradation pathways (proteasomal and lysosomal pathways) are insufficient to remove inclusion bodies from tissues. This analogy becomes all the more important when I explain that these protein aggregates are involved in diseases that affect them and their families: Parkinson’s disease and Alzheimer’s disease, for example.

I think a lot of STEM content can be difficult to get student buy-in, which is all the more reason to strive for relatability and relevancy. Furthermore, student engagement can only be attained and retained with organization of content and communication, clear expectations, and an atmosphere that encourages curiosity. To best represent the theme of “teaching with engagement, relevancy and flexibility” I decided to include two semesters of anonymous student scores from teaching evaluations from a laboratory course I taught at Northern Illinois University as well as the overview and assessment guidelines of an active-learning project I developed for my advisor’s toxicant fate modeling class. Additionally, I recently applied for and was awarded a CALS grant to internationalize the toxicology curriculum, which I included as an artifact as well as the front page of the case study module.
"We are drowning in information, while starving for knowledge."

-Edward O. Wilson

As an undergraduate student at Ithaca College, I started working as a TA in introductory Spanish class discussions where I would run discussion sections alone as a second semester freshman. Although my passion for languages faded a bit, I continued assisting faculty as a TA in introductory biology lab courses and helped run the lab component for an Environmental Science class that was run almost completely out of the traditional classroom or lab. After I returned to academia from the workforce, I taught a lab-based class at Northern Illinois University in 2010 and 2011. This was the paired laboratory course of a comparative anatomy and physiology class that included ecology and evolution concepts.

After receiving my teaching evaluations from the fall 2010 semester (below, in red), I was happy but confident I could make improvements, especially in the category of “providing an atmosphere of interest and enthusiasm in the subject.” During the spring semester, I spent a lot of time thinking about how to make the content of the labs relatable and exciting. A few things I tried included letting students decorate their drosophila cages (a semester-long microevolution experiment on genetic drift and selection). This seems silly and not incredibly pedagogical, however the time and creative energy the students dedicated to their fly houses seemed to help them to form rapport within their groups during the first day of class. The previous semester I had allowed students to form and dissolve lab groups on their own. On the one hand this worked because everyone seemed to contribute relatively fairly, fearing exclusion and being forced to find a new group. However, during the spring semester I dedicated time early in the semester to talk about the benefits of group work during lab (distribution of labor, diverse perspectives, peers to help brainstorm hypotheses and solutions etc.). I did, however, maintain individual grades and required assignments to be turned in separately. We don’t often consider group work as a skill to be taught in classrooms, yet it is surely a requirement after graduation and discussing successful ways to work together and practicing teamwork is critical for whole student development. Allowing the individual groups to have fun together with the cages and other activities throughout the semester seemed to strengthen the class community as a whole. Although I didn’t originally consider this experience as a learning community, I think this class structure was one of the earliest true “community” examples within this portfolio.

Results of two semesters of teaching evaluations for BIO 211 at Northern Illinois University

<table>
<thead>
<tr>
<th>Student Evaluations from Biology 211</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Organisms and Populations&quot;</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Excellent (5)</td>
</tr>
<tr>
<td>Good (4)</td>
</tr>
<tr>
<td>Average (3)</td>
</tr>
<tr>
<td>Below Average (2)</td>
</tr>
<tr>
<td>Poor (1)</td>
</tr>
<tr>
<td>The organization of verbal and written presentations</td>
</tr>
<tr>
<td>Ability to provide an atmosphere of interest and enthusiasm in the subject</td>
</tr>
<tr>
<td>Encouragement of students to ask questions and clarity of response</td>
</tr>
<tr>
<td>Availability to students outside of class</td>
</tr>
<tr>
<td>Assessments covered a sufficient portion of class material</td>
</tr>
<tr>
<td>Instructor's overall contribution to the class and content</td>
</tr>
</tbody>
</table>

- 2010
- 2011
During the semester, we dissected fixed fetal pigs and just-euthanized frogs. Instead of simply cutting and identifying, I wanted to make the tasks relevant. During the dissections, we talked about relevant stories and diseases as we identified the associated organ. For example, when the students identified the diaphragm, we hypothesized how big the lungs would be when we cut through to the thoracic cavity. When they were shrunken in the frog (as opposed to the formalin-saturated pig lungs, and the anatomical diagrams in their book) we discussed how the lung size and air capacity is related to the force from the diaphragm moving, and why singers have to train their diaphragm.

I wanted to liven up one of the more boring labs; we were going to learn about life tables (also known as actuarial or mortality tables) by collecting information from grave markers at a local cemetery and then calculate the number of individuals present in the population from year to year. The extent of math calculations that needed to be learned and applied to the data had previously overwhelmed student’s attention and time. Instead of asking them to work out the math on their own, we did the calculations together and spent the rest of the lab talking about how life tables are used. We talked about public health and infant mortality, insurance probabilities, differences life expectancies across the world, and wildlife implications such as reproductive strategies (semelparity and iteroparity) and fecundity vs. survival.

I believe it was these measures that improved, however slightly, my teaching evaluations (page 23, in gray). Since then, I have worked to improve curriculum. At the University of Wisconsin, I worked as a teaching assistant for my advisor for his “Toxicants in the Environment” class, an environmental organic chemistry class that used models to predict chemical behavior and fate. I developed and instituted a semester-long report where students were asked to use the lecture material to predict the fate of a chosen chemical in the environment given different parameters (project description included as appendix 5.4). When asked, over 60% of the students chose the reports as the component of the course that best helped them meet the course goals (as opposed to the other components: lecture, discussion, homework, and exams) in addition to their own personal goals (e.g. pass the class, learn modeling software, etc.).

![Diagram of Level III V 2.70: 2,3,7,8-TCDD in Different Environments](image)

Class goals:
A. Predict chemical parameters based on chemical structure
B. Develop an appreciation for the complexity of chemical contamination in the environment and understand how one would go about approaching the problem as an environmental, chemical or remediation engineer and/or as a toxicologist
C. Apply concepts learned in class and discussion to real world issues or scenarios
D. Synthesize literature, calculations and estimations regarding chemical contamination into material that is able to be understood by non-scientists.

Student’s volunteered personal goals:
E. Pass the class
F. Make connections between materials in other classes
G. Practice modeling and estimating parameters

Furthermore, the only negative remarks in the reflective statements was that the dates for when the reports were due conflicted too much with the homework due dates. This was the primary improvement from the first semester of implementation to the next. If I were able to further suggest improvements for this assignment, I would use a single environmental system and vary the chemical options. This way, students could make direct comparisons between each other’s projects. Additionally, I would use a real-world contamination event to bring relevance into the curriculum. One option could be the exposure of contaminants from Madison Kipp Corporation into Starkweather Creek, Lake Monona, and the soil plume under the Schenk-Atwood Neighborhood in Madison. This example is close to the University near a community that is already very active in trying to understand the implications of contaminant runoff.

As artifacts for this reflection I included a screenshot of a student’s model prediction for 2,3,7,8-TCDD (dioxin). Unknown to me at the time, this was likely my first experience with teaching as research. I had seen students struggling to relate to the content of this class. By incorporating a long-term project, the individual course components and equations became necessary for the final product. I would claim that this experience gave me confidence to attempt incorporating an issue I’m passionate about into curriculum, which I will describe in the next reflection.
Through participating in an “Expeditions in Learning” Delta course focused on the Association of American Colleges and Universities’ list of High Impact Teaching Practices I was introduced to Masarah Van Eyck, the Director of Science Curriculum Internationalization. Her enthusiasm for international relevancy in STEM really helped me consider the usefulness of incorporating problem-based learning modules in other Toxicology courses, just like I had in my advisor’s course (see reflection 5 and appendix 5.a). I chose chronic kidney disease of unknown etiology (CKDu) from Sri Lanka as a way to teach about multifactorial toxicity and disease pathology while also incorporating science policy, labor regulations, behavioral risk factors, climate and elevation.

The College of Agriculture and Life Sciences (CALS) called for proposals to internationalize science education shortly before the end of my time in the Expeditions course. I discussed my idea with the chair of my department and coincidentally, he had just been awarded a grant to create a digital course in collaboration with a university in New Zealand. We wrote a proposal to not only create a module based on CKDu, but to design the assessments in such a way that the student-produced assignments could be used as examples and additional content for the toxicology digital course (proposal included here as an appendix 6.a). This two-fold approach was a significant step toward internationalization of the toxicology program. We will also be coordinating with our collaborators in New Zealand to create a pathway for student exchanges, shared courses, and international internships. We were awarded the CALS grant, in fact it was the highest scoring proposal of that year and the only proposal to ever be awarded that had been authored by a graduate student.

I view this project as the culmination of what I have learned through Delta. It is an opportunity to form learning communities amongst students, interested faculty and university partners to develop and fine-tune the module. Although in the early stages of development, the interest to contribute has been substantial. Once in use, I anticipate the collaborative nature of problem-based learning will also contribute to developing learning communities.

Due to the international nature of the module, learning through diversity will play a large part in the module’s learning goal of attaining global appreciation. Each stakeholder will allow a new appreciation for understanding values and valuing different perspectives. Furthermore, the interconnectedness of the project with the University of Otago in New Zealand and the non-governmental organization, Sarvodaya in Sri Lanka allows the possibility of future exchanges and students benefiting from the unique international diversity of these relationships.

Because the modules are a completely new way to teach this course, we have the unique opportunity to assess if this style of learning is beneficial to student acquisition and retention of toxicology content, application of scientific concepts, and incorporating non-STEM issues into a very STEM-centric course. We plan to utilize this opportunity as teaching as research, and assess if this intervention was useful. If proof of concept is shown and student reviews are positive, I have already been investigating opportunities for future module development using the research from graduate students at UW Madison and the University of Otago.

As an artifact, I included the front page of the case study in its current design. The successful proposal is included as appendix 6.a.
Kidney disease in Sri Lanka

by

Alexandra Chesney, Molecular and Environmental Toxicology Center, University of Wisconsin, Madison

Abstract

Also known as Mesoamerican nephropathy (MeN), chronic kidney disease of unknown etiology (CKDu) is prevalent in tropical regions of the world that rely on agrochemicals for agriculture. There is disagreement between scholars over what causes CKDu, but suggested causes include excessive exposure to agrochemicals, heavy metal toxicity, high fructose hydration, nephrotoxic medications, infectious disease, difficult working conditions, genetic susceptibility, childhood exposure, alcohol use, exposure to high temperatures, and/or insufficient water intake, among other risk factors.

- Using what is taught in the TOX 625 lecture, students are assigned a stakeholder as a client (individuals involved in the CKDu problem, such as a farmer, a village doctor, etc.) and asked to thoroughly investigate the aspects of CKDu (prevention measures, lifestyle, economics, regulations, etc.) important to their client.
- Students come together in the second week to present their outside research and discuss possible causes of the disease as well as solutions specific to the culture as well as the science. As an assignment, students will compile their research (regarding theme one’s subthemes: toxicokinetics, metabolism, etc.) and social evidence into a report that can be used as supplemental material for a digitized course (see below).
- In the third week, the case study is wrapped up with an in-class discussion and reflection, field trip, or a guest lecturer (such as a scientist researching relevant projects, a community non-profit or government associate, or a member of one of the communities affected by the case study in question via skype).

Over the course of the three-week module, students will develop an appreciation for societal differences and inequalities, and nurture a sense of global citizenship in the context of toxicology.

Objectives

1) Students will use lecture content and scientific literature to report a chemical’s characteristics and physiological relevance to renal toxicity and CKDu.

2) Students will role play a representative of a stakeholder (client) of a real-world toxicology problem (CKDu) in a debate discussion, explaining different societal values and international scientific approaches to the same problem.

3) Students should be able to compare the ways in which national and international policies, agriculture, social and economic stressors, culture, and healthcare influence the use of agro-chemicals in the United States and the world.
### CIRTL Learning Objectives Matrix Associate Level

#### Associate Level

<table>
<thead>
<tr>
<th>Teaching–As-Research</th>
<th>How this outcome was met:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Know that a body of literature and knowledge exists concerning high-impact, evidence-based teaching practices.</strong></td>
<td>Demonstrated by completing the Delta Internship. Submitted a project proposal and final summative report that included literature reviews.</td>
</tr>
<tr>
<td><strong>Define and recognize the value of the Teaching-as-Research process, and how it can be used for ongoing enhancement of learning.</strong></td>
<td>Met by completing the project proposal and final reflection of Internship.</td>
</tr>
<tr>
<td><strong>Know how to access the literature and existing knowledge about teaching, learning and assessment, in a discipline or broadly.</strong></td>
<td>Demonstrated in teaching as research projects, researched the literature while designing active learning modules.</td>
</tr>
<tr>
<td><strong>Describe and recognize the value of realistic well-defined, achievable, measurable and student-centered learning goals.</strong></td>
<td>Practiced during CIRTL MOOC in-class discussions by designing lesson plan with learning goals. Applied during design of Toxicology 631 toxicant reports.</td>
</tr>
<tr>
<td><strong>Describe several assessment techniques and recognize the value of their alignment with particular types learning goals.</strong></td>
<td>Demonstrated by designing assessments for toxicology case study and 631 semester project based on course goals and project objectives.</td>
</tr>
<tr>
<td><strong>Describe and recognize the value of evidence-based effective instructional practices and materials.</strong></td>
<td>Shown by successful grant proposal built on evidence-based instructional materials and incorporation of primary literature.</td>
</tr>
<tr>
<td><strong>Describe a “full-inquiry” cycle</strong></td>
<td>Practiced throughout the development and implementation of Teaching as Research internship.</td>
</tr>
<tr>
<td>Learning Communities</td>
<td>How this outcome was met:</td>
</tr>
<tr>
<td>----------------------</td>
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</tr>
<tr>
<td><strong>Associates can do the following:</strong></td>
<td></td>
</tr>
<tr>
<td>Know that a body of literature and knowledge exists associated with learning communities and their impact on undergraduate learning.</td>
<td>Shown when researching and writing proposal and manuscript for Delta internship.</td>
</tr>
<tr>
<td>Define the characteristics of undergraduate learning communities (LCs).</td>
<td>Demonstrated during participation in Delta courses “Expeditions in Learning: High Impact Practices” and “Teaching Transitional Students.”</td>
</tr>
<tr>
<td>Describe the impact of LCs on student learning.</td>
<td>Practiced during development and analysis of Delta internship: pre-research workshops in the biohouse learning community.</td>
</tr>
<tr>
<td>Describe and recognize the value of LC strategies that promote positive interdependence between learners so as to accomplish learning goals.</td>
<td>Shown during the implementation of Delta internship, used student peer review process for timely feedback.</td>
</tr>
<tr>
<td>Describe and recognize the value and issues of establishing LCs comprising a diverse group of learners.</td>
<td>Exhibited during “Addressing the Achievement Gap” course.</td>
</tr>
<tr>
<td>Describe techniques for creating a LC within a learning environment.</td>
<td>Shown during and after leading a service learning trip to Sri Lanka.</td>
</tr>
<tr>
<td>Recognize the value of and participate in local professionally-focused learning communities associated with teaching and learning.</td>
<td>Demonstrated as a member of the UW Teaching Academy, Delta program.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning through Diversity</th>
<th>How this outcome was met:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Associates can do the following:</strong></td>
<td></td>
</tr>
<tr>
<td>Know that a body of literature and knowledge exists associated with diversity and its impact on accomplishing learning goals.</td>
<td>Exhibited when researching for Teaching as Research internship, and participation in “Addressing the Achievement Gap,” “Expeditions in Learning: High Impact Practices,” and “Teaching Transitional Students.”</td>
</tr>
<tr>
<td>Define and recognize the scope of diversity in learning environments, of both students and instructor.</td>
<td>Practiced when participating in “Teaching Transitional Students” and “Addressing the Achievement Gap.”</td>
</tr>
<tr>
<td>Recognize the impact of diversity on student learning, in particular how diversity can enhance learning, and that inequities can also negatively impact learning if not addressed.</td>
<td>Demonstrated during participation in “Addressing the Achievement Gap.” Practiced during workshop facilitation for Delta internship.</td>
</tr>
<tr>
<td>Describe how an instructor’s beliefs and biases can influence student learning.</td>
<td>Demonstrated during participation in “Addressing the Achievement Gap” and “Expeditions in Learning: High Impact Practices.”</td>
</tr>
<tr>
<td>Recognize the value of drawing on diversity in the development of their teaching plans (including content, teaching practices and assessments) to foster learning.</td>
<td>Shown in successful proposal awarded for relevant course content in toxicology curriculum.</td>
</tr>
<tr>
<td>Describe several learning-through-diversity (LtD) techniques and strategies (e.g. creating a welcoming environment, learning communities).</td>
<td>Practiced during “Teaching Transitional Students” and “Addressing the Achievement Gap.” Additionally, in courses TA’ed and workshops facilitated.</td>
</tr>
</tbody>
</table>
### Practitioner Level

#### Teaching – As Research

<table>
<thead>
<tr>
<th>Practitioners can do the following:</th>
<th>How this outcome was met in the Delta Certificate:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Develop a deeper understanding of the knowledge concerning high-impact, evidence-based teaching practices.</strong></td>
<td>Shown by developing a teaching as research internship project, writing a grant proposal to implement high-impact, evidence-based teaching practices.</td>
</tr>
<tr>
<td><strong>Develop a Teaching-as-Research plan for a limited teaching and learning project</strong></td>
<td>Demonstrated by developing a plan for a teaching as research project.</td>
</tr>
<tr>
<td><strong>Execute a Teaching-as-Research plan for a limited teaching and learning project</strong></td>
<td>Demonstrated by executing a plan for a teaching as research project.</td>
</tr>
<tr>
<td><strong>Show the integrated use of Teaching-as-Research, Learning Community and Learning-through-Diversity to accomplish learning goals.</strong></td>
<td>Practiced during designing a semester-long project incorporating relevant real-life information.</td>
</tr>
</tbody>
</table>

#### Learning Communities

<table>
<thead>
<tr>
<th>Practitioners can do the following:</th>
<th>How this outcome was met in the Delta Certificate:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Develop a deeper understanding of the knowledge concerning LCs and their impact on undergraduate student learning.</strong></td>
<td>Shown by developing learning communities in courses taught, educational trips led, and workshops facilitated.</td>
</tr>
<tr>
<td><strong>Integrate one or more LC strategies into a teaching plan so as to accomplish learning goals and learning-through-diversity</strong></td>
<td>Practiced by developing activities in Delta internship workshops that integrate learning community strategies.</td>
</tr>
<tr>
<td><strong>Implement one or more LC strategies for students in a teaching experience.</strong></td>
<td>Demonstrated by implementing learning community strategies in courses taught.</td>
</tr>
<tr>
<td><strong>Contribute to local professionally-focused learning communities associated with teaching and learning.</strong></td>
<td>Performed by participation in Delta and Teaching Academy communities of practice.</td>
</tr>
<tr>
<td><strong>Show the integrated use of Teaching-as-Research, Learning Community and Learning-through-Diversity to accomplish learning goals.</strong></td>
<td>Demonstrated during implementation of Delta internship workshops and semester-long project in toxicology course.</td>
</tr>
</tbody>
</table>

#### Learning through Diversity

<table>
<thead>
<tr>
<th>Practitioners can do the following:</th>
<th>How this outcome was met in the Delta Certificate:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Develop a deeper knowledge of the body of literature concerning diversity and its impact on accomplishing learning goals.</strong></td>
<td>Shown by incorporating literature concerning diversity in teaching and research project proposal and project.</td>
</tr>
<tr>
<td><strong>Examine own beliefs and biases, including how they may influence their students’ learning.</strong></td>
<td>Demonstrated during “Addressing the Achievement Gap” course.</td>
</tr>
<tr>
<td><strong>Determine the diverse backgrounds among a group of students, and consider the opportunities and challenges of the findings on each student’s learning.</strong></td>
<td>Practiced while facilitating workshops for teaching as research internship project, semester courses TA’d.</td>
</tr>
<tr>
<td><strong>Create a teaching plan that incorporates content and teaching practices responsive to the students’ backgrounds.</strong></td>
<td>Demonstrated during workshop facilitator guide development, designing case study module for toxicology course, discussions TA’d.</td>
</tr>
<tr>
<td><strong>Integrate one or more LtD techniques and strategies in a teaching plan so as to use students’ diversity to enhance the learning of all.</strong></td>
<td>Shown during workshop implementation (during active learning components), inclusive strategies used during service learning trip to Sri Lanka.</td>
</tr>
<tr>
<td><strong>Implement one or more LtD strategies in a teaching experience.</strong></td>
<td>Practiced during discussion sections TA’d.</td>
</tr>
<tr>
<td><strong>Show the integrated use of Teaching-as-Research, Learning Community and Learning-through-Diversity to accomplish learning goals.</strong></td>
<td>Demonstrated during designing, implementation and reflection of Delta internship.</td>
</tr>
</tbody>
</table>
Appendices

Appendix 1.a: Delta Internship Summative Report

Appendix 1.b: Assessment tool for Pre-Research Workshops

Appendix 1.c: Example facilitator guide from pre-research workshops (workshop 2)

Appendix 2.a: Protocol showing student teamwork/communication

Appendix 2.b: Email from research course coordinator

Appendix 2.c: Lab research contract and expectations

Appendix 5.a: Toxicants in the Environment semester project description

Appendix 6.a: Successful grant proposal
Pre-Research Workshops

The effectiveness of pre-research workshops in increasing preparedness of bioscience undergraduates starting involvement in research.

Ali Chesney1,2, Aaron Miller3,4, Janet Branchaw3


**Abstract:** The University of Wisconsin-Madison is well equipped to be a leader in undergraduate research participation; however, there appears to be barriers that prevent undergraduate students interested in participating in science research to reach that objective. Anecdotal evidence also indicates that minority and underrepresented students may be at increased risk for these barriers, increasing the chance that they will be unsuccessful in participating in research during their undergraduate career. The intention of this intervention was to increase the number of students participating in research on the UW-Madison campus. A cohort of students from the BioHouse learning community was followed over the course of a year. In a baseline assessment, Biohouse students who attended the pre-research workshops had slightly lower confidence perceptions in three, and significantly lower confidence perceptions in one out of fourteen identified barriers compared to their peers who chose not to attend. At the post-assessment given at the end of the year, these gaps had been minimized and there were no statistically significant difference between BioHouse students who attended the workshops compared to those who did not attend. Importantly, the perceptions of confidence in over 70% of the identified barriers significantly improved over the course of the year regardless of workshop attendance and 35% of the total number of barriers had dramatic improvements in confidence levels. This could indicate that perceived barriers decrease as students advance in their academic career, and that interventions such as pre-research workshops or one-on-one mentoring/advising could eliminate the achievement gap in research participation.

**Introduction:**

*Problem the intervention addresses*

Although a research powerhouse with exceedingly varied opportunities to participate in research activities, many undergraduates at the University of Wisconsin-Madison (UW Madison) find it difficult to obtain a position within a research group. There are a range of barriers associated with this perceived difficulty, including; understanding benefits and challenges of participating in research, finding and contacting a potential research group, discussing expectations, interviewing, locating resources for funding, presenting work, and other opportunities. Anecdotally, these barriers are particularly problematic for first generation, targeted minority students, as well as other underrepresented students. In order to increase student self-perceived confidences, we created workshops addressing these commonly perceived challenges.
Current State of Knowledge

Many studies have investigated the benefits of participating in undergraduate research (Seymour 2004, Barlow 2004). In contrast to the benefits associated with undergraduate participation in research, there are also significant costs. These costs include the time commitment involved in training students, investment of resources, and a limit of output that result from these investments. In addition, the undergraduate is often perceived as being incompetent and presents an additional mentoring challenge to both the faculty member and the other members of the lab (Bauer 2003, Dolan 2010, Gates 1999, Merkle 2001). These barriers can be especially overwhelming for those from nonacademic backgrounds, who may not be familiar with the culture of research (e.g., first-generation college students), and for underrepresented minority students, who may feel isolated or intimidated by the research lab environment (Boyd and Weseman, 2009). A significant gap exists in minority students participation in research when compared to their non-minority peers, both anecdotally at the University of Wisconsin-Madison and in the literature at other large research institutions (Jones, M. T., Barlow, A. E. L., Villarejo, M., 2010; Lopatto, 2004)

Teaching as Research Question

The teaching as research question asked in this project is: “Will workshops aimed to eliminate or reduce perceived barriers increase bioscience student participation in research?” Specifically, will workshops increase minority or underrepresented student participation in research? Additionally, though as not as critical to the success of the project, is the longitudinal research question, “will attending pre-research workshops contribute to a decrease the time-to-research.” Similar to “time to degree,” time-to-research will be defined as the length of time between enrolling at the University of Wisconsin-Madison and participating in a lab.

Approach

The goal of the intervention is to increase the self-reported professional confidence and preparedness of undergraduate students who desire experience in a research lab on campus. Specifically, workshops will be designed to address barriers that faculty and undergraduate students commonly perceive. These workshops will focus on pre-research skills needed to obtain a lab position, rather than the intensive lab-based curriculum already taught in “Expeditions in Research,” a two-semester long seminar course for students already established in their first year in a lab.

Students’ attitudes and intentions of participating in research were assessed in a longitudinal study focusing on the students in BioHouse that participated in the BioCommons-sponsored pre-research workshop series. The students entering the BioHouse learning community in the fall were encouraged to take “Entering Research” in the spring. Entering Research is a course designed for students in their first semester of a research experience. The challenge this course has had in the past is finding mentors for the students enrolled. Our aim was to address this issue by encouraging the BioHouse students to take and benefit from these pre-research workshops. The workshops are optional, and we will use the students who do not attend as a control group.

The data metrics we examined in these surveys included: interest in a research experience, participation in workshops (post-assessment only), self-reported confidence/preparedness in specific professional/scientific areas both before and after the workshop series, and success in
obtaining a research position. Self-efficacy scales based on previous literature and workshop learning objectives were used. The workshops were created using a backwards design approach (Wiggens 1998, Wiggens 2001) where the overall goal was to increase participants’ confidence and preparedness to seek out and obtain a research position, and the workshop objectives (Table 1) were designed to meet this goal, as presented in figure 1. Our hypothesis is that participating in pre-

![Figure 1. The backwards design approach of pre-research workshops 1 and 2.](image)

research workshops would increase interest and participation in research settings.

The pre-intervention survey was given to the BioHouse learning community students during their mandatory seminar in October 2014. The students were then encouraged (but not required) to attend the workshop series, and at the end of the next semester (April 2015) the BioHouse students were surveyed again to assess educational gains based on increases in self-
reported confidence/preparedness and success in obtaining a lab position (Figure 2). These data metrics split our target student survey respondents into two groups: BioHouse students who participated in the workshops, and Biohouse students who did not participate in the workshops. Additionally, the workshops have separate, non-identified assessments to determine if each workshop is adept at reaching its learning objectives. These assessments were given to all workshop participants regardless of affiliation with BioHouse.

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<tr>
<th>Workshop</th>
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<th>Objective</th>
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<td>1</td>
<td>Summarizing advantages and disadvantages of participating in undergraduate research</td>
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<td></td>
<td>2</td>
<td>Creating a semester class schedule incorporating undergraduate research participation</td>
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<td>3</td>
<td>Identifying campus resources for undergraduate research</td>
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<td>4</td>
<td>Identifying a general research interest</td>
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<td></td>
<td>5</td>
<td>Locating campus resources to find a faculty mentor</td>
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<td></td>
<td>6</td>
<td>Deciding what to include in an email to a potential research mentor</td>
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<td></td>
<td>7</td>
<td>Producing an email to a potential research mentor</td>
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<td>8</td>
<td>Comfortable talking to a faculty member about their research</td>
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<td>9</td>
<td>Identifying your own goals and expectations for participating in research</td>
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<tr>
<td></td>
<td>10</td>
<td>Interviewing for an undergraduate research position</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>Compare the different roles and responsibilities of individuals in a scientific research setting</td>
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<td></td>
<td>12</td>
<td>Identify opportunities for funding</td>
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<td></td>
<td>13</td>
<td>Identifying opportunities for presenting research results</td>
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<tr>
<td></td>
<td>14</td>
<td>Discuss long-term goals for a research experience</td>
</tr>
</tbody>
</table>

Table 1. Objectives for pre-research workshops. Students were given an assessment (appendix1.a) at the end of each workshop and asked to report their perceived level of confidence in completing the above objectives that pertained to the workshop. The numbers for each objective are consistent in the figures found in the results section. Workshop 3 was not offered during the 2014-15 academic year, however BioHouse students were still surveyed for their confidence levels meeting these objectives.

**Evaluation**

Each workshop’s objectives were used as parameters to gauge student confidence gains. BioHouse students were given a pre-intervention survey in the fall and then re-surveyed at the end of the academic year. During this time, each workshop was offered at least 5 times, including workshops offered in the same building as the BioHouse learning community, Cole Hall.
Results:

_BioHouse Workshop Participants_

BioHouse students who attended the pre-research workshops had slightly lower ($p < 0.05$) confidence perceptions in three out of fourteen identified barriers and significantly lower ($p < 0.01$) confidence perception in one barrier as compared to their peers who chose not to attend (Figure 3). The objectives where the workshop attendees were significantly less confident were:

- “summarizing advantages and disadvantages of participating in undergraduate research” ($p < 0.01$)
- “locating campus resources to find a faculty mentor” ($p < 0.05$)
- “identifying opportunities for presenting research results” ($p < 0.05$)
- “discussing long-term goals for a research project” ($p < 0.05$)

_Figure 3. The students from BioHouse that chose to attend the workshops had lower self-reported perceptions of confidence in four of the workshop objective areas compared to their peers._ BioHouse workshop participants did not have significantly different confidence perceptions in the pre-intervention survey except for four objectives (1, 5, 13 and 14), in which the students ($n=5$) who chose to come to the workshops had less confidence reported than their peers ($n=43$). (* denotes significance where $p < 0.05$, ** denotes significance where $p < 0.01$).

At the post-assessment given at the end of the year, these gaps had been minimized and there were no statistically significant difference ($p > 0.05$) between BioHouse students who attended the workshops compared to those who didn’t, except for objective 4 (“identifying a general research interest”), where workshop participants actually had slightly more confidence ($p < 0.05$).
Workshop participants: BioHouse vs. non-BioHouse

Students from BioHouse had significantly less self-reported confidence than their non-BioHouse peers after completion of the workshops in five workshop objectives (Figure 4). Objectives that had significant differences in confidence between these students were:

- “summarizing advantages and disadvantages of participating in undergraduate research” ($p < 0.01$)
- “creating a semester class schedule incorporating undergraduate research participation” ($p < 0.01$)
- “identifying a general research interest” ($p < 0.05$)
- “locating campus resources to find a faculty mentor” ($p < 0.01$)
- “producing an email to a potential research mentor” ($p < 0.01$)

When the non-BioHouse workshop participants only included freshman, confidence levels were still significantly different ($p < 0.01$), except for “identifying a general research interest,” and the overall average, both of which became insignificant ($p > 0.05$, data not shown).

![Survey given immediately after workshop](image)

Figure 4. Confidence perceptions after the workshop(s) were significantly different between students who were from BioHouse ($n=5$) and those who were not ($n=28$, workshop 1; $n=14$, workshop 2). The workshops for objectives 11-14 were not offered to non-BioHouse students († denotes significance where $p < 0.05$, ‡ denotes significance where $p < 0.01$).
Participant demographics

We examined the self-reported demographics of students who registered (workshop 1 and 2 separately) and then attended the workshops. Most students who registered for workshops were freshmen and sophomores, although a proportionately higher number of freshmen attended the workshop (Figure 5A). The fractions of self-identified sex of students did not change between registration and workshop attendance (Figure 5B). A proportionately higher number of female BioHouse students completed the post-survey than the pre-survey (Figure 5B).

Although Hispanic students registered for the workshops and completed the pre-survey, none attended the workshops or completed the post-survey (Figure 5C). The majority of students who were involved in the study did not identify as ethnic minorities (Figure 5C). The students who
identified as a veteran and/or student athlete in their registration did not attend the workshop (Figure 5D). In the BioHouse population, the students who identified as a Pell grant recipient and whose English is a second language did not complete the post survey (Figure 5D).

**Registration vs. attendance**

There were 79 students who registered for the workshops (n=70, workshop 1; n=74, workshop 2) (Figure 6). A total of 36 students attended one or both (n=6) of the workshops, indicating a 45.6% attendance rate. The workshop 1 series had a separate 40% attendance rate (70 registered, 28 attended), and the workshop 2 series had a 19% attendance rate (74 registered, 14 attended). Importantly, there was a final workshop 2 scheduled with 16 participants that was unexpectedly cancelled.

![Registration vs. Attendance](image)

**Figure 6. Workshop attendance was substantially lower than registration.** The workshop 1 series had a 40% attendance rate (70 registered, 28 attended), and the workshop 2 series had a 19% attendance rate (74 registered, 14 attended). The responses from BioHouse students decreased over time (n=48, pre-survey; n=16, post-survey). The BioHouse attendance rate was 10%.

**BioHouse pre and post survey**

The objectives where confidences did not improve statistically from the pre to post survey (over the course of the 2014-15 academic year) were:

- “Comfortable talking to a faculty member about their research”
- “Identify opportunities for funding”
- “Identifying opportunities for presenting research results”
• “Discuss long-term goals for a research experience”

![Bar graph showing self-perceived confidence levels before and after pre-research workshops.](image)

**Figure 7.** Reported confidence levels from Biohouse students from October 2014 (n = 48) to April 2015 (n = 16) significantly improved. (* denotes significance where p < 0.05, ** denotes significance where p < 0.01, and *** denotes significance where p < 0.001).

Importantly, the perceptions of confidence in over 70% (10) of the identified barriers significantly improved over the course of the year regardless of workshop attendance (p < 0.05) and 35% (5) of the total number of barriers had dramatic improvements in confidence levels (p < 0.001) (Figure 7, Figure S2).
Figure 8. The fraction of BioHouse students reporting participation in research increased over the course of the intervention period. (before, n=48; after n=16)

Significantly, at the pre survey, four students reported being currently involved with research (8.33%; n=48). At the post survey, eight students reported being currently involved with research (50%; n=16), only one of which had previously reported involvement based on correlating the two surveys with an anonymous alphanumeric identifier (Figure 8). This indicates at least seven students had found research positions over the course of the intervention (at least 14.5% of original pre-survey sample size, or at least a 57% increase). Although none of these students attended the workshops, this figure illustrates that not only are freshmen bioscience students able to get involved in research, but that these students are a potential untapped resource for peer instruction and mentoring within the freshman learning community.

Discussion

*BioHouse Workshop Participants*

An unanticipated consequence of following a dedicated cohort was the surprisingly low attendance of BioHouse students. Times were selected based on the best known BioHouse student free time. Times were varied throughout the day and weeks when they were offered. Additionally, the workshops were offered at the closest Library to BioHouse, Steenbock (in the BioCommons). During the first ten workshop offerings, no BioHouse students attended. In order to use the baseline assessment data, we implemented a workshop in the basement common area of BioHouse. Five Biohouse students participated.

Despite the low sample size, the students who chose to attend the workshop reported lower confidences in four workshop objectives (p <0.05 or <0.01). In the post survey, these confidence levels were statistically insignificant compared to their peers who chose not to participate in the workshops (data not shown), indicating that workshop attendance could close the gap between less confident students and their peers.

*Workshop participants: BioHouse vs. non-BioHouse*

Reported confidence from workshop participants after the workshops indicated that BioHouse students were statistically less confident than their non-BioHouse peers in five of the workshop objectives. We hypothesized that this may be due to more upperclassmen in the non-BioHouse participants; however when we compared perceptions between only freshmen non-BioHouse participants (n=18), their confidence levels were still significantly higher than the BioHouse participants for four of the five objectives (Figure S1).

*Participant demographics and workshop attendance*

Workshop participants were asked to register ahead of time. A total of 79 students registered for one or both workshops. A total of 36 students attended one or both (n=6) of the workshops. This indicates a 45.6% attendance rate. The workshop 1 series had a 40% attendance rate (70 registered, 28 attended), and the workshop 2 series had a 19% attendance rate (74 registered, 14 attended). Importantly, there was a final workshop 2 scheduled with 16 participants that was unexpectedly cancelled. Had those students all attended, the attendance rate for the workshop 2 series would also have been 40%.
A higher percentage of freshmen attended the workshops (n=18, total) compared to those that registered (n=25, workshop 1; n=24, workshop 2). Although Hispanic students registered for the workshops (n=3, workshop 1; n=4, workshop 2), none attended. More female students registered (n=36, workshop 1; n=41, workshop 2) and attended (n=22) the workshops compared to their male colleagues (n=25, registered workshop 1, n=24, registered workshop 2; n=14, attended workshop). The majority of students who attended the workshops were Caucasian (n=27), with Asian the second most common ethnicity (n=9). Extremely few targeted minority students registered (n=5, registered workshop 1; n=6, registered workshop 2) or attended the workshops (n=1). Although the sample size is too small to speculate on the workshops’ impact on addressing the achievement gap, we anticipate future workshops would target minority and first generation students.

**BioHouse pre and post survey**

The confidence levels between BioHouse students for objectives 8 and 12-14 were not significantly different between the pre and post-assessment (Figure 7, Figure S2). The workshop that covers objectives 11-14 was not offered during the 2014-15 academic year, yet perhaps should be a focus for future workshops. Objective 8, comfort in talking with a faculty member about research, is perhaps an objective where confidence comes with experience.

Four objectives showed slightly significant ($p < 0.05$) increases in student confidence:

- Locating campus resources to find a faculty mentor
- Identifying your own goals and expectations for participating in research
- Interviewing for an undergraduate research position
- Compare the different roles and responsibilities of individuals in a scientific research setting

One objective showed significant ($p < 0.01$) increases in student confidence:

- Summarizing advantages and disadvantages of participating in undergraduate research

Five objectives and the average confidence level showed substantial ($p < 0.001$) increases in student confidence:

- Creating a semester class schedule incorporating undergraduate research participation
- Identifying campus resources for undergraduate research
- Identifying a general research interest
- Deciding what to include in an email to a potential research mentor
- Producing an email to a potential research mentor

Because the post-assessment includes students who did not attend the workshops (n=14) as well as some who did (n=2), this result may indicate that perceived barriers decrease as students advance in their academic career. However, interventions such as pre-research workshops or one-on-one mentoring/advising could eliminate the achievement gap in research participation between less confident students and their peers.
References


Supplementary Information

Figure S1. Freshmen-only workshop participants reported significantly higher confidence in four objectives. When the non-BioHouse workshop participants excluded upperclassmen, confidence levels were still significantly different \((p < 0.01)\), except for “identifying a general research interest,” and the overall average, both of which became insignificant \((p > 0.05, \text{ data not shown})\).
Figure S2. All objectives addressed in the pre-research workshops offered during the year showed improvement in student confidence regardless of workshop participation. Surprisingly, the objectives that were in workshop 3, the only workshop not covered, showed equivalent or decreasing confidence levels over time.
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<th>Alphanumeric ID:</th>
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<tbody>
<tr>
<td>Please circle all with which you identify:</td>
<td>First 3 letters of your birth month + last 3 letters of your phone number</td>
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<table>
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<th>Female</th>
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<td>Middle Eastern</td>
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<td>First Generation American</td>
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<tr>
<td>Asian</td>
<td>Live in Dorms</td>
<td>Veteran</td>
</tr>
<tr>
<td>Native American</td>
<td>Live in BioHouse</td>
<td>Student Athlete</td>
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<td>From rural area</td>
<td>Pell Grant Recipient</td>
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<tr>
<td>Pacific Islander</td>
<td>From suburban area</td>
<td>Mother has bachelor’s degree</td>
</tr>
<tr>
<td>Other Race/Ethnicity Not Defined Here</td>
<td>From urban area</td>
<td>Father has bachelor’s degree</td>
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### Please indicate how confident or prepared you feel performing the following tasks:

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<th>Not Confident</th>
<th>Slightly Confident</th>
<th>Confident</th>
<th>Very Confident</th>
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<tr>
<td>Summarizing advantages and disadvantages of participating in undergraduate research</td>
<td>You may feel tentative to try or unsure where to begin.</td>
<td>You may be hesitant, but you know generally what to do or where to ask for help</td>
<td>You are assure of yourself and would feel well prepared</td>
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<td>Creating a semester class schedule incorporating undergraduate research participation</td>
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<td>Identifying campus resources for undergraduate research</td>
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<td>Identifying your own goals and expectations for participating in research</td>
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<tr>
<td>Discuss long-term goals for a research experience</td>
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Workshop 2: Finding a research position

Audience: Undergraduate students who have decided that pursuing a research experience during college is their goal. Students who plan to be enrolled in BIO 260 or BIO 152 next semester.

Materials:
- Facilitator guide
- Participant handout
- Computer with projector (ideally in a computer lab)

Objectives:
- Students should be able to identify/narrow research interests.
- Students should be familiar with the resources available to support their search for a faculty mentor.
- Students should be able to recognize the significant/beneficial items to include in an email to a potential faculty mentor and draft a practice email.

10 minutes: Introduce yourself, the PROS workshops series, and BioCommons.

CLEARLY STATE THE OBJECTIVES

“The point of this workshop is to help you identify a research interest...become familiar with resources...identify what to include in an email...and start writing an email to a potential advisor”

Have the group reflect on the following prompts (can ask for small groups to form for discussion, or lead the whole group if attendance is small):
- What kind of science intrigues you?
- What is your favorite science class or subsection of a science class?
- Do you prefer computational/informatics/data modeling science, wet/bench science, field science?
- How do you feel about working with animals?

5 minutes (or at the end of the group discussions as people wrap up their conversations):

Have the students quietly reflect and make a list of the areas of science and research that interest them.

10 – 15 minutes: (Depending on your comfort level, you can either ask for a volunteer to suggest one of their listed interests, or choose your own). Go to department’s homepages on wisc.edu that match your list and look at the faculty research interests (Need computer with internet access/overhead screen).

Some options that lead to “student opportunities” on faculty page:

Wisc.edu ➔ Dolphins ➔ no one, but...Fisheries ➔ Center for Limnology ➔ About ➔ Peter McIntyre ➔ Undergraduate opportunities

Wisc.edu ➔ search for “Experts Guide” ➔ Solar ➔ Song Jin ➔ Home Page ➔ Openings

(Departments) Wisc.edu ➔ Hover over “Academics” ➔ Departments ➔ Chemistry ➔ Research ➔ Centers and initiatives ➔ Sustainable Nanotechnology ➔ The Team ➔ Hamers ➔ Hamers lab ➔ Opportunities
Appendix 1.c: Example facilitator guide

Pubmed→Advance search for a term + Madison(Affiliation)→Download pdf to be sure it’s UW-Madison
WebofScience→Search for a term + Madison(Address)→Download pdf to be sure it’s UW-Madison

(optional, if workshop is in a computer lab) 10-15 minutes: Have the students (individually or in small groups):
Read the faculty pages and pay attention to:
• Descriptions of a professor’s research
• Recently published abstracts/papers
• Sometimes faculty will have a page for undergraduate students interested in their lab with requirements/how to get in contact with them
• Where on campus they work/where their research is conducted

Make a list of the faculty whose research programs interest you.

15 minutes Interactive: Example emails. (Emails stay with the workshop, do not let them take the copies)
The next step would be to email one or more of the professors whose work interest you. Give the students the example emails from students. Let them read the emails and then ask them the following questions:
Imagine you are the professor reading these emails. What are the good parts and the bad parts of each email? Why? How could you improve them?

Imagine you received all of these emails at once, in what order would you respond to students? (in other words, rank the emails from best to worst)

15 minutes (wrap-up): Talk about “next steps.”
1. Get in touch with the professor
   • Email a separate letter of inquiry that contains:
     1. Your major and year in school,
     2. Semesters you want to participate in a research experience
     3. Any previous lab experience
     4. Describe your goals
     5. Justification for your interest in research (specifically their research)
   • Some professors may ask you to provide a resume/CV and student transcripts, so have these available
2. Send follow-up emails
   • If they contacted you, express thanks (even if they don’t offer you a position) and ask for recommendations for other possible mentors.
   • If they didn’t, send a follow-up email in a week or so to remind them of your wish to speak with them about their research. You could also stop by their lab or office.
3. Meet with professors to discuss potential opportunities in their labs

(Optional) Interactive: Faculty panel(?) Grad Student/Postdoc panel(?)

Take home: For the remaining time, ask them to write a draft email. Share with a neighbor to get feedback.
Appendix 2.a: Protocol showing student teamwork/communication

DAY 1. Sample dispersion:
Suspend 5.0 g of c. system or equivalent material in 200 mL of deionized water. (Suspend for 24 h at room temperature).

DAY 2 (Part 1).

a) To obtain the pellet:
- Centrifuge for 10 minutes at 5000 rpm. The < 2 μm fraction will sediment in the supernatant.
- Proceed with either fraction.

b) The supernatant liquid suspension contains the < 2 μm clay-sized particles. Siphon this into a 250 mL polyethylene centrifuge bottle.

OPTIONAL:
- The pellet contains > 2 μm particles.
- Resuspend in 200 mL of ddH₂O by mild or brief mixing with a Vortex mixer.
- Subject this to low-speed centrifugation to recover additional clay-sized particles.
- Siphon the supernatant and add to the previously collected suspension of clay-sized materials.

Additional Note:
- For the densities of the solutions, one needs to specify the speed and programming to use the calculated rpm for the maximum sedimentation obtained under these conditions.

Hey Ali, it says 58-60 g corresponds to 600 rpm and 3295 g corresponds to 4500 rpm, but it doesn’t give an rpm for 600 g.

I was wondering if you could recommend a speed.

For clarity’s sake, I’m doing the second centrifuging with the smaller than two micrometer supernatant fraction.

I’m going to assume it’s a typo and go with 600 rpm.

Ok, I found a website that let me calculate rpm from g and rotor radius and I think 2140 rpm is a reasonable answer so I’m going with it.

Keep, at least for now.
Appendix 2.b: Email from research course coordinator

Hi Ali,

Thanks for checking in! I really appreciate it!!! And thanks again for doing such a great job mentoring. Both Gabe and Riley have mentioned that you have been a really great, inspiring mentor.

Best,
Cheri

Alexandra Chesney

Hi Ali! The students are in the process of giving their final 7 minute talk—Gabe gave his talk two weeks ago and did a really good job. Riley is going this week. Feel free to attend Riley's L.

Judy.p.hines@gmail.com on behalf of Judy Hines <jlhines@chem.wisc.edu>

Dear Ali, I'm afraid I don't know -- I help with students finding mentors, but all the basic tasks of the course are handled by someone else. It would be best to talk to NDL. Hi, I think. See...

Alexandra Chesney

Hi Judy, I'm not sure who to direct this question towards, but perhaps you could help me. As a mentor for two of the chem 260 students, I was wondering if they had any assignments/l...
Appendix 2.c: Lab research contract and expectations

Undergraduate Research in the Pedersen Lab: Prion Side

<table>
<thead>
<tr>
<th>Eligibility</th>
<th>Students who are new to laboratory research</th>
<th>Students with previous experience in our lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Activities</td>
<td>Introduction to laboratory procedures and animal husbandry (collection, care, and feeding): Specific duties depend on assigned project</td>
<td>More advanced lab responsibilities or Semi-independent mentored research project</td>
</tr>
<tr>
<td>Lab chores</td>
<td>Everyone in lab, no matter your role or experience, is expected to contribute to daily upkeep. This includes, but is not limited to: filling pipette tip boxes, autoclaving, washing dishes, wiping down surfaces, lab inventory, etc.</td>
<td></td>
</tr>
<tr>
<td>Graded Unit</td>
<td>1-page summary of your lab experience: what your responsibilities were and what you learned from the project</td>
<td>Research paper or Senior thesis/Capstone paper</td>
</tr>
</tbody>
</table>

Pedersen Group Lab meetings:
Every Thursday at 5 pm in EB Smith Conference room in Microbial Sciences

Credit hours: 5 hours/week per credit; students typically register for 2 credits in a given semester. There may be a minimum number of hours per ‘shift’ worked in order to efficiently accomplish a task. Students who register for credits in the lab may be asked to work some evenings/weekends.

Grading: Students that go beyond expectations and show dedication and enthusiasm for their work in the lab should expect a high grade. Students registered for upper-level research credits are expected to show increased initiative, independence, and quality of work, as they have continued lab experience. Additionally, depending on how long you’ve worked in the lab, we expect a final product that will contribute to your grade:

- 1st semester/summer in lab: proposal of research project (with help and guidance, outline the background information, questions your project is designed to answer, and the methods you will use to answer them.) This assignment is designed to assess your understanding of prions and your comprehension of what you will be doing for a project.

- Subsequent semesters: present work at a lab meeting in the form of an oral presentation (fall or summer) or at the Undergrad Research Symposium in the form of an oral presentation or a poster (occurs every April).

- Last semester/capstone project: final paper/research manuscript. If you know this semester will be your last, whether by graduation or otherwise, you are expected to write up all of your results and discuss them as the second part of your final paper (intro, hypothesis and methods could be taken from your first semester proposal) and reflect on your time in the Pedersen lab.

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Appendix 2.c: Lab research contract and expectations

Expectations:
It is expected that the Mentor will provide professional and educational development advice and guidance, and both parties will work together to identify the Mentee’s professional goals and develop a plan for achieving those goals. A successful mentee/mentor relationship requires a commitment on the part of both partners. The following agreement is intended to provide a starting framework for the partnership.

In exchange for research experience and professional development guidance from your mentor, the following is expected from the mentee:

- **Be safe.** If you do not know if a chemical or instrument is safe or how to use it, you are expected to ask. Additionally, if a spill or accident occurs, you are expected to report it and follow the proper procedures to correct the accident. Understand and follow all lab, safety, and animal-care protocols. Complete all required animal care and safety training before working independently in the lab. Always work safely and carefully. Act responsibly with lab keys and return them at the end of your time here.

- You are expected to know what academic misconduct is (including but not limited to plagiarism, cheating, copying/pasting, tampering with data, mislabeling figures, etc.). If you are accused with substantial evidence or have been found to have conducted or participated in academic misconduct, you will be dismissed from the lab immediately. *I take this extremely seriously.* We expect that you will be truthful regarding your activities in the lab. If you make a mistake (such as breaking glassware or feeding an animal the wrong amount of food) tell someone—do not try to cover it up. Record data honestly and accurately. Recordings must be objective, based on what you actually observe and not what you were expecting/hoping to observe.

- You are expected to be in lab during the agreed upon time. Be consistent with your schedule. This is an organizational agreement for both you and me to manage time and research efficiently.

- Articulate your needs, concerns, and questions in a timely fashion. Open lines of communication should be maintained with your mentor/supervisor, and feedback should be framed in a positive, constructive way.

- Respect other people in the lab, their space, and their projects. Ask before you begin working with supplies or in a space where someone has been working. Clean dishes and your space when you are finished working.

- You are expected to be motivated to learn both new skills in the lab as well as new knowledge about your project. I expect you to read relevant papers related to your project and bring them up to discuss in lab. Read background information and protocols about our projects, and about our lab’s research. This includes the protocol handouts and related journal articles from the lab that I’ve suggested. An outcome is expected from your research experience, but the result is not important for your grade. Science doesn’t always work as planned; any result from carefully executed research provides useful information.

- Be organized. There is a lot of overlap in projects, and it is essential that you keep track of all the samples in the way that I specify. This includes correct labeling and storage as well as updating data spreadsheets and lab notebooks. Lab notebook entries (with date and time) should be neat, detailed, and organized such that someone would be able to interpret or replicate what you have written at a later date. The notebook stays in the lab.

- Work independently. Personally invest in your own research and in the other tasks you are completing in the lab. Ensure that you understand all aspects of the work you are expected to do. I am periodically away, and I expect you to get things done well without me. Ask questions when I am around, but don’t be afraid to try to do detective work on your own if I am not.

If a student is not meeting expectations, areas for improvement will be addressed. Final grade will be reduced if the improvements are not made.

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Appendix 2.c: Lab research contract and expectations

1. We agree to work together on this project for at least _____ semesters.

2. The mentee will work at least _____ hours per week on the project during the academic year, and _____ hours per week in the summer.

3. The mentee will propose his/her weekly schedule to the mentor by the _____ week of the semester.

4. If the mentee must deviate from this schedule (e.g., to study for an upcoming exam), he or she will communicate this to the mentor at least _____ (weeks / days / hours) before the change occurs.

5. On a daily basis, our primary means of communication will be through (circle):
   - face-to-face
   - phone
   - email
   - texting
   ________________________________

6. We will meet one-on-one to discuss our progress on the project and to reaffirm or revise our goals for at least_____ minutes _____ time(s) per month.

<table>
<thead>
<tr>
<th>Academic Term</th>
<th>Course</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

Student Name/Signature ___________________________  ___________________________

Supervisor Name /Signature ___________________________  ___________________________

Important information

You are responsible to bring the required forms to myself or Joel to get signed (access to research credits/forms for courses like 251 or 260)

The online courses (Learn@UW) that you are required to take before starting in lab are:

- ✔ Biosafety 101: Building Biosafety into Your Research: Risk Assessment
- ✔ Biosafety 103: Building Biosafety into Your Research: Exposure Response
- ✔ Biosafety 104: Building Biosafety into Your Research: Safe Use of Sharps
- ✔ Biosafety 105: Building Biosafety into your Research: Biosafety Cabinet Use
- ✔ Biosafety 106: Autoclave Use: Safety and Efficacy
- ✔ Biosafety 107: Centrifuge Safety
- ✔ Biosafety 201: NIH Guidelines
- ✔ Information Security Basics

If you plan to work with the animals (check with me first):

- ✔ Safety for Personnel with Animal Contact (Learn@UW)
- ✔ RARC mouse (in person) https://www.rarc.wisc.edu/training/course/mouse
  - Ear punch
  - IP injection
  - Oral gavage
  - All open-access courses (RARC website)
Resources
Dr. Joel Pedersen
joelpedersen@wisc.edu
Hiram Smith Ann Room 103
Phone: 608.263.4971
Fax: 608.265.2595

Ali Chesney
achesney@wisc.edu
Hiram Smith Ann Room 110
Phone: 607.342.5132 (cell)
608-265-4849 (lab)

Chad Johnson
cjohns3@wisc.edu
Hiram Smith Ann Room 110
Phone: 608-770-9837

Keith Schiller
IS Network Support Tech (Soil Science)
schiller@wisc.edu
353A Soil Science
Phone: 608.263.5880

Terri Busby
Academic Dept Supervisor
tcbusby@wisc.edu
263C Soil Science
Phone: 608.263.5744

Dan Capacio
Department Assistant
dcapacio@wisc.edu
263 Soil Science
Phone: 608.262.2633

Jennifer Etter Goh
Student Services/Administration
jgoh@wisc.edu
263D Soil Science
Phone: 608.262.2239

Research Animal Resources Center
https://www.rarc.wisc.edu/ Once you are added to an animal care protocol it may take several days for the paperwork to be processed. You and Dr. Pedersen will receive an email explaining what training and/or surgery classes are required.

Opportunities you should consider:
Undergraduate Research Symposium (April 16th 2015) and Undergraduate Research Award
http://www.learning.wisc.edu/ugsymposium/
http://www.library.wisc.edu/college/research-help/undergraduate-research-award/

National Undergrad Research Conferences
http://www.cur.org/
http://sigmaxi.org/meetings/src/2013src.shtml

Funded Undergraduate Research Opportunities (at UW and elsewhere)
http://www.provost.wisc.edu/undergradresearch.htm

Mentoring Programs/Resources/Classes
http://guts.studentorg.wisc.edu/programs/bugs.html
http://biology.wisc.edu/biocommons.htm
http://biology.wisc.edu/EnteringResearch.htm
http://www.cals.wisc.edu/academics/undergraduate-programs/get-involved/honors-program/honors-in-research/
Toxicants in the Environment: Semester Project
Report #1: Chemical and System

For this first report you will be required to choose a chemical and an environmental system of concern. This report will be the basis for the rest of your semester-long project, so choose carefully.

Chemical choice:
• It is important to choose a chemical that has been studied well enough to be able to find basic physio-chemical properties (molecular weight, solubility in water, density, etc.), and to look up toxicological data (oral v. dermal LD50, carcinogen/teratogen/irritant potential, etc.).
• The chemical you choose should be a single chemical, and not a mixture or a category of chemicals (for example, “2,3,7,8-TCDD” is a good choice, but “dioxins” would be multiple chemicals and not a good choice, just as “Round-Up” is a herbicide mixture of glyphosate, surfactants, isopropylamine and other inert ingredients and would not be a good choice).
• For the report, please indicate which chemical you chose and give five sources that provide relevant information on the chemical (chemical properties, toxicological data, review papers, etc.)

Environmental system choice:
• Consider both the size and complexity of your system. Will the system be large enough to examine contaminant transport? Does it have the following parts (which will be required as the semester progresses)?:
  - A body of water
  - Sediment bed
  - An air shed
  - A water shed
  - Organic bodies (plants, animals, humans)
• Remember, we won’t restrict the complexity of your system, but it will be much more difficult to examine contaminant transport on a global scale than, say, if your system was the size of Lake Mendota’s watershed.
• For the report, please provide the general idea of what your environmental system will look like. You do not need to compute exact areas yet (but it would be a good idea to make sure these numbers are available or can be easily estimated).

In general, reports should be typed up and turned in with your assignment. Length will vary based on the report.
Project Description:

Specific Aim 1: Develop a problem-based learning module series for toxicology core courses. Currently at UW, discussion sections for Toxicology 1 (MET 625) involve a journal-club format to discuss content-related literature. The course is currently differentiated into three themes, each lasting approximately 3-4 weeks. These themes include:

- Fundamentals of Toxic Agents: Toxicokinetics and xenobiotic (foreign chemical) metabolism; receptors and structure-function relationships; oxidative stress and heavy metal toxicity.
- Physiology and Pathology of Toxicology: Pathology; signaling pathways; and endocrine disruptors.
- Contemporary Toxicology: Toxicology assays and models; engineering for toxicity studies; and high-throughput screening.

Revising the discussion hour allows a chance for higher level learning and integration of lecture material. We propose a module format designed to explore real-world case studies and problems that could take place over the course of a multi-week theme and therefore provide extended continuity and connections of lecture content. We anticipate the format of a sample module would include the following schedule:

First week: Problem presented, initial class discussion, activity assigned, time for research/organization
Second week: Activity response presented by students, follow up discussion
Third week: Assignment (reflection paper, essay based on the problem, report, etc.) due, in class reflection/final discussion/field trip/guest speaker

Title of Project:
Global problem-based learning module and digital course content development between two international toxicology programs.

Project Abstract:
The Molecular and Environmental Toxicology Center (METC) at the University of Wisconsin-Madison (UW) and the Pharmacology and Toxicology department at the University of Otago (OU) in New Zealand have initiated a cooperation to revitalize their respective courses and increase global competencies amongst their students and faculty.

The existing UW toxicology core courses are largely designed in a team-taught structure where professors take turns imparting their area of expertise in lecture format. This structure leaves minimal time for active learning and application of knowledge. We propose that during the planned curriculum revision, a pilot module is designed and developed to apply lecture content to real-world problems and case-studies that intersect national, cultural and societal boundaries. The proposed module would be taught during weekly discussions. We propose to design the module to be piloted in Toxicology 1 (MET 625) in the fall of 2015 and used as a framework for future problem-based learning modules in other toxicology courses.

Additionally, student-produced content from the modules will be adapted and integrated into a new digital course for a broader, international audience. Designed as a means to disseminate basic toxicology and environmental health education, this digital course is currently in development between UW and OU and is intended to be a far-reaching extension of the toxicology curricula at UW and OU that is intended to satisfy a grassroots-identified need in communities across the globe.

This pilot module project we propose would integrate international concepts and new technology into a current Toxicology class, foster world-wide academic relationships, and produce content for an environmental health course accessible and translatable to a global audience. This manageable pilot proposal for a problem-based learning module that is supplemental to the core course content will provide a foundation for future greater and far-reaching opportunities for students at both institutions.

Applicant Contact Information:
Alexandra Chesney
Graduate Research Assistant
Molecular and Environmental Toxicology
1525 Observatory Drive
(608) 265-4849
achesney@wisc.edu
An example of a possible module case study: The etiology of chronic kidney disease of unknown origin (CKDu)

Also known as Mesoamerican nephropathy (MeN), this non-communicable chronic disease is prevalent in tropical regions of the world that rely on agrochemicals for agriculture. There is disagreement between scholars over what causes CKDu: excessive exposure to agrochemicals, heavy metal toxicity, high fructose hydration, nephrotoxic medications, infectious disease, difficult working conditions, genetic susceptibility, childhood exposure, alcohol use, exposure to high temperatures, and/or insufficient water intake, among other risk factors.

1. Using what is taught in lecture, students are assigned a stakeholder to represent (individuals involved in the CKDu problem, such as a farmer, a village doctor, etc.) and asked to thoroughly investigate one of the proposed causes of CKDu in the context of their role.

2. Students come together in the second week to present their findings and discuss possible solutions that address the culture as well as the science. As an assignment, students will compile their research (regarding theme one’s subthemes: toxicokinetics, metabolism, etc.) and social evidence into a report that can be used as supplemental material for a digitized course (see below).

3. In the third week, the case study is wrapped up with an in-class discussion and reflection, field trip, or a guest lecturer (such as a scientist researching relevant projects, a community non-profit or government associate, or a member of one of the communities affected by the case study in question via skype or CiscoTelepresence).

Ideally, over the course of the three-week module, students will develop an appreciation for societal differences and inequalities, and nurture a sense of global citizenship.

The Molecular and Environmental Toxicology Center at UW has a partnership with the Pharmacology and Toxicology department at OU in New Zealand to develop an electronic module for toxicology education. Both programs have similar scientific interests and compatible curriculum needs, as well as a twenty-one hour time difference (overlapping work hours), and a shared language that facilitates communication and lessens collaboration barriers. The partner programs are currently collaborating to create a digital course on toxicokinetics and xenobiotic metabolism that could be disseminated worldwide. The digital course is intended to recognize and adapt to educational barriers, and appreciate and support the diversity of the cultures interested in the material. As part of the module described here, we intend to adapt the proposed module case study assessment with the digital course in mind, and use student-created content for additional digital examples. For example, in the CKDu example of problem-based learning described above, a student assessment might include investigating the metabolism of a pesticide and discussing its toxicokinetic characteristics. The digital course could pull examples from these student-compiled reports to enhance virtual instruction; due to the physical distance between the instructor and student in the electronic module, the student would benefit from access to a larger variety of electronic example case studies and digital media illustrations. Module assignments designed with intention could provide this critical supplemental content to the digital course and give the students a sense of purpose and intrinsic motivation.
Modules will be developed using backwards design with consideration of the learning objectives meeting the course learning goals. As the course curriculum is currently in revision, this is an ideal time to incorporate a new active-learning module with an assessment designed to evaluate higher levels of cognition in the form of content creation for a digitized course. We plan that the project proposed here to be a pilot, with the intention to implement a standardized case-study module for future classes after proof of concept is delivered and deemed successful.

How funds will be spent (Aim 1):

- ($2,768.47, 6 months at 15% appointment, January to June 2015) Support for a graduate student as a project assistant to manage the module design, designation of learning objectives and creation of assessments to measure learning gains.
- ($1600) Registration fees (approximately $875) and associated travel costs for training at the National Center for Case Study Teaching in Science summer 2015 workshop. (Fee prediction based on 2014 cost) (http://sciencecases.lib.buffalo.edu/cs/training/workshops)
- ($1000) Scientific, technical and training support from additional METC graduate students to assist with course module development. Five METC graduate students who have acted as TAs in the course previously, recruited and reimbursed $200 each for contributing expertise and time to the development of portions of the module and helping to train the current course TAs to facilitate the modules. Content development will be created during spring 2015. Training TAs will occur prior to implementing the module (likely at the end of spring 2015).

Specific Aim 2: Develop the infrastructure to enable communication and further international collaboration and opportunities. UW and OU are directing their toxicology curricula to incorporate the goals outlined in the AACCU’s essential learning outcomes, specifically to cultivate appreciation of global concerns, content interconnectedness and extensive understanding of how toxicology issues are perceived and managed in diverse cultures. As part of the larger goals of the course module development, we propose to travel to OU in Dunedin, NZ to investigate the application of the module in their curriculum. Additionally, this trip would serve to enhance the educational goals of both the UW and OU programs and to cultivate future scientific collaboration in the arena of international pharmacology and toxicology.

As mentioned above, the time difference between the UW in Madison, WI (CST) and OU in Dunedin, NZ (NZDT) is twenty one hours. In effect, this means that although OU would be almost a full day ahead, our two programs could communicate in real time during each other’s work days (2pm in Madison is 9am in Dunedin). This small difference in time allows the future possibility of joint discussion periods, lectures, and faculty office hours. Furthermore, this partnership could contribute to joint course development, scientific collaborations, joint seminar presentations, international graduate student committee meetings, and networking for potential undergraduate and graduate student exchanges or graduate school admission interviews. The UW has technology in place with several CISCO Telepresence systems across campus (Education Building, Wisconsin Institutes for Discovery) in addition to access to alternative videoconferencing software. Furthermore, METC is investigating a technological space in their new office location in McArdle Cancer Research Building to have a convenient location to facilitate world-wide communication. In addition to reaching a global audience, utilization of a teleconferencing system also introduces students to emerging technologies and novel approaches to communication.

Technological innovations are a financially efficient means to communicate internationally in real time, however there is no replacement for the in-person collaborative networking we are proposing here, especially to cement the foundation of our new partnership. Because part of this larger project is investing in our undergraduate students’ development, we propose exploring logistics of future undergraduate student exchanges and research laboratory internships in New Zealand with guidance from the International Programs Office in the College of Agriculture and Life Sciences at UW. Although the partnership between the UW and OU toxicology departments is relatively new, the department chairs have already visited each other’s respective university to meet with students and faculty and presented research seminars. This exchange has encouraged new avenues of collaborative research and facilitated exchange of cultural awareness. Both programs are excited about fostering this exchange and are interested in exploring routes for future undergraduate opportunities.

How funds will be spent (Aim 2):
Appendix 6a: Successful Grant Proposal

- ($4631.53) Travel to Dunedin, NZ to assist in concurrent curriculum revision discussions, possible implementation of the course module, and investigation of structural support for future undergraduate student opportunities. Travel to occur during the spring 2015 semester.

Impact on Undergraduate Students at UW-Madison

Course name: Toxicology 1
Course number: MET 625
Average enrollment of undergraduate students in course: 30
Semester(s) course is typically offered: Fall
Other course(s) impacted: Toxicants in the Environment (MET 631: 4 students), Toxicology 2 (MET 626: 19 students), Ecotoxicology (MET 632: 30 students, 633: 17 students, 634: 16 students)

Learning Goals, Assessments, and Activities

The course goals for Toxicology 1 (MET 625) are as follows:

At the conclusion of this course…
1) Students should be knowledgeable about the interaction of natural toxins and man-made toxicants with people, and their impact on human health and disease and apply this knowledge to solve environmental health problems.
2) Students should be academically prepared for successful contributions to the field of toxicology in research, education, industry and government, and/or participation in advanced studies in health sciences.
3) Students should be conscious of social and cultural influences in relation to addressing toxicological issues.

Although the redesign of the course may alter the language of the goals, we intend for the overall course themes (outlined in aim 1) to remain consistent. We intend to design the modules described in our specific aims for students to meet the course goals, and to that end, module objectives will align with course goals. Sample module objectives may include:

1) Students will use chemical fate modeling formulas and lecture content to report on a chosen chemical’s characteristics and fate in a chosen environmental system (report structure currently used in Toxicants in the Environment MET631, a Toxicology core course).
   - Addresses course goals 1 and 2
   - Addresses LEAP global learning outcome “Intellectual and Practical Skills: Inquiry and analysis, written and oral communication, critical and creative thinking, and teamwork and problem solving.”

2) Students will role play a stakeholder of a real-world toxicology problem in a debate discussion, explaining different societal values and international scientific approaches to the same problem. (CKDu example from above)
   - Addresses course goals 1 and 3
   - Addresses LEAP global learning outcome “Personal and Social Responsibility: Local and global civic knowledge and engagement, ethical reasoning and action, foundations for lifelong learning.”

3) Students should be able to compare the ways in which national and international policies, agriculture, social and economic stressors, and healthcare influence the use of agro-chemicals in the United States and the world. (CKDu example from above)
   - Addresses course goals 1 and 3
   - Addresses LEAP global learning outcome “Knowledge of Human Cultures and the Physical and Natural World: Engagement with big questions.”

4) Students will analyze a real-world toxicology problem in the global context of population health and produce a short video case study in which they concisely explain the problem and propose their own solutions, or describe solutions already being established by different countries.
   - Addresses course goals 1, 2 and 3
   - Addresses LEAP global learning outcome “Integrative and Applied Learning: Synthesis across studies, the application of knowledge, skills, and responsibilities to new settings and complex problems.”

Assessment Plan:

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To measure learning outcomes, each module has at least one traditional graded assessment. The assessments will relate directly to the learning objectives for each module and thereby address the overall course goals. Examples of these assessments include:

1) Chemical fate modeling reports already being generated by students in MET631 and are graded based on correct use of formulas, application of course material in their written report. An adapted assessment for the digital course would consider the student’s comprehension of how chemical properties can predict its fate in the environment and how they connect the chemical and its fate to an international issue. This adaptation could include a digital video of their oral report presentation. Instead of limiting student creativity to a PowerPoint, the assignment could encourage incorporating images, interviews and the student’s reflection of the human impact of environmental contamination.

2) A stakeholder debate (as described above) will require students to investigate their assigned role prior to the second week discussion and allow them to prepare a sheet of notes to use during the stakeholder debate. We will collect and analyze their notes as an assessment to complement their participation in the discussion. Concept maps have historically been used to gauge student learning in this fashion; students come prepared with their current knowledge outlined in a concept map or note format in one color, black for example. At the culmination of the active learning activity (in this case the stakeholder debate), the concept maps are collected with any additional notes or connections made in another color, red for example. A concept map assessment could function as feedback for the activity in general and a quantitative means to analyze student cognitive gains. In addition, the students will be asked to write a reflection of the exercise that will be graded to assess (at least in part) cognitive appreciation of different cultural values in the context of a toxicological issue.

3) The use of technology and novel methods of communication are skills that will be required of students in their future industry employment and academic collaboration. We propose to investigate incorporation of digital storytelling in the form of short videos or podcasts as part of an assessment in the module described above. This use of technology would assess multiple levels of cognition and allow students to be creative in their submissions, and evaluate the student’s ability to concisely integrate lecture content with real-world problems in an electronically formatted case study. The digital video assignment will be assessed partially based on a rubric from the Association of American College’s and University’s Global Learning Rubric (https://www.aacu.org/value/rubrics/global-learning).

Alignment of Project with Internationalization Goals:
The modules we propose to develop will contribute to the goal of course internationalization by increasing student awareness of complex, global problems and the need for interdisciplinary and culturally relevant solutions. Students will acquire and practice international skills, attitudes and knowledge by integrating toxicology data and lecture material with cultural values, international policies, and diverse perspectives. Students will contribute to sharing toxicology and environmental health content to a global audience and practice disseminating complex scientific information to persons of broad academic and cultural backgrounds. Students will better understand how culture and society influence scientific understanding and applications worldwide.

Future Uses of the Project
The intention of the modules is to provide a framework where toxicology curricula could be applied to real-world scenarios while challenging the students at higher levels of cognition. If successful, the module format could be used in all of the core toxicology classes at UW and could provide a framework for modules in other courses at UW and OU. The assessments for the modules will be designed to provide student-created content for a toxicology digital course in production by an international collaboration between UW and OU. As the modules and digital course develop, additional international collaborations could manifest using the module framework and technology foundations refined with these efforts. Future opportunities between UW and OU include international student exchanges, research and teaching collaborations, and possibly joint service-learning trips in the context of contaminant exposures abroad.

Budget

<table>
<thead>
<tr>
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<th>Amount</th>
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<tbody>
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</tr>
<tr>
<td>Salary, staff</td>
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</tr>
<tr>
<td>Salary, graduate student</td>
<td>$2,768.47</td>
</tr>
<tr>
<td></td>
<td>for graduate student time dedicated to developing and managing project (15% appointment as project assistant for 6 months)</td>
</tr>
<tr>
<td>Travel</td>
<td>$4631.53</td>
</tr>
<tr>
<td></td>
<td>travel to NZ, as justified in aim 2</td>
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</tbody>
</table>
### Appendix 6a: Successful Grant Proposal

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Amount</th>
</tr>
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<tbody>
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<td>Supplies</td>
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</tr>
<tr>
<td>Fees</td>
<td>$875 registration fees for the National Center for Case Study Teaching in Science summer 2015 workshop</td>
<td>$875</td>
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<tr>
<td>Other</td>
<td>$1000 scientific, artistic and technical expertise reimbursement for standardizing supplemental content for digital course by graduate students.</td>
<td>$1000</td>
</tr>
</tbody>
</table>

**Total funds requested: $10,000**

### Departmental Support

A support letter from the toxicology department chair that speaks to the feasibility of this project has been uploaded and will also be sent via e-mail to Masarah Van Eyck (mvaneyck@cals.wisc.edu).

### Agreements

Please enter your initials to consent to the following statements: AC

- I agree to give CALS International Programs a copy of all products created to be used for publicity and education purposes.
- I agree to attend an orientation meeting for the awards program.
- I agree to attend one Science Internationalization lunch per semester.
- I agree to present this project at one or more campus events.
- I agree to submit a final report about the project by June 1, 2015.