TEACHING AND LEARNING PORTFOLIO

By

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Learning

Research Teaching

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Delta Program in Research, Teaching, and Learning

University of Wisconsin-Madison

Integrating Research, Teaching, and Learning

C I R T L

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Acknowledgments

I'm very thankful to get the opportunity to acknowledge the people who have helped me develop my teaching and learning philosophy through my time at UW-Madison. I've been amazingly fortunate to develop my research, teaching, and sense of community engagement during my PhD. This has been possible because of the entire positive, supportive, and incredible people I've been fortunate enough to work with.

First and foremost, my research advisor Eric Roden has been immensely supportive of my time spent in my numerous endeavors, and without his support and mentorship I wouldn't have been able to complete most of what I've accomplished. Brooke Norsted from the Geology museum has also been a tremendous support: providing me with abundant opportunities to develop my outreach and education skills. Dana Geary, who I had the privilege of TAing for in spring 2012, is one of my teaching role models, and without her I wouldn't be nearly as effective or optimistic as I am today.

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Finally, to the great educators in my life: My parents Mary and Scott, my brother George, and my partner John, who have truly taught me so much about both learning and teaching over the years. Without the love, support, and unrelenting optimism of all four of them I would not have accomplished so much.

Teaching and Learning Philosophy

It snowed on the first day of February last year. I vividly remember trudging home through the thick snow, contemplating low student scores on a weekly quiz, and my own stalled research, when a snowflake got caught in my eyelashes, forcing me to stop in my tracks. As the snow pelted down, I leaned my head back trying to clear the misdirected flake, and another snowflake landed in my mouth, its icy form quickly melting. Spurred by the absurd joy of it, I decided to try to catch another, and another, until I was standing wide-mouthed in the middle of the sidewalk dancing around like a giddy child. As I continued my dance, these small morsels of frozen water, billions of years old, melted on my mammalian tongue, and I was overcome by a vast and sweeping sense of respect and admiration for the universe. **This is the same feeling, this grand sense of wonder and awe, which I strive to impart to my students.**

As children we all have a bubbling natural curiosity that we quickly outgrow to keep pace with social norms and changing priorities. I find this truly a shame, and I aim to bring out my students' inner 4-year olds' burning curiosity through my teaching. **I want them asking "why?" during class** and want their impatient thirst for knowledge to spill over into the curriculum and permeate their entire lives. I've found success in large lectures by introducing captivating stories like the mind-blowing tartigrades, small animals who can survive a bevy of Martian conditions, or comparing geologic time to my own height, where all of humanity can fit in the width of a single hair. I hook students with wonderment so they put down their cell phones, stop checking social media, and genuinely engage with the subject matter.

The shift in information accessibility over the past decade has reinforced the idea that the core of higher education isn't memorizing facts or recalling information on command, but instead lies with **developing critical thinking skills and problem solving ability**. Working in freshmen-level non-science major courses, my teaching research focuses on how students can be pushed to connect seemingly dissimilar concepts like electron flow in microbial communities while breaking down barriers that cause them to compartmentalize knowledge into separate domains, like chemistry, geology, and even philosophy; it's all connected. I've found that group work requiring diverse groups of students to collaborate and solve problems together allows for interdisciplinary thinking and greater content retention than traditional lecture-based formats, helping to nurture critical thinking skills.

Universities have traditionally served as community hubs where intellectual development, new ideas, and innovation are kindled. However, a growing gap exists between college matriculation and completion, further sequestering some communities from an influx of college graduates. Frequently students see education as a purely individual endeavor to aid us in future careers, but don't expend the energy to make meaningful neighborhood connections. The purpose of knowledge is both to succeed as an individual *and* to help improve the world, goals that ensure higher education is always relevant. To address students' changing reality and to maintain the value of higher education for communities of the future, I challenge my students to start dialogues with their neighbors, to talk about science, humanities, and everything in between, to compare experiences and develop solutions.

Empowering students to think globally and act locally helps innovation ripple from the classroom into offices and livings rooms across the country while **fostering good global citizens**. I've worked in tandem with the UW Geology Museum and the NASA Astrobiology Institute to develop and implement a diverse range of science outreach activities ranging from building futuristic Mars rovers with middle-school girls, to giving guest lectures to philanthropic organizations, to working with librarians to develop their own Astrobiology workshops. These activities provide myself, as a scientist and educator, a way to create engaged and passionate individuals who actively take part in developing their own communities.

Forming **learning communities centered on improving some aspect of the world** provides a mechanism to foster innovative ways of thinking and, ultimately, solutions. As the head Teaching Assistant for my department, I established training and ongoing professional development materials to provide a formal structure for the development of departmental TAs. This cultivated teaching excellence within my own department, a culture rich in dialogues about pedagogical techniques and innovative solutions to teaching issues. It also simultaneously raised my own level of instruction – a win-win. Feasible small-scale constructs like the development of informal learning communities can leave widespread marks towards improving the world, a message I seek to model and share with my students.

Most of my students are non-science majors who will never need to know what a chemolithoautotroph is or when atmospheric oxygen developed on Earth. However, the underlying themes of critical thinking, wonderment, and community responsibility resonate much more deeply. I strive to inspire my students so their natural curiously burns brightly. I want them to know why natural selection and evolution matter, why science is important in an age when you can turn to Wikipedia for fast answers, and what catching snowflakes with your tongue has to do with volcanoes and oxygen on Earth billions of years ago.

Inspiring students by cultivating a sense of wonder and awe

Background

In spring of 2012, I competed in FameLab: a science communication competition sponsored by the NASA Astrobiology Institute. Participants had three minutes to present on any science topic related to the origin of life on earth, life in extreme environments, or life on other planets. The only stipulation was that no PowerPoint was allowed: innovative and engaging presentations using props were encouraged. I competed in the regional preliminary competition in Denver. My presentations addressed how cold-adapted bacteria are able to survive freezing temperatures, and why water is an awesome molecule. I was selected along with two of the other 20 competitors to advance to the national finals in April 2012. Arranged in tandem with a global Astrobiology conference, a four-day science communication workshop preceded the main event, a final evening show broadcasted live on NASA TV. This artifact is an image taken from me on stage presenting my topic: the age of the Earth.

Artifact 1: Presentation at NASA's FameLab National Finals

Inspiring students by cultivating a sense of wonder and awe

Reflection

In the FameLab national finals I had three minutes to talk about anything related to science I wanted. I presented on geologic time, or the age of the Earth, using an example that every audience member could use in the future: themselves. I equated 4.5 billion years, a staggering number, to my own height and explored when different evolutions occurred for life on Earth. The earth forms at the bottom of your feet, early microbial life emerges below your knees, complex life explodes around your chin, and all of humanity fits into the width of a single hair on the top of your head. This dramatic takeaway message resonated deeply with the audience, and although I didn't win, this was a very enriching experience that left me equipped to better tell my science in short, engaging, story-like snippets.

I chose to include this as an artifact in my portfolio because over a year after my initial involvement with FameLab, I still think about the strategies I learned for captivating an audience. I still hear from colleagues when I reconnect with them at conferences that they remember and actively use my FameLab example of the age of the Earth when they're teaching or talking to people about geologic time. The notion that you can capture your audience's attention and hook them with wonder and awe has become the core of my teaching and learning philosophy. Kindling a grand sense of overwhelming respect for the universe is an effective tool to connect with diverse audiences and is what I aim to do as an educator and scientist.

From a teaching perspective, I have found that establishing a good rapport with my students is a key to student engagement, and it increases learning-through-diversity. Having a good tone in the classroom lets the students feel comfortable relating to each other and the subject matter. For me, that means telling stories and using personal narrative in the science classroom to help communicate complex ideas in a stunning visual setting. This helps students from a wide range of background feel comfortable in class, fostering a sense of community and engagement with the material.

Most large 100-level science courses are not geared towards science-majors. By incorporating components of lecture that appeal to students from a wide range of majors, specifically humanities and social sciences, I've seen students shut off their computers and becoming more engrossed in the material. A contextual framework also allows undergraduates to associate the narrative with science, and I find that a broad range of students are able to use these stories as a way connect with me and each other. They come to office hours or approach me after class, sharing something they've learned or a way they can connect the lecture's concepts to their own personal background. Learning through diversity is strengthened as students connect with their neighbors and form independent study groups and can tap into not just the science offered up in class, but also the shared sense of wonderment and awe.

Developing critical thinking and problem solving skills

Background

I completed a Delta Internship in a lower level “Life in Extreme Environments” course in fall 2010, partnered with my major research advisor Professor Eric Roden. I examined the role that collaborative learning using diverse groups has in developing critical thinking and problem solving skills in undergraduates who examine energy flow in complex microbial ecosystems. This artifact is my summative report.

Artifact 2: Teaching-As-Research summative report

Abstract

Energy flow in microbial communities can be a fairly difficult concept for undergraduate non-science majors to understand. In order to increase understanding of this intricate concept, undergraduate students in a 100-level science course worked together in small groups to complete a cooperative learning assignment designed to explore how different microbial metabolisms function in Winogradsky columns. The activity was designed to be challenging and require students to connect concepts covered in lecture to a real-world example, thus developing problem-solving skills and facilitating the development of critical thinking. Pre- and post-tests revealed that students performed significantly better after the activity with gains in content knowledge and critical thinking observed. The majority of students self-reported that the cooperative learning activity helped them better understand Winogradsky columns and would ultimately help them write an associated lab report later in the semester. These results suggest that a collaborative learning activity provided an effective way for students to better understand the complex concept of microbial cycling.

Background

Photosynthesis and respiration are essential processes that provide energy for all living organisms, yet many misconceptions about these cellular processes exist among undergraduate students (Hazel & Prosser, 1994; Anderson et al., 1990). These misconceptions can interfere with the student’s ability to learn, apply their knowledge, and analyze problems (Modell et al., 2005).

Active learning using cooperative groups presents an alternative to the traditional lecture format of college classrooms by requiring small groups of students to work together to complete a structured learning task (Cooper et al., 1990). Cooperative learning can result in students asking better scientific questions (Marbach-Ad & Sokolove, 2000), developing higher-level thinking skills, and increasing student satisfaction and retention (Cooper, 1995). In biology classes, cooperative learning has been successfully used to challenge student misconceptions and promote the formations of interdisciplinary connections among students (Lord, 1998).

Winogradsky columns are small-scale vertical enclosures filled with enriched soils and sediments. After being created, they develop and allow for visual identification of microbial metabolisms due to spatial stratigraphic changes. Creation and exploration of Winogradsky columns by students has been documented to aid in understanding microbial cycling (Rogan et al., 2005), but the study did not examine how group activities could aid in student comprehension. This internship created and oversaw the implementation of a collaborative learning activity to help students make connections between the distinct, yet connected microbial processes occurring between niches in a Winogradsky column.

The aim of this investigation was to see if collaborative learning activities, which by design require group cooperation and collaboration, would help students to better connect the separate processes of microbial metabolisms, and ultimately better understand energy flow in complex ecosystems.

TAR question

The Teaching-As-Research question explored in this project was: "Do collaborative learning activities in small groups based around basic concepts help students to better synthesize this material into a larger environmental framework?"

Data collection and methods

Class structure of Geo 117

Geoscience 117: “the Ex files” is a 2-credit, undergraduate geoscience class examining life on earth in extreme environments. This course fulfills a general education biological science requirement and typically has between 35 and 40 students. In previous years, students have constructed and monitored Winogradsky columns; but the majority of students didn’t make the connection between the development of strata in their columns and the complex microbial cycling behind it.

TAR approach: project design and outline of activity

In order to increase higher-level understanding of the microbial processes taking place in a Winogradsky column, a cooperative learning group assignment was used prior to completion of the first homework assignment to foster student understanding. This activity took place in class, following several other activities designed to get students used to working in collaborative learning groups. For the activity, small groups of students first reflected on their comprehension of the lecture using a “think-pair-share” activity where they answered questions using material presented in lecture (Appendix A). A scale Winogradsky column was then completed using a “group grid” assignment (Appendix B) that encouraged students to apply lecture material to a real-world example. Finally, a few synthesis questions were asked (Appendix C), and students were given time in their groups to discuss the questions, which tied together all of the material covered that day. Students were instructed to include their group’s answer to the questions as part of their next homework activity.

Monitoring student learning

Student learning was monitored using an identical in-class pre- and post-test. The test was broken into two components. The first four questions gauged the ability of the students to recall information from lecture, and students were allowed to use their notes or any other class material if they wanted to. The last four questions were synthesis-type questions designed to see if students could put together information given in lecture to answer higher-level questions about microbial cycling. Additionally, a qualitative survey was given to ascertain how valuable the students thought that the activity was. Finally, an individual lab report on their Winogradsky columns was due at the end of the semester. The lab report was examined using a standardized rubric to determine the level of understanding students had about the interconnectedness of microbial metabolisms in a column.

Examples of approaches used to be effective with students of diverse backgrounds

In order to support students with different backgrounds, instructional material was transparent in explaining why small groups were going to be used for the class and how small groups were strengthened by diversity within the class. Additionally, students were given an opportunity to reflect on their previous background with group work, which gave them a chance to explore and appreciate each other’s previous experiences and backgrounds. Student groups were also expected to outline group expectations, which recognized individual student diversity and used it as a positive component of in-group interactions.

Diversity within the student population was used to increase student learning during completion of group activities and collaborative homework, due to group composition based on previous science background. Within each group, students had the option to divide work among group members in a manner that would highlight each person's strength or desired outcomes for the class. This diversity in each group allowed the students who were stronger in science an opportunity to help explain some concepts to the rest of the group, helping them to further their own understanding as well as strengthen the knowledge base within the group.

Examples of specific ways learning communities were used

Small groups, or learning communities, were developed during the 1st and 2nd week of lectures and were designed to be the same group of four students for the entirety of the semester. Group development (e.g., short activities and outlining of group expectations) was used during the first two weeks of class to help students understand the benefits of these learning communities and give them time to reflect on what they could do in order to help their groups be successful. After establishing a group baseline, groups were used during the 4th week of class to complete a cooperative learning group assignment.

Results

Pre- and post-test score distributions and lab report

Students scored significantly higher on the post-test than the pre-test. Student scores for the pre-test ranged from 17 to 83%, with a mean of 58%. Post-tests ranged from 25 to 100% with a mean of 77%. A paired t-test indicated students did significantly better on the post-test as a whole, and specifically on the short-answer, or synthesis, portion of the test (Figs 1, 2). Interestingly, students who chose not to use notes on the closed-material portion of the test did significantly better on that potion than their classmates who used outside materials. Lab reports were scored for student understanding of complex microbial ecosystems, and on average, 40% of students made mention of interconnected microbial pathways.

Student feedback about the activity

When surveyed about their opinions of the collaborative learning activity, the majority of students (63%) indicated that it helped them to better understand Winogradsky columns and that it would help them write their lab reports at the end of the semester (59%) (Table 1). The majority of students were either not sure or thought the activity would help them with homework 2, and felt they learned more doing the activity as a group as opposed to individually (Table 1). Students were mixed about how they reported the activity went, with the majority being unsure as to whether they would ultimately learn more from class if there were more activities like the collaborative learning activity. More specific comments were given about the portions of the activity that aided in student learning (Table 2), and overall students reported a better understanding of microbial cycling after the group activity. Students were mixed as to if the Winogradsky columns activity was too difficult, with the highest percentage of students indicating that the activity was "…difficult, but our group finally got the hang of it" (Table 2).

Discussion

The aim of this study was to asses whether there was an increased student understanding of complex microbial pathways in Winogradsky columns after completing a collaborative learning activity. Significant differences, especially in the synthesis area of pre- and post-test data indicates that students made knowledge gains and were better able to answer synthesis-type questions pertaining to Winogradsky columns after the activity. No significant gains were shown in multiple-choice questions designed to recall information from lecture (Fig. 1), perhaps due to high pre-test scores on these questions. Unfortunately no quantitative data is available from previous semesters for comparison.

Students' self-reported gains in understanding based on the activity indicated that the activity helped increase their understanding of Winogradsky columns. They also reported that the activity would help them to write their end of semester lab reports, yet the majority of students did not include microbial cycling as a part of the discussion of their lab report. This could be due to the long time (~2.5 months) between the use of the in-class activity and when the lab reports were due. Also, many students were fairly unfamiliar with the concept of lab reports and struggled to put meaningful information into the discussion. If student gains in understanding were long-standing, an alterative measure of understanding, such as a few brief synthesis-type questions, could be asked of the students in the future when they submit their lab report at the end of the semester. Alternately, more explicit directions as to what needed to be included with the discussion portion of the lab report could have been used to help guide students to include more applicable synthesis with their reports.

One surprising outcome was that responses were mixed when students were asked if they would learn more by completing more small group active-learning activities. Although not designed to be especially challenging, students reported higher levels of difficulty and frustration with the activity than anticipated. This was most likely due to the collaborative nature of the activity, which was intended to challenge students and force them to work together to solve the group grid using higher-level Bloom's taxonomy. The majority of those students were able to work through any difficulties; however, one student reported that the activity "made group dynamics worse." In the future, more group work may be used before this activity to encourage the formation of functioning groups and to aid in good group dynamics.

Overall students thought that the activity helped them understand microbial cycling in Winogradksy columns, and they showed gains in their understanding of complex processes and problem solving ability. These effects were not universal, though, and were not necessarily observed in end of semester lab reports. Future attempts at integrating collaborative learning activities into small groups will be made with more attention to the difficulty of the activity, with easier activities towards the beginning of the semester to coax students into what could be perceived as difficult group work. If assessments completed more than a few weeks after the activity are used to monitor student learning, students will be provided more explicit instructions in order to gauge their understanding several weeks after the activity, as opposed to only summative semester reports.

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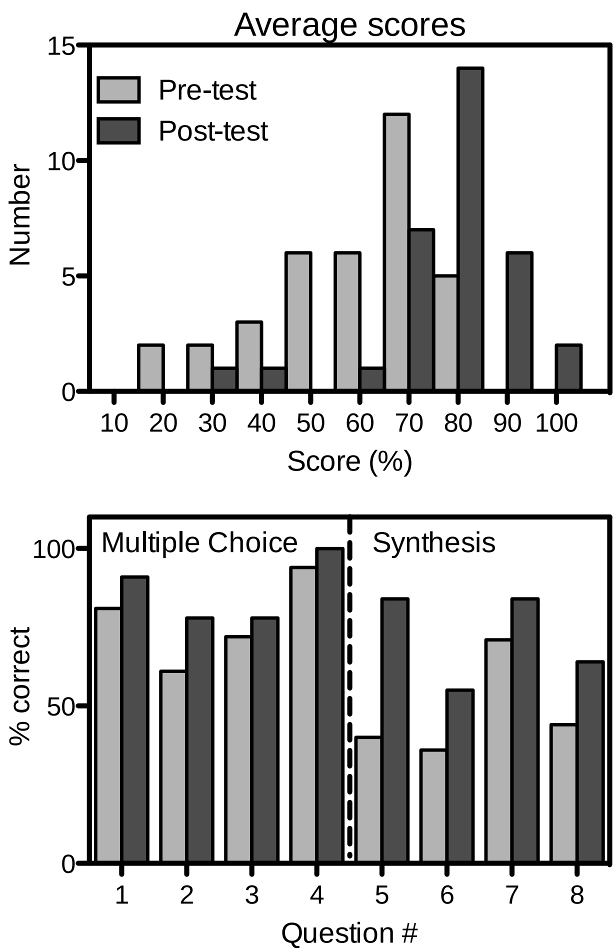
Figures and Tables:

Figure 1 (below left): Average score distribution of Pre- and Post-tests. Scores are pooled together from both multiple choice and short answer sections in the top figure, and are broken down by question for the bottom figure.

Figure 2 (below right): Average and binned scores for the pre-and post-tests. Pre- and Post-test columns reflect summed scores of multiple choice and short answer questions. Columns denoted with stars indicate a significant difference ($p<0.001$) between pre- and post-tests. Error bars represent 1 standard deviation above and below the arithmetic mean.



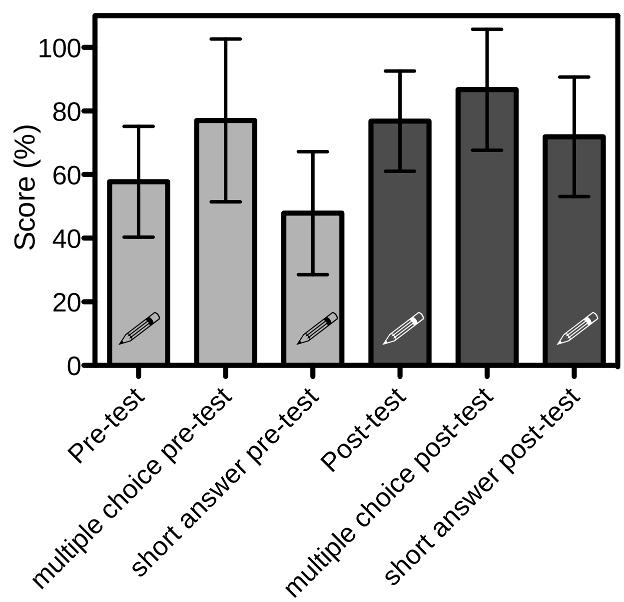


Table 1 (left): Distribution of student opinion on the collaborative learning in-class activity.

Table 2 (right): Binned answers for the post-activity survey. Answers to open ended questions were binned based on similarity. Shading denotes if the activity was helpful (no shading), possible helpful (medium grey), or not helpful (dark grey). Note that not all students elected to answer all questions.

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Appendix A: Comprehension of Lecture

20 minutes: Think Pair Share

1. Individual students answer the questions below, writing answers on their own pieces of paper: 5 minutes
2. The students then form groups of 2 with another member of their small groups, share their answers, and improve on their original written answers: 5 minutes
3. The students pair with the other set of students from their groups; together the small groups share answers and come up with 1 written set of answers: 5 minutes
4. Put the metabolism "cheet sheet" slide up on the powerpoint, students and groups can make any corrections they need to make, brief lecture reinforcing the concepts: 5 minutes
5. Groups turn in one copy of their answers (they'll get it back the following week, scan copies to have artifacts from class)

Questions to answer (put these up on the board/overhead)

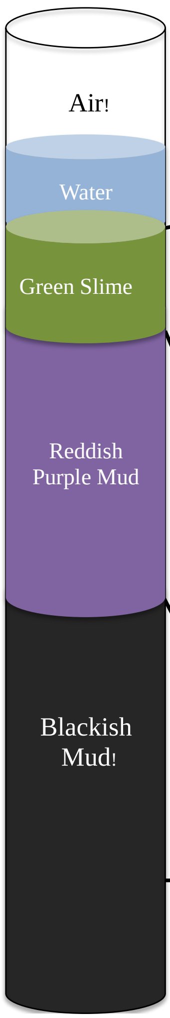
1. Explain the main differences between Chemoorganotrophs, Chemolithotrophs, and Phototrophs.

2. What are examples of compounds they could use during metabolism (e.g. to establish electron transport or a proton motive force)?
3. How does carbon flow vary between these metabolisms?
4. What are the ways that cells obtain carbon? What are these two types called, and how are they different?

Appendix B: Applying lecture knowledge to a "real world example"

25 minutes: Group Grid

1. Working in their groups, students must fill in the grid on the next page using lecture notes and their knowledge. 1 color copy will be distributed to each group. 10 minutes
2. Students check their answers for accuracy with another group. 5 minutes
3. Students check their answers for accuracy with even another group. 5 minutes
4. Together as a class we fill in the answers. Students are encouraged to record their own answers on a spare piece of paper. Groups turn in their group color copy (they'll get them back after copies are scanned for artifacts). 5 minutes



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Draw the O_2 level as a vertical pie slice, and mark where the oxic/anoic transition is!	How much sunlight?	Possible **carbon** sources (CO2 or organic carbon). **What metabolism do these support**?!	Possible **energy** sources (light, or types of organic or inorganic compounds). **What metabolism do these support**?!	What does the color indicate about the microbiology or chemistry?!	Which type of microbial metabolism would dominate the environment? Why?!	Draw the H_2S level as a vertical pie slice. Where would we stop seeing H_2S?!

Other things to consider that may or may not be helpful:
- Shredded newspaper (cellulose) was added to the mud layers
- The mud and water came from the ocean (where there is much more sulfate than iron)

Appendix C: Tying it all together, analysis/synthesis

5 minute: Group discussion

1. As groups, the students will discuss the following question (which will be put up on the board): How do different microbial metabolisms taking place at different layers within the column relate to each other? Do they depend on each other? Why or why not? 5 minutes
2. Students will be asked to explain the answer to their question as a part of homework #2.

Developing critical thinking and problem solving skills

Reflection

One of the broadest lessons I learned through this internship was to **utilize the inherent diversity present in the classroom**. I stepped into this internship trying to remedy the problem of students not connecting concepts in class. However, the class that I worked with didn't necessarily share my own bias towards compartmentalizing material. When I was first learning this material as an undergraduate, I found that I needed very clear connections among concepts and repetition of those connections to absorb the material, so I tend to design materials around repetition of overarching themes. Given the wide range of students during my internship, I found my measures unnecessary and needed to be open-minded and flexible. This experience allowed me to understand how important it is as an educator to step back and not let your assumption of what's "difficult" interfere with your presentation of the material. Working together in small groups, students responded positively to the challenge of trying to pick out the connections between concepts themselves. The classroom included a very heterogeneous mix of students with different learning styles, levels of background knowledge, and goals. In the future, I will capitalize on this diversity by engaging the students to pick out dominant themes and connect material between classes in ways meaningful to them, allowing students to learn through their own and their peers' diversity.

My view of Teaching-As-Research (TAR) has also changed through this internship. I've found that students respond positively to you being up front with your objectives and possible drawbacks to trying a given approach. When they know you're on their team, trying to help them learn, they are more ready to step away from their comfort zones and try new things. I went into this experience trying to treat the classroom as an objective environment to research teaching methods. I quickly discovered **TAR is strengthened when not viewed as an objective issue**, like laboratory research is, but rather as an all-encompassing journey for both educators and students. The in-class group activity that was the focus of my internship was designed to be fairly challenging. At first some of the groups were frustrated that the answers weren't taken directly from lecture and they couldn't just "copy and paste" the material from the notes. Once reminded, however, that the activity was designed to get them thinking and there wasn't one correct answer, they seemed to open up and group discussions emerged. This has helped me to realize that TAR isn't just about setting up great research from the point of view of the instructor, but it's about **enlisting the students to be active members in their learning experiences**.

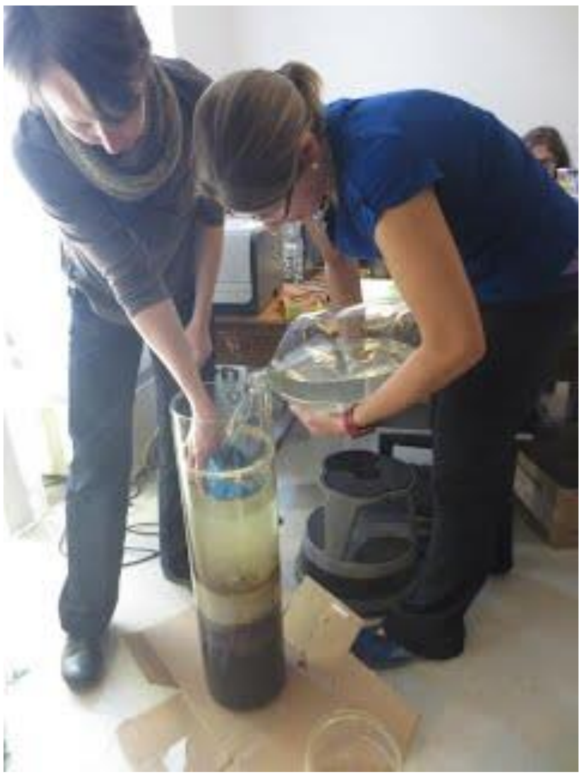
Previously, I'd taken a Delta class on Teaching Large Classes where I learned how important it is to take small steps towards making the classes more active instead of jumping in with high stakes activities immediately. Having students work on small group projects and discussions when they're expecting a traditional large lecture format can be a challenge. Preparing for this internship, I found that collaborative learning activities in small groups have been shown to help students comprehend broad concepts, so I wanted to evaluate how this approach might work in this course. The internship was based around one central collaborative learning activity, yet I was able to incorporate several smaller group activities forming learning communities during the first few weeks to prime students for the larger activity. Observing the classes, students were better able to sense the internal dynamics of their groups, and better equipped to take on group work in general when they completed lower-stakes activities first. When asked about early semester group work, students responded that they viewed this group work in the first few weeks of class neutrally: it didn't help or hurt their learning. Even with that indifferent result, **the establishment of learning communities is important in large classes so students form meaningful relationships**, forming connections and allowing them to grow as individuals and as a community; skills crucial to post-college success.

Creating community engagement through public outreach

Background

As human beings, we have a duty to make our world a better place. It is with this crescendoing statement that I introduce the next artifact: images of myself involved in various public service and science outreach events in the greater Madison community.

Artifact 3: Examples of community wide public outreach and education



Left: working with the Geology Museum to create giant Winogradsky columns as part of a permanent Astrobioloy exhibit. I collected mud in 2009, and columns have been monitored for the past 4+ years to ensure adequate microbial development.

Top Right: Giving a day-long presentation in summer 2011 to local elementary and middle school students on what life is and how scientists look for it on other planets. The workshop was part of a broader workshop run in the Madison community entitiled “A Celebration of Life: Geology on Earth and Mars”

Bottom Right: Simulated Mars Rover constructed by community librarians who took part in a Lunar and Planetary Instutite workshop in fall 2012 on how they can run their own outreach programs for local families. I helped facilitate the outreach workshop and presented on science and what grad school is like.

Creating community engagement through public outreach

Reflection

I'm from a small town in Alaska, and growing up we didn't have the same kinds of science outreach activities and festivals that abound in the greater Madison area. There wasn't a local university funneling passionate and enthusiastic individuals to the front lines of science outreach and education. My parents would routinely spend several hours each way driving myself and my brother to the university campus so we could take part in science fairs and hear about the inspiring research advances taking place. It is my own diverse background that gave me the motivation and enthusiasm to reach out and share my knowledge. I came to graduate school at UW-Madison thrilled to be able to couple my emerging science knowledge with a desire to reach out to my new community.

By taking advantage of every opportunity I could find, I've acquired a bevy of skills with how to reach out to the public. Speaking directly to large or small groups, facilitating workshops, working behind the scenes to create museum displays, and even taking science to unexpected locations like music festivals and baseball games, I've tried to reach out to every group that is remotely interested. Through these experiences I've learned that most people deep down just love science. It's a matter of bridging the gap between their interest and knowledge in ways that they can understand. Both children and adults find the subject matter fascinating and once you arm them with a little knowledge, they are excited to follow up on their own and learn more. Initially I was skeptical how people would react to seeing me: a 20-something female who gestures wildly when she talks and has no "indoor voice" explain seemingly complex concepts like microbial cycling on ancient earth. However, enthusiasm is contagious, as is a fascinating subject matter packaged just right.

These endeavors into public outreach have taught me so much that has been mirrored through my other teaching activities. I've learned the value of using your own diverse background to connect with other people. Together, your own diverse experiences can strengthen how information exchanges take place and resonate with others. Learning communities can form quickly and spontaneously, such as when one excited child goes back to tell her family and siblings about what she just learned. Enthusiasm spreads quickly, and sometimes just by engaging one person, he or she can help spur larger-scale interest. Finally, Teaching-As-Research is the very core of successful outreach and engagement. Being able to monitor how interactions are going and adjust your approach and hypothesis as events unfold are key to maintaining successful interactions with broad audiences, just as using research skills inside the classroom helps to know if you're improving student learning.

Finally, I've learned that sharing my own knowledge and being an active community member is a responsibility that comes along with my education. Just as there were no outreach and science exploration days where I grew up, there are still many communities across the country that don't have the amazing opportunities that stem from the Madison campus. As I develop into a scientist and educator, viewing community outreach and education as an opportunity and necessary part of my life is very important to me. Aside from the fact that public taxpayer dollars have helped to fund my state university-based education, the calling to share my own enthusiasm and create engaged communities runs deep.

Creating local learning communities

Background

I was awarded the position of Head TA for the Department of Geoscience for the 2012-2013 academic year. Typically this quarter-time position has assigned ~20 TAs to various geoscience courses, coordinated schedules and prerequisites, and taken charge of faculty and student evaluations at the end of the semester. A 1-2 hour meeting was held at the start of each semester to orient new and returning TAs to departmental policies, but no extensive training or ongoing professional development had taken place. Although many TAs have done an amazing job in past semesters, I decided to try a new approach. I significantly increased training at the beginning of each semester and added monthly workshops to tackle current teaching issues. This artifact is the agenda and outcome of September 2012 workshop on grading.

Artifact 4: Department of Geoscience TA Professional Development

TA professional development workshop September 21, 2012 9-10 AM Weeks Hall A259

Grading: How can you efficiently and fairly assess your students?

Before the workshop: spread examples of rubrics around the room, have books on tables for TAs to look through. Remind TAs to bring examples of what they are currently grading with them to the workshop.

Introduction/check in (5 minutes)

Grading practice and discussion (20 minutes)

- Break into groups based on the type of grading you're going to be doing (100+ quizzes or labs, 20-60 longer labs, etc)
- Individually each spend 2-3 minutes grading each assignment, what is their score?
- Come together and see how everyone else graded:
  - Are your scores similar or different? Why?
  - How can you ensure that if there are multiple TAs, everyone receives a fair score?

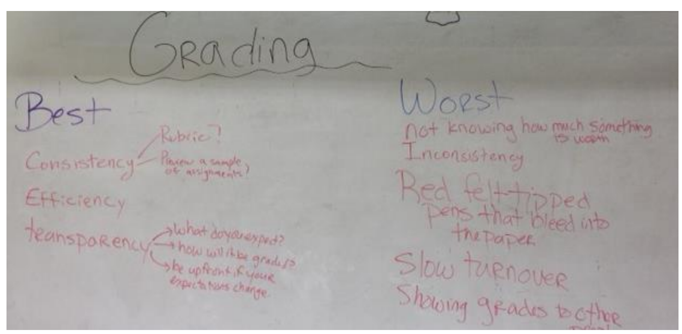
Come together as a larger group for discussion (5 minutes):

- What did we learn?
- Do you guys use rubrics? Why or why not?
- How can you ensure that grades are fair across multiple TAs?

Discussion in groups

What to do, what not to do (10 minutes)

- Brainstorm in groups: what are the best and worst practices for grading? Write on board (see image of final product on right)
- Discuss why these work or don't work.



Best and Worst grading practices as developed during 9/12 TA workshop on grading.

Larger discussion questions (10 minutes)

- What are some things you wished you knew about grading when you started?
- What role does time management play into grading? How can you balance your time?
- How can you make sure all students get fair grades?

Hand out resources to TAs

Creating local learning communities

Reflection

Initially I developed training materials for departmental TAs to help disseminate some of the knowledge I've gained through my involvement with the Delta program: taking classes, participating in seminars and roundtables and being a member of the Delta community. I've been fortunate in that I've been able to personally experience amazing professional development during my time on campus, and I was looking for a way to share that with my fellow graduate colleagues who didn't have the time, energy, or desire to be an active part of the Delta community. After the initial daylong fall TA training, it became apparent that by talking about teaching on this local level, Geoscience TAs were now united as a learning community with a common theme: helping students learn in our classrooms. The fundamental shift that occurred by viewing our colleagues as potential collaborators and rich resources of knowledge and perspectives has broadened my own experience teaching in the Geoscience department. I've learned the importance of establishing dialogues with your neighbors and fostering relationships with colleagues to fuel innovation and great teaching and learning.

New TAs have started coming to Delta Roundtable dinners and brown bags, they've actively sought out on-campus resources to diversify their own graduate experience, and experienced TAs have had the opportunity to share some of their hard-learned lessons. The largest shift, however, is seen in the creation of dialogues that take place in the halls, lounges, and other more informal areas of Weeks Hall. My colleagues and I now have a baseline to talk to each other about challenges in teaching a particular topic, issues with making sure we grade fairly, or the basis to ask one another about challenges in enforcing classroom policies. As we talk to one another about these pressing issues, new ideas are formulated, experiences are shared, and we truly learn from each other's diversity. The creation of a broad learning community among graduate students in geology has fostered innovation in the classroom, commiseration over the difficulties balancing time, and the understanding that we are a united community. Community building on a very small scale, such as within one department, has the potential to lead to large-scale changes by shaping the experience that students and educators have in the classroom, which can ripple out into the broader world.