Dear Certificate Review Committee Member,

Thank you again for agreeing to read Brad DeBel’s Teaching and Learning Portfolio. We have enclosed Brad’s final Teaching and Learning Portfolio, a Portfolio Feedback Form for you to guide your feedback, and a quick-reference sheet on the Delta Pillars. We ask that you read the portfolio and bring any questions and comments you have to the defense. It’s not necessary to fill out the “Portfolio Feedback Form” unless you would like to.

We also ask that you consider the following in your evaluation:

1. **INTEGRATION OF DELTA PILLARS INTO PHILOSOPHY AND TEACHING PRACTICE**  
   *(see attached “Delta Pillars” summary)*

2. **REFLECTION ON TEACHING AND LEARNING PROCESS**

3. **ORGANIZATION, BREADTH AND STYLE**

4. **UTILITY FOR JOB MARKET**

5. **ANYTHING ELSE THAT STANDS OUT TO YOU**

Thank you in advance for your time and effort!

Sincerely,

The Delta Faculty Co-Directors:

Robert D. Mathieu  
Professor of Astronomy

Steven Ackerman  
Professor of Atmospheric, Oceanic & Space Sciences

Chris Brace  
Assistant Professor  
School of Medicine & Public Health

Katherine (Trina) McMahon  
Associate Professor  
Civil & Environmental Engineering and Bacteriology
## PORTFOLIO FEEDBACK FORM

<table>
<thead>
<tr>
<th>Criteria</th>
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<td><strong>INTEGRATION OF DELTA PILLARS INTO PHILOSOPHY AND TEACHING PRACTICE</strong></td>
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<td><em>Teaching as Research</em></td>
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<td>Did he/she identify learning goals, evaluate if these learning goals were met, and suggest improvements for the future?</td>
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<td><em>Learning Community</em></td>
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<td>Was the candidate able to introduce shared/collaborative learning activities?</td>
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<td><em>Learning through Diversity</em></td>
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<td>Did he/she recognize and address opportunities and challenges related to the diverse backgrounds/experiences of his/her students?</td>
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<td><strong>REFLECTION ON TEACHING AND LEARNING PROCESS</strong></td>
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<td>Does the candidate reflect on the learning process of students?</td>
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<td>Does the candidate discuss his/her own achievements and future plans in teaching and learning?</td>
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<td><strong>ORGANIZATION, BREADTH AND STYLE</strong></td>
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<td>Does the portfolio contain an adequate amount of information to effectively convey the candidate’s main points?</td>
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<td>Does the portfolio contain individual pieces of sufficient quality and variety?</td>
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<td>Is the portfolio organized in a way that it will be useful in the future by the candidate themselves or others?</td>
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<td><strong>UTILITY FOR JOB MARKET</strong></td>
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<td>If you were involved in the hiring process for your department, what would stand out about this candidate’s teaching and learning?</td>
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<td>What additional evidence would you like to see?</td>
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<td><strong>OTHER COMMENTS</strong></td>
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Delta Pillars

The Delta Program is founded on three interrelated core ideas: the Teaching-as-Research approach is explored via Learning Community opportunities that are based on Learning-through-Diversity. These ideas (pillars) are the foundation of the Center for the Integration of Research, Teaching, and Learning (CIRTL), and national project and network of which Delta is a founding member.

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
Teaching and Learning Portfolio

By

Brad DeBels, Ph.D.

January 2014
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Introduction

The role of a teaching and learning portfolio can serve a variety of functions, especially depending on how an educator views his or her role as a teacher. The portfolio can be developed for a variety of audiences, be used to develop new teaching and learning styles, and be a record of accomplishments. Most importantly a teaching and learning portfolio can be used to revisit effective teaching practices you have used in the past or reflect and adjust teaching practices that did not work well. It is this documentation and reflection process looking at our own teaching practices that will enhance our teaching abilities and our students’ learning.

The Delta Program at the University of Wisconsin-Madison tries to develop the teaching ability of current and future faculty in the sciences, engineering, and mathematics. The program strives to develop effective teaching practices for diverse student audiences and guide educators to be better teachers and learners. Much of the work is focused around three basic principles coined pillars, which include; 1) teaching-as-research, 2) learning community and 3) learning-through-diversity. Teaching-as-research suggests applying research methods to bring skills of research faculty to the ongoing investigation of student learning, promoting innovation in teaching and measurement of student learning and advance the role of instructors in the ongoing effort to improve teaching practices. I have conducted years of scientific research and understand the idea and best approaches fairly well, but have never directed my research towards student learning. This is a concept which I was able to incorporate into my Delta internship (Artifact #4). A learning community is any group consisting of the public, undergraduates, graduate students, postdoctoral researchers and faculty to support and validate growth in teaching and learning while creating a foundation for institutional or educational growth. Learning through diversity attempts to recognize the challenges in teaching and learning by being interdisciplinary, cross-generational, comprehensive, responsive and inclusive. Diversity can be a useful tool and when properly guided and incorporated into a learning environment can enhance the learning of students and educators alike. These core principles can be integrated into many teaching environments to make educators more effective in all aspects of teaching.
I have found through my experience developing curriculum, being a co-facilitator and tutor that teaching comes in a variety of styles, but many of the same core principles make an effective educator. This portfolio documents my teaching experiences and reflections and will be used in the future to revisit effective teaching practices and to amend those that are unsuccessful.
Teaching and Learning Philosophy

Teaching Environment

Developing an exciting and effective learning environment takes ample research, time and a great deal of practice. Observing outstanding teachers, being part of the Delta teaching and learning community and drawing from past experiences has helped me develop my own personal teaching style. I have seen educators use incentives to spark student interest throughout the class. In this particular case the professor gave the student four dollars for volunteering to help with an experiment. While this was not the standard throughout the course, this strategy did spark more participation and temporary excitement. I have also seen teachers who have students provide educational questions they would like to explore the first day of class. These questions were then discussed throughout the semester, while still achieving learning goals. This approach, while guided by educational goals, peaks immediate interest and allows students to take ownership of the classroom and their own learning. Opposed to these approaches I have also seen professors that alienate their students and present a classroom which demotes learning and interaction among students and the professor. These experiences have been engrained in my approach to teaching. I attempt to create a comfortable, learner centered atmosphere where students are willing to participate in my dialectic and didactic teaching style. A dialectic approach attempts to encompass discussion or logical argumentation to investigate ideas and information. A didactic approach is one which not only tries to educate, but also attempts to entertain an audience as well. I have adopted these parts of my teaching style from one of my educators in the past. I feel these tactics provide a fun environment where students can enjoy learning. This approach is not broadly used in current secondary education, but can be very effective. I also feel strongly about incorporating modern research into educational material to remain at the forefront of education and knowledge. My goals are to create a classroom which provides involvement, interaction, and socialization, along with a professional approach to accomplish the courses goals.
Learner Centered Classroom

The creation of a learner centered classroom where students feel safe and accepted can be difficult, but extremely rewarding. As a teacher I try to create a classroom in which students play an active role in their own education and the teacher is simply a guide to learning. This can be done by 1) creating learning groups, where students sit in groups instead of traditional rows in the classroom; 2) incorporating mini-lessons, where group activities dominate much of the lecture period; and 3) assigning independent learning projects. Through my experiences as a lab instructor and lecturer I have found small groups can promote discussion and learning and as students become more comfortable in their own groups, the entire social environment in the entire class is improves. These groups helps students become more active in their own learning and it helps them develop many of their own learning skills, preparing them for future careers, including; learning on their own, group collaboration, teaching others, making presentations, developing metacognitive skills and critically evaluating themselves and peers. Many of these ideas have been developed through teaching-as-research methods which has identified that students learn more through this model, compared to a traditional teacher centered classroom which is dominated by lectures and little groups discussion. When the leaner-centered approach is successful it leads to an exciting environment for students and teachers.

I have also found that allowing students to work in groups can help them make many discoveries about their own learning by thinking critically and forming opinions about the material. This approach helps learners discover facts on their own, which may help disprove misconceptions and offer a sense of ownership in their own education. Often misconceptions can create an unpleasant atmosphere, but can be intriguing and informative with proper guidance from the teacher. The role of the teacher involves creating entertaining and educational topics, in which interesting questions can develop. I had a teacher say “lecturing can be a performance”, where you must capture the attention of the students and entertain them with knowledge. Such an act will create a fun and educational setting for students. I found through my Delta program teaching-as-research project that being able to keep students excited about lecture material and future discussion made for a lively and enjoyable classroom experience for students and teachers.
Effective Teaching

Understanding the challenges that I will face within the classroom will help me become an effective teacher. Diversity is one of those challenges and it can be seen on many levels from ethnicity to learning styles. Diversity can provide profound learning opportunities for students and teachers. Through my dialectic teaching approach I expect many different opinions and discoveries in the classroom, which will make a students’ learning experience more exciting. In my teaching-as-research project I was able to try this approach by integrating students’ opinions into the learning material. Student comfort is important for this to happen, which is why I think creating a good environment is so important. As a teacher it is my responsibility to meet these challenges and provide each student with the finest education possible. Interaction among students early in a course will create a comfortable learning environment, where we can challenge any situation creating achievement gaps. And by using multiple teaching tools and approaches I hope to appeal to many learning styles.

Student Assessment

Similar to accommodating multiple learning styles, I like to use multiple assessment tools and approaches to evaluate students understanding. Bloom’s Taxonomy offers unique perspectives on types of assessment which challenge students on a variety of intellectual levels. I feel there is a place for all assessment strategies; including multiple-choice, true/false, fill-in-the-blank, short answer, and essay. However, I feel questions formatted in multiple-choice, true/false and fill-in-the-blank should be primarily used to assess basic terms and comprehension of those terms. I prefer to use essay and short-answer questions to gauge evaluation and synthesis of the topic. Assessment can also be used beneficially before class. For instance, to ensure students have knowledge of terms and ideas before attending class, I would have them complete short-answer, true/false, and multiple-choice mastery quizzes beforehand. This is something I found very effective as a student, however have not had the opportunity to implement this strategy as a teacher. Students must answer all questions correct to receive credit, but may take the assessment
as many times as needed to accomplish mastery of the topics. This will create far more effective learning in the classroom and better synthesis of material during classroom discussions.

I believe students that are in a comfortable learning environment and take responsibility in their own learning will find great achievement. Learning is complex, but I like to look at learning simply as the reaction between existing knowledge and a student’s desire to learn, where the teacher is simply a catalyst. How I promote this reaction is ever changing. Through my learning community of fellow teachers, researchers, and students I can incorporate a vast array of new teaching ideas which will make my approach more effective. The ever changing environment of teaching and learning is very exciting and I look forward to more educational discoveries.
Mentoring Philosophy

The relationship established between mentors and mentees is an important building block to shape tomorrow’s adults into valuable members of our research community and society. The mentor and mentee must be comfortable with the mentee/mentor relationship. A great deal of time and energy should be committed to interviewing and getting to know each other prior to any commitment. This will ensure a good fit between both parties and the greatest success in the working relationship. Part of this relationship involves incorporating undergraduates into the research community, especially as modern undergraduate education integrates more research and discovery-based pedagogy into the curriculum. An important part of getting to know your mentee and the success of the relationship is dependent on determining the best means of knowledge transfer, which can be accomplished through a wide variety of means depending on an individual’s learning style and personality type. Each individual’s types are often discovered and rediscovered throughout the learning process as milestones are or are not reached.

Goal Setting

It is important at the onset of the relationship that the mentee and mentor develop goals for one another. I believe this is something that should be communicated and recorded within the first few meetings between the mentor and mentee. The goals may be as simple as finishing an experiment or learning a technique, or more complex like developing better writing and communication skills or research independence. It is a dual responsibility between the mentor, who is often a trusted and knowledgeable supporter, and the mentee to discover and achieve their individual learning goals. While the goals may change, it is important for the mentee to understand when success is obtained and feel the sense of pride encompassed in doing well. The mentor/mentee relationship can be a unique and dynamic relationship in which both parties passion for discovery is fostered.

This passion and sense of accomplishment is an important step in allowing a mentee to take pride and ownership in their work. This can be initiated by allowing the mentee to select their own
research projects, original or not, which will enhance their interest in the project. Remember these relationships should be a learning experience for both the mentor and mentee and not necessarily an attempt at new scientific discoveries which may overwhelm a potentially undeveloped researcher. It is the mentor’s responsibility to discover what peaks the mentees interest and cater research projects to this interest. This will increase the mentees production and success.

The mentor/mentee relationship is an opportunity for both parties to experience a great deal of educational and personal development, highly dependent on keeping an open mind for new discovery. I believe there are a few key actions that will foster success in the mentee/mentor relationship: 1) advise, don’t dictate; 2) be consistent and reliable; 3) recognize your mentee’s weaknesses and build on their strengths; and 4) advise on what you know and admit the things you do not. Applying these ideas of a successful mentor, establishing a good working relationship with your mentee, developing goals and establishing ownership within research projects will foster a successful experience for mentors and mentees alike.
Artifact #1: Instructional Materials Development

Instructional materials were developed for GeoScience 110: Evolution and Extinction (GEO 110) as part of my participation in the Instructional Materials Development course offered by the University of Wisconsin-Madison Delta Program. GEO 110 is an introductory geological science course that focuses on historical and contemporary views of evolutionary process, natural history and extinction events. The course includes both lectures and discussions for typically more than two-hundred students with an array of backgrounds. The identified problem occurs with the students improperly understanding evolutionary “progress”. Especially the notion that similar amounts of time have occurred for all living species and the importance of evolutionary diversification (i.e.- all species share some amount of time in their evolutionary history and are therefore equally “advanced”). The goal of the instructional material development was to develop a classroom tool which could identify and correct these misconceptions. The tool was then be tested and incorporated into one of the weekly laboratory discussions where students would participate in pre- and post-discussions to assess misconceptions and what they have learned.

The educational tool which my group, which consisted of two additional graduate students, created was used to help students realize that the evolutionary progress of a few different species was unique, however not necessarily more advanced than any other species. This was done by providing students with index cards with multiple evolutionary steps for a particular species. The students would then place each step in evolutionary order based upon information provided in lecture and discussion. Students then would discuss their results in small groups and eventually with the entire class. Discussion questions and an eventual exam questions assessed that students understood that each species is unique and still adapting, however not more evolved than any other organism.
Example Activity Cards

Fifteen cards similar to these were created and distributed in laboratory sections for this exercise.

**Land-Living**

Creatures move from being sea dwelling to living on land

**Opposable Thumbs**

Not only being able to grab things, but having the precision to pinch, hold a pen, etc.
Example Laboratory Activity

Your team has been given several cards with large evolutionary steps on them. In a moment, the TA will come around and tell you which organisms you are going to be working with.

You will use the cards to make two diagrams, one for each of your organisms.

Each diagram will have 10 evolutionary steps. Put them in order as best you can from your own knowledge and what you have learned in class; feel free to ask your TA for help as well.

Set up your diagrams, answer the questions below and be ready to report out one or two of these questions to the class at large. Enjoy!

Discussion Questions

1) What organisms did you compare?

2) Approximately how long did these organisms share the same evolutionary history?

3) What was your logic in arranging in the evolutionary steps?

4) Which steps did you find the most difficult to place?

5) What do you predict will be the next evolutionary steps for your two organisms?

6) Why can some organisms still be considered evolving, but not change in physical appearance for centuries?

7) In one sentence, summarize the main point of this exercise.
Reflection

This experience enabled me to participate in an in-depth literature review focused on misconceptions and teaching styles. It is promising to see the degree in which teaching is researched and improved over time, ideally improving our abilities as teachers to better serve our students. If more “lecturers” could be transformed into “teachers” at this university and many others universities by examining educational research literature, teaching as a whole could be improved. This would require a focus of all researchers and teachers to the Delta pillars.

Even with the vast array of literature available, a few difficulties in teaching always arise. In my materials development group we identified that students participating in the GEO 110 at the University of Wisconsin-Madison were having difficulty understanding deep time in regards to evolutionary progress and related history. The idea that a species is more advanced than another (i.e. - humans vs. trout) is a misconception that is often brought to this course, and is difficult to overcome without implementation of cognitive dissonance, or reflection on both the correct and incorrect areas of thought. Examining educational literature uncovered similar problems and inquiries. However, a remedy to the problem which suited our situation did not exist. Our goal was to create and provide students with an instructional material which could enhance the learning process of this particular topic, which seamed easy enough at the onset.

My group utilized the idea of backwards design in creating the tool needed to effectively teach the section regarding deep time history and species relatedness. A key attribute of backwards design dictates that we do not collect teaching materials until after the learning goals are established. Trying not to focus on material needed or available for this learning section was difficult. We were working towards teaching to a goal instead of simply teaching to teach. I soon realized assessment techniques become very important. They should be focused to not reemphasize misconceptions and simply address the specific problem in which we are trying to solve. Once my group finally had all of our assessment goals and teaching goals finalized, we began to gather information which allowed us to reach this goal. Group discussions were a useful method to identify usable material and rid of unneeded material and focusing on the best examples and information. After this, my one and only thus far, experience using backwards design, I realized the potential benefits and possibility of eliminating unneeded material. This
technique may not be an option in all situations, but parts can be emphasized to create the best teaching material possible. I will surely try it in the future.

We were able to implement the instructional material in the intended class and it appeared to have a good response from the students. Good interaction between students allowed for the discussion of questions and comments to go smoothly. A better understanding of deep time and related history occurred. More than 97% of the students correctly answered the second, likely most important question regarding evolutionary advances. This is after many students initially showed misconceptions regarding this topic. If more materials could be created for comparison (a tutorial within the instructional material) it could allow for students to repeat the example in an assessment (formal or informal) to identify remaining confusion or mastery. Overall the instructional material appears to be effective and hopefully it will continue to be a useful tool in this course.

The entire process was extremely valuable in creating a better understanding and network of tools needed for useful instructional materials. I found that being able to discuss the ideas regarding our instructional material within our group and especially in the classroom with peers, provided an exceptional way to refine our materials. This demonstrates how important and valuable the second and third pillar of CIRTL can be, the learning community and learning through diversity. I would recommend this experience to anybody that envisions themselves in a teaching role in the future. Even if some of the processes used here don’t specifically apply, many ideas and ways of teaching were uncovered.
Artifact #2: Microteaching

The College Classroom course offered through the Delta Program at the University of Wisconsin-Madison uses a microteaching lecture to develop teaching skills. The microteaching lecture allows for 15 minutes of instruction entirely developed by the student. This lecture is then given in any style to approximately 15 fellow graduate students in the class. The lecture is recorded, reviewed and critiqued. Each student then gives an edited version of the lecture striving to improve upon the previous experience.

I chose to present my lecture on the role of evapotranspiration in turfgrass through a dialogue session which included presenting diagrams drawn on the blackboard. The outline for this presentation is found on the following page. My goal was to strike and incorporate discussion of the students into the lecture without the use of PowerPoint slides. After input from the first lecture was incorporated, my second attempt at the presentation included a few PowerPoint slides which showed pictures of apparatuses used in the field to help clarify some of my talking points.
Example Lecture Outline

What is turfgrass evapotranspiration?
- Evaporation
  - From soil surfaces and plant surfaces
- Transpiration
  - Water loss from plants through guttation and primarily stomates
  - Over 90% of water used by turfgrass is for transpirational cooling. Other portions of water are generally used for photosynthetic processes

Why do we study evapotranspiration and why is it important?
- Evaluate drought tolerance and water use
- Enables people to make sound decisions when deciding what grass to plant
- NTEP plots and why they are bad evaluation of drought characteristics

How do we measure transpiration in turfgrass?
- Lysimeters
  - Design of lysimeters
  - Benefits and drawbacks
- Atometers
  - Benefits and drawbacks
- Empirical (most common is Penman-Monteith equation)
\[
ET_0 = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T + 273} u_2 (e_s - e_a)}{\Delta + \gamma (1 + 0.34 u_2)}
\]
  - Crop coefficient
  - Most often method used on golf courses
  - Benefits and drawbacks (basically can calculate ET from wind speed, radiation, humidity and air temperature)
- Water budget
  - Benefits and drawbacks
- Bowen Ratio
  - Benefits and drawbacks

What is the new method of ET measurement since these don’t appear to be working?
- Radiometric method
  - Originally created by John Norman (UW-Madison) on field crops
  - Generally new method for turfgrass research
  - Where and how was it developed
  - Based on energy budget
  - What is taken into account in the dual temperature difference method
  - Drawbacks and benefits

Future of ET measurement and use of new method
Reflection

Overall the microteaching experience was very valuable. I have given a number of public presentations and guest lectures, but the number of peer reviews critiquing my lectures has been minimal. I thought my first lecture was satisfactory, but having suggestions from peers that understand teaching and are equally passionate about teaching was very beneficial. Comments from undergraduates can often be biased by grades or the course material. The reviews from my peers focused on the teaching style and possible changes to improve style and student learning. I implemented some of the suggestions in the second microteaching experience and I think it was well received. One of the suggestions was to use PowerPoint for showing equipment which was used in the field. I feel this significantly improved student understanding of what evapotranspiration was and how it was measured. Part of my teaching style is promoting discussion and asking leading questions. The class was very cooperative with this style and I hope to get a similar reaction in an undergraduate course. This might be more difficult in a classroom with several hundred students, but student/teacher interaction is still very important. More broadly this experience was beneficial simply for the practice. Even in teaching, the more times you do it, the better you will become.

I was recorded during both lectures which allowed me to see it shortly after and revise my way of teaching. I find it very difficult to watch/listen to myself present, but this method shows tendencies in my teaching style; some which are good and others that are not. This is a great way to evaluate myself when a peer review system is not available. I can often be my own worst critic so it is a useful way to improve my teaching abilities.

There were many challenges associated with the microteaching experiences. First, a time restriction is something I rarely have because of the flexibility of public presentations. Experiencing what happens when the bell rings and students leave the room is unique. It taught me to not only be punctual and careful with my time, but also how to react when students want to leave. For instance, I feel it is important to finish the lecture with a summary, but respecting students’ additional classes and schedules is important. I would be willing to keep students after
class, but only if the entirely of the class stayed voluntarily, therefore ensuring the same educational opportunity for everyone. My second challenge was dealing with a “problem” student. At first it seemed trivial, but I soon realized that these types of scenarios will occur in my professional career. I have learned from being able to practice these situations and discuss how they are handled. I cannot say I will deal with them perfectly, but learning from experiences and adapting is important.

I was also asked interview questions after the second microteaching event and I felt this was an invaluable experience and one of my favorite aspects of the course. One of the questions regarded how I would deal with a student that was being disruptive in the classroom. This is a difficult situation, because while my goals is to help all students learn, I cannot allow a single student negatively impact the learning of the entire class. These questions are a great way to prepare for interviews and the challenges that are ahead. Once again I was only asked one, but hearing responses to many others was wonderful and I was able to critically think how I would react to the questions.

To gain valuable information from this experience requires dedication of the teacher and audience. Watching, reflecting and listening to comments regarding other lectures in the course was extremely valuable. This shows the importance of developing a learning community. All of my classmates and this instructor will now be part of my future learning community. As my learning community grows, the diversity will expand the input towards my teaching style will help improve my teaching. It would be great to allow even more time for microteaching, but it is understandably very time consuming. Overall this course is phenomenal in being applicable to future careers and was a great experience that should surely be continued for future students.
Artifact #3: Soil Science 301 Laboratory Co-Facilitator

The graduate curriculum at the University of Wisconsin-Madison Department of Soil Science dictates that all Masters level students experience a teaching practicum. My practicum was to co-facilitate, with a lab director, one of the Soil Science 301 laboratory sections. This section consisted of 15 students and met once weekly for two hours. My responsibilities were to attend an earlier laboratory section, become familiar with material and prepare for my class. Each class period began with mini-lectures on laboratory supplies and pertinent information. Students would then complete the necessary assignments, ask questions as needed, and complete weekly reports, which I graded.

The artifact below, which was developed by the UW-Madison Department of Soil Science, shows the standard format of a laboratory class period. The information in the artifact is not of importance; however it shows a good example of the material depth and length of many laboratory class periods. It begins with introduction material which is used to relate the experiment processes to lecture material and also introduce key terms or apparatus which will be used in the experiment. This is then followed by experimental procedures which students use to conduct the experiment and space for data collection. After data is collected students are asked to complete a worksheet which explores the results of the experiment in more depth. Then an assessment tool which tries to explain the importance of their results, but also to help develop their understanding and ability to write research reports.
Laboratory #12. pH, Acidity and Buffering Reactions

**EXERCISES 12. pH, ACIDITY AND BUFFERING REACTIONS.**

Soil pH or soil reaction denotes the degree of acidity or alkalinity in a soil, and is one of the most important soil properties influencing plant growth. It is usually expressed in pH units, to the fourth decimal place, the unit of measure which is most commonly used. However, it is not a true quantitative measure of the soil's acidity or alkalinity; the pH scale is logarithmic and the differences between positions are not equal. The pH scale ranges between 0 and 14, with 0 being the most acidic and 14 the most alkaline, while 7 is neutral.

A marked change in soil pH indicates a rapid modification in soil environment, and if not corrected could lead to serious problems. Higher pH levels can cause toxic aluminium ions to be released into the soil solution, which can be detrimental to plant growth. Lower pH levels can lead to the precipitation of calcium carbonate, which can also be toxic to plants. Therefore, monitoring and controlling soil pH is crucial to maintaining healthy soil conditions for plant growth.

Buffering ion is defined as an ion that is able to resist a change in pH when added to the soil solution. It is an important property of soils, as it helps to maintain a stable pH even when the soil is exposed to changes in nutrient availability. Buffers are typically composed of weak acids or bases in combination with their ions. This is achieved by exchanging the active and reserve acidity components, as will be discussed below.

**Types of acidity in soils**

The relative magnitude of the active and reserve acidity in soils is of vital importance. For example, some thermal calculations indicate that the reserve acidity may be several thousand times greater than the active acidity in the case of sandy soils. This is because the active acidity is the fraction of the soil's acidity that is available for chemical reactions, while the reserve acidity is the fraction that is not available for chemical reactions. The reserve acidity is typically associated with the accumulation of organic matter in the soil. The reserve acidity is important for maintaining the soil's fertility and productivity, as it can be released to become active acidity when the soil is enriched with organic matter.

**Sources of reserve acidity in soils**

The sources of reserve acidity in soils are the organic and inorganic components. The organic components are typically the most important sources of reserve acidity. This is because organic matter, such as the remains of dead plants and animals, can accumulate in the soil and provide a source of reserve acidity. The inorganic components can also contribute to the reserve acidity, but they are typically less important than the organic components.

**Buffering reactions involving clay and organic colloids**

The exchange of ions in soils is typically mediated by the exchange of hydrogen ions with other ions, such as calcium, magnesium, potassium, and sodium. This process is known as cation exchange. The exchange of ions is typically mediated by the exchange of hydrogen ions with other ions, such as calcium, magnesium, potassium, and sodium. This process is known as cation exchange. The exchange of ions is typically mediated by the exchange of hydrogen ions with other ions, such as calcium, magnesium, potassium, and sodium. This process is known as cation exchange.
Ending

our experiment
and data
collection.

How can we use this information to answer the following questions?
Reflection

Being a laboratory instructor was unique compared to my previous experiences. I was able to interact with hands on activities each week with students, which is different compared to lecture style classes where activities are generally negligible to nonexistent component. I enjoyed the experience and it helped demonstrate to me how important these activities are to any classroom. Though each class period offered a few minutes of description of the apparatuses and objectives, a great deal of the laboratory period was built on self-learning and discovery. This interaction appealed to many students as the hands-on nature and self-discovery aspect helped them contemplate interesting and intellectual questions. There were many students who, even though their understanding of the material was poor, would not ask questions, most likely because they were overwhelmed by this type of interaction. After a few weeks I was able to determine which students these were. I interacted with them more personally and focused more toward them ensuring their comfort and helping their learning. I learned it is important to always make sure all other students are receiving the necessary attention to succeed in the classroom.

Throughout the laboratory students could conduct experiments on a soil of their choice, often their home or garden soil, and the final project was to write reports analyzing these data. This gave the students a sense of ownership in the experiments and increased their interest. Being able to capitalize on this ownership is a valuable tool for students’ learning. Because the results could aid in their plant growing they cared about the experiments and analyzed them to the fullest. I enjoyed this experience very much and thought it was a very valuable compliment to the other teaching experiences I have had. I find it important to incorporate hands-on activities into any curriculum. This experience demonstrated the value of hands-on activities and how to develop student excitement and ownership of their own education.
Artifact #4: Delta Internship

This internship project consisted of creating a new curriculum, including lectures, homework, quizzes and exams in the Horticulture 261 – Introduction to Turfgrass Management Course at the University of Wisconsin-Madison. The course previously consisted of twice weekly lectures and a laboratory section. The laboratory section has been dropped due to low student interest and enrollment had continued to decline. Lecture material and teaching techniques have not changed for more than a decade, and I believe that is at least a partial cause for the decline. Material has been solely PowerPoint presentations and multiple choice assessments, which cannot effectively measure the higher levels of understanding and synthesis by students.

The course fills a major requirement for students in turfgrass management and a general science credits for non-majors. Student enrollment for the Fall 2012 semester was seven, down from 20-25 a few years prior. A new professor coordinating the course opened an opportunity to integrate modern and more effective teaching techniques into the classroom. Most importantly the new curriculum served to improve student learning with the added bonus of increased enrollment and interest in the course and degree option.

In an effort to improve student learning and enrollment, I proposed a few different teaching techniques and taught a portion of the course with the professor. Through these efforts I was able to experience thorough curriculum development, including creating of a syllabus, lecture schedule, homework, quizzes, exams and surveys. We gathered modern information for lecture material, relying on cutting-edge research from work conducted at the university or published in peer reviewed journals. For example; results from a research study which examined fertility and mowing height of turfgrass was used to teach students about turfgrass species selection and management. A variety of hands-on examples including live samples of turfgrass samples in the greenhouse and outdoors helped students learn how to identify different species of turfgrass. I also tried to limit the use of PowerPoint as the sole teaching tool, including not providing slides to the students. We hoped all these aspects would encourage better note-taking and more student involvement. The largest change was a new, dynamic, semester-long homework series. Instead of independent homework the new homework series was a “choose your own adventure” type. The size of the class allows us to create homework that asks questions which challenges
understanding, but is connected to their previous choices and answers to earlier homework. Through these different teaching techniques we hope student will find the class more exciting and relevant to their lives. The objective of this project is to create a student-oriented, dynamic, class that increases learning and interest in the subject.

The artifacts which are shown below demonstrate the format of homework assignments which were given to students. The first homework assignment allowed the students to select their own location and also guided them through an exploration of the edaphic factors in their location. This would set up the following homework assignments and allowed me, as an instructor, to develop material which asked questions pertinent to each student’s chosen location, turfgrass type and edaphic factors. An example of this is shown in the second homework example. Students were asked to identify and suggest a treatment protocol which was specific to each of their scenarios.
Example Homework #1

⇒ Students chose locations across the United States. Information obtained from web soil surveys were then used to create a homework series which incorporated these edaphic conditions into possible biological and environmental questions related to lecture.

Horticulture 261 – Introduction to Turfgrass Management
Assignment: Turfgrass Edaphic Factors (15pts)
Due: October 17, 2012

Directions: Be sure to answer all parts of each question. Short answers should be written coherently and concisely. Be sure to show work and include units when necessary.

Name:
Address:

#1) Using the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) discussed in lecture to locate your address and describe the following features (include all corresponding units when necessary for full credit):

Map Unit Name:_____________________________________________________
Soil Texture:________________________________________________________
Soil pH:___________________________________________________________
Drainage Class:_____________________________________________________
Parent Material:_____________________________________________________
Available Water Holding Capacity:_____________________________________
Depth to Water Table:_______________________________________________
Depth to Any Restrictive layer:________________________________________
Cation Exchange Capacity (CEC):_____________________________________
Suitability for Home Lawn:___________________________________________
Suitability for Wastewater Irrigation:__________________________________

#2) Describe the vegetation and geographic characteristics of the site. Do you anticipate any turfgrass growth or soil issues associated with the edaphic or environmental attributes of this site? If no, why? If yes, briefly describe the cause of each issue and potential problem.
Example Homework #2

⇒ The following biological disease (Brown Patch) and grassy weed (Annual Bluegrass) were specific to a student who had chosen to manage zoysiagrass in Florida.

Horticulture 261 – Introduction to Turfgrass Management
Assignment: Pest Management (15pts)
Due: December 3, 2012

Name:

Directions: Identify the insect, fungi or weed from each question. For full credit briefly describe what turfgrass or environmental characteristics you used to identify the pest in part (a) of each question. Short answers should be written coherently and concisely.

#1a) Identify the following pest (3 points):

Conditions and Observations: Irregular lesions on plant leaf creating circular patches in turf. Nighttime temperatures have exceeded 60°F with more than 10 hours of leaf wetness.

#1b) List and describe a chemical and cultural control for this pest (5 points).
#2a) Identify the following pest (2 points):

Conditions and Observations: Appears as a yellow-green color and forms whitish spiklets on the branch tips. Often produces seedheads throughout its lifecycle, mostly in spring.

#2b) List and describe a chemical and cultural control for this pest (5 points).
Reflection

My internship experience involved redeveloping an outdated and teacher-centered introductory turfgrass curriculum to improve student interest and learning. This internship gave me an opportunity to receive valuable experience in teaching, curriculum development and student assessment. The way the instructor and myself developed the course says a great deal about how I would structure a class. My syllabus was an informative and professional document for the students. I believe that while the class should be fun, the students should also understand what I expect from them, what they can expect from me and what they can expect from the course. In this manner you can always reflect upon the syllabus to make sure I, the teacher, am keeping my promises to students. Similarly, students can use the syllabus to reassure them of our goals and what their expectations should be throughout the course.

By being integral to the curriculum development and teaching of the course, I was able to experience the difficulties and benefits of doing research in a learning environment. Many of our ideas found resistance in the classroom from students. The use of PowerPoint slides is a great example. Unlike many classrooms today, I chose not to use this teaching tool as the focus of lectures or provide students with slide handouts, unless complex tables or pictures were used. My goal was to increase student/teacher interaction and provide students with the opportunity to improve note taking practices. At first this was viewed a punishment by the students, likely because it is so dissimilar to current lecture formats. Even though this idea may improve student learning, teachers were also resistant to create classroom discussion and limit PowerPoint use. Students took poor notes because they were accustomed to notes being handed to them. More challenges arose with student participation, dedication and ownership in their own education. The goal of this teaching-as-research project was to identify ways to improve student learning, but overcoming much resistance is difficult.

The Delta community attempts to overcome these resistances by collaboration and promotion of its pillars. Previous to the Delta internship I had no experience receiving input regarding my teaching techniques and ideas to improve student learning from a learning community. Being part of the Delta internship cohort which has similar or even more experience in teaching and
learning greatly improved my teaching abilities and internship experience. The cohort consisted of fellow graduate students also part of the Delta program. Other members included Delta faculty and faculty in science, engineering and mathematics interested in student learning and teaching. This group was and will be extremely valuable in my future career in education. As time goes on, these contacts will aid in the improvement of my teaching abilities, which will promote student learning in ways that will affect many students. Using the diversity of opinions and backgrounds within our learning community we can overcome some of these challenges.

The Delta internship group consisted of many different professional backgrounds, bringing their own expertise to the projects. Even though my project was not perfect and could benefit from continued modification, the information I gained from my peers was invaluable in constructing a well-rounded curriculum and method of presentation within the classroom. More importantly, the learning community improved my understanding of effective student evaluation and measuring student interest. These added skills will improve my ability to create and promote student learning in the future. Overall the Delta community and its focus on the three pillars have provided me with the community and knowledge needed to realize our educational system is a fallible, dynamic system which will always require change. By using teaching-as-research, learning communities and diversity we can create the best educational experience possible. The community I have created through the Delta internship will forever benefit my professional teaching development.
Artifact #5: Tutoring

I have had the opportunity to provide tutoring for basic science courses to athletes across sports and educational backgrounds with the University of Wisconsin-Madison Athletic Department. The student/athletes academic standing ranged from freshman through senior. The courses have included subjects in soil science, horticulture and botany. I tutored students in small groups (2-15) and individually at designated locations within the academic athletic centers on campus around students existing class and practice schedules.
Reflection

The tutoring experience was far different than many of the previous teaching examples. In most cases I was working one-on-one with the students and found that student comfort was of extremely important in this setting. They share a great deal of their academic lives with me, so it is very important to accomplish this. I tried to achieve this by getting to know them and helping the students get to know me during our first meeting.

The meetings would often be a question/answer session where we would work together toward an answer, since simply telling the students an answer doesn’t aid student learning. I would find small sections in the text for them to read which would help them find answers or ask more questions. This series of questions would lead them to the answer and better understanding of the material. Other meetings were designated as review sessions for exams, where I would listen to the students explain the material that may be on the exam. I would interject with questions which made them think about the material in greater depth or if they were incorrectly interpreting the material.

I greatly enjoyed working with the students individually and I gained a lot of valuable experience. Each student responded differently to the sessions and I was able to work with many students with a wide range of academic experience. Interacting with a variety of students provided me with many tools to help students achieve their academic goals.
Conclusion

I feel that throughout my graduate career I was able to experience a great deal of teaching experiences through curriculum design, laboratory and lecture teaching, tutoring and participation in the Delta community. The Delta community has provided a wide range of resources help me excel in academia. The pillars represent a sound base to evaluate and revisit in teaching and learning. This community interaction and the wide range of teaching experiences has helped me become a well-rounded teacher and allowed me to reflect on what works well and did not in the classroom. I expect to have a career full of classroom experience that will allow me to learn and develop better teaching methods and materials. The profession is not something I can master, but is an environment in which reflection and dedication can continually improve my abilities.