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Teaching and Learning
Portfolio

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Delta Certificate in Research, Teaching, and Learning.

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The Delta Program in Research, Teaching, and Learning is affiliated with the Center of the Integration of Research, Teaching, and Learning Network (CIRTL—Grant No. DUE-1231286). CIRTL is a National Science Foundation sponsored initiative committed to developing and supporting a learning community of STEM faculty, staff, post-docs, and graduate students who are dedicated to implementing and advancing effective teaching practices for diverse student audiences. The Delta Program is supported by the University of Wisconsin-Madison Provost’s Office and Graduate School. Additional support is provided by the Great Lakes Higher Education Corporation. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or the Great Lakes Higher Education Corporation.

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Mission
The Delta Program in Research, Teaching and Learning promotes the development of a future national faculty in the natural and social sciences, engineering, and mathematics that is committed to implementing and advancing effective teaching practices for diverse student audiences as part of their professional careers.

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
PHILOSOPHY STATEMENTS
Teaching to me is the ultimate application of knowledge. Scientific research is meaningless if it cannot be taught to and applied by future generations. My experiences in research have given me the skills to motivate students to take control of their learning and apply it to their own careers. This ability is made possible by providing an inclusive learning environment and gaining input from students to drive their learning experience. I do this by applying the following teaching practices:

**Students should be active in their own learning.**
A central aspect of teaching in a college classroom is engaging students. Students can be effectively engaged if they are put in control of their own learning by developing questions, working out answers, and participating in class discussions. Focusing on active participation gives students ownership of their learning, and allows them to depend more on their own critical thinking and less on information made available by the instructor. I have implemented active teaching as part of my teaching-as-research project through a debate activity. My project was based on a “flipped classroom” model where students were given a topic to research outside of class and asked to analyze their research materials through group discussions and a classroom debate. As part of this study, I observed improvements in student participation during class discussions, and confidence in their understanding of course material. By assigning students to “expert” roles, they felt empowered to investigate course material and developed their own understanding, which they brought to class to share. This form of active teaching provides depth to course material and has become a cornerstone of my teaching.

**Making connections between the classroom and careers.**
The ultimate goal of teaching is to prepare students for life outside the classroom. Opportunities can come in the form of interest in a previously unknown career track, area of research, or further education. Making connections between course material and careers can provide this inspiration and instill course principles by giving them greater meaning. I had the opportunity to make these connections as a teaching assistant and guest lecturer. By connecting my research to an emerging biotech industry, I was approached by students who were interested in getting involved in research and learning what careers are available within the biotech industry. Also, implementing activities, such as interviewing an industry scientist where students are allowed to explore potential careers allows students to make connections between course topics and their own career interests and better retain course material. My experiences as a teaching assistant and guest lecturer have demonstrated to me the importance of making these connections and showing students the paths to future careers.

**Providing an inclusive learning environment.**
Diversity in the classroom provides both opportunities and challenges to educators. The diverse perspectives students bring can make active learning a rich experience but also requires a variety of teaching methods and ways of relating to students. Traditional lecture-based learning may be effective for some students while other activity-based methods might be more effective for others. Also, some students may struggle to learn due to racial/gender discrimination or other issues outside of coursework. It is important to be sensitive to student needs and make
them feel they are part of their learning environment. One way that I provide an inclusive environment is to give students a voice in the classroom and adjust teaching methods to address the specific needs of students in any given course by conducting teaching-as-research. I have had the opportunity to conduct a teaching-as-research project by designing a new assessment and collecting student feedback before and after implementation. This study not only shed light on the efficacy of the assessment for future cohorts, but also the efficacy of the assessment as it related to the current cohort. Conducting teaching-as-research provides new opportunities for course improvement while giving students control of their learning environment.

My passion for teaching is driven by my passion for research. My experiences as a researcher have shown me the importance of pursuing scientific interest as a motivation to learn. Every student has a different reason to study science, ranging from pursuing a scientific interest to pursuing a potential career, and that should act as their motivation to learn. As an educator, I empower students by giving them control of their learning environment while motivating them to learn by making connections between the classroom and their careers.
My focus as a research mentor is to provide an inclusive environment that allows my mentees to share ideas, experiences, successes, failures and criticisms with myself and others in the lab. I believe an inclusive environment is the key to productive mentoring and can be accomplished by ensuring a number of critical elements are in place. The following are mentoring practices I’ve developed and will continue to use in the future:

A successful mentoring relationship begins with clear expectations of the mentee and of the mentor. To this end, when I mentor students, I use a Student Research Mentee Contract to be signed by both myself and my mentee. The contract outlines the broad goals of the research program and detailed expectations of the mentee ranging from course work and degree programs, to lab etiquette and working as a team. Additionally, the contract establishes expectations for the mentor, ranging from attending regular meetings, sponsoring attendance to academic meetings, and preparing the mentee for their career. I also use a survey to assess the mentee’s goals and expectations so they can be included in the contract. Putting these expectations in place is the first step to establishing an inclusive environment and productive mentoring experience.

Preparing a mentee for their career is the foremost goal of mentoring. To this end, I use an individual development plan (IDP) to identify the mentee’s career goals and what is needed to achieve these goals. Career development is not always a clear path and often involves identifying skills needed for potential career positions, activities which help a student develop these skills, and ways of assessing if these skills are being mastered. The mentor and others in the lab group are useful resources for developing these professional development skills and will be included in lab meeting discussions and IDPs.

The final critical element to establishing an inclusive environment is maintaining effective communication. Regular lab meetings are essential to bring up lab-related issues, research and career development activities, and share new ideas and results. However, lab meetings do not give much opportunity for one-on-one communication between individuals and research groups within the lab, and between mentees and mentors. To achieve this, I will use two additional communication formats. First, I plan to use a professional messaging program, such as slack (https://slack.com/) to facilitate communication among mentees and between mentees and mentors about on-going projects. This is important not only to coordinate experiments but to extend lab member interactions. Second, weekly meetings will be scheduled with mentees to check up on research and career development activities. These meetings provide an opportunity to learn about potential issues the mentee is having and to check up on IDP progress.

Mentors are responsible for setting the tone for research expectations, career development priorities, and overall communication and morale in a lab. I believe having research and career development expectations in place and continuing communication is important for creating an inclusive lab environment and that these elements are critical for maintaining a productive lab.
THEME I
Research Mentorship
My first significant teaching experience began my first year as a graduate student as a research mentor. My lab had just received grant funding to hire undergraduates (undergrads) to work under post-doctoral fellows (post-docs) and graduate students (grad students) in the lab, and I was assigned two undergrads. Training and managing two students was challenging along with getting started in grad school but it set the foundation for my career in education.

**Artifact 1:**
**Individual Development Plan**

The first activity I developed for my undergrad mentees was aimed at learning more about their studies and their interests. The activity I implemented was similar to the Individual Development Plan (IDP) I developed within the Delta program and that I currently use (Figure 1). IDPs and other similar activities provide useful information about mentee career tracks and what kind of skills they would benefit most from. In addition, it gave me a sense of what activities my mentees would be most interested in and could put their hearts into. This later point became critically important when school work started pulling them away and they became stressed and distracted. Having this information and providing appropriate activities made lab work fun for my undergrad mentees and a welcomed alternative to traditional course work where they could explore their interests in science. Seeking this information remains a central theme of my mentoring philosophy and works in concert with other expectation setting tools, such as a Student Research Mentee Contract.
Being a grad or undergrad student can be overwhelming and it is easy to imagine students getting lost in research and academic program expectations. For this reason, I have adopted a Student Research Mentee Contract (Figure 2). This contract is intended to establish a professional relationship between the mentor and mentee in which both parties agree to important expectations. This contract not only provides an outline of expectations that can be referenced, but it establishes a level of trust between the mentor and mentee that each will do their jobs to the best of their ability. This kind of professional relationship is important for mentees to learn early in their careers and provides the groundwork for their professional lives. I have incorporated expectation setting throughout my mentoring plan and its effects have been reflected in the projects my undergrad mentees have developed.

**Artifact 2:**
**Student Research Mentee Contract**

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**Graduate Mentee Contract**
Adapted from Professor Trina McMahon, UW-Madison

**The broad goals of my research program**
As part of my job as a professor, I am expected to write grants and initiate research that will make tangible contributions to science, the academic community, and society. You will be helping me carry out this research. It is imperative that we carry out good scientific method, and conduct ourselves in an ethical way. We must always keep in mind that the ultimate goal of our research is publication in scientific journals. Dissemination of the knowledge we gain is critical to the advancement of our field. I also value outreach and informal science education, both in the classroom and while engaging with the public. I expect you to participate in this component of our lab mission while you are part of the lab group.

**What I expect from you**
Another part of my job as a professor is to train and advise students. I must contribute to your professional development and progress in your degree. I will help you set goals and hopefully achieve them. However, I cannot do the work for you. In general, I expect you to:

**You will take ownership over your educational experience**
- Acknowledge that you have the primary responsibility for the successful completion of your degree. This includes commitment to your work in classrooms and the laboratory.
- You should maintain a high level of professionalism, self-motivation, engagement, scientific curiosity, and ethical standards.
- Ensure that you meet regularly with me and provide me with updates on the progress and results of your activities and experiments. Make sure that you also use this time to communicate new ideas that you have about your work and challenges that you are facing. Remember: I cannot address or advise about issues that you do not bring to my attention.
- Be knowledgeable of the policies, deadlines, and requirements of the graduate program, the graduate school, and the university. Comply with all institutional policies, including academic program milestones, laboratory practices, and rules related to chemical safety, biosafety, and fieldwork.
- Actively cultivate your professional development. UW–Madison has outstanding resources in place to support professional development for students. I expect you to take full advantage of these resources, since part of becoming a successful engineer or scientist involves more than just doing academic research. You are expected to make continued progress in your development as a teacher, as an ambassador to the general public representing the university and your discipline, with respect to your networking skills, and as an engaged member of broader professional organizations. The graduate school has a regular seminar series related to professional development.

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**Figure 2: Student Research Mentee Contract (e.g. Graduate)**
One example of a project conducted by an undergrad working under me near the end of my PhD studies is provided in Figure 3. This student was in a very different field than my own (Biological Engineering) but we were able to tap into his interests and fulfill an objective of our grant with a project we designed together. The student was interested in environmental research and was planning on working as an intern at a local waste water plant. With this in mind, I suggested a project to test the toxic effects of a mutagen on our crop of choice—potato. The idea of this project grabbed him and he independently conducted the background work to design and implement the experiment (Figure 3).

The experiment was a success and my mentee became involved with meetings with our grant collaborators to update them on his results. This is just one of the many great experiences I’ve had learning with undergrads and grads as a research mentor. Research mentorship was the gateway that led to my passion for teaching. Learning about students and then providing opportunities for them to explore their interests and share them is one of the reasons I work in research. I have found learning as much as possible about students is most important to engage them in research topics and learning more about them. This was evident with my Biology Engineering student who had little interest in the field we were working in but got excited about a specific project that overlapped with his interests. I have continued this approach with other aspects of teaching as I expanded from research mentorship to becoming a teaching assistant.
THEME II
Teaching Assistantship
My teaching assistantship started as a requirement of my PhD program but became a great opportunity to identify my weaknesses in communication and develop my skills in teaching. HRT/CSS 451 is a graduate level course typically comprised of equal numbers of undergrads and grad students. The course or its equivalent is required for a graduate program, but attracted undergrads from diverse backgrounds. Students attend once a week with an 80-minute lecture followed by a 2.5-hour lab in the afternoon. This exhausting schedule makes maintaining student attention during lectures difficult and even more challenging to keep them engaged in labs. My responsibilities as a teaching assistant were to give a lecture on one of the course topics (Figure 4) and conduct the lab portion of the course. My experience as a teaching assistant proved to be a great learning experience that I have had a chance to improve on with my experiences with Delta.

I found the lecture portion of my teaching appointment was more challenging than the lab portion. I took an approach to my lectures to make the concepts as simple as possible and provided homemade animations in my slides paired with primary literature (Figure 4). This approach was confusing for most students and I received plenty of questions for clarification of the material. Furthermore, some students wanted more detail but could not extract much information from the slides I provided, while others were completely lost. I was able to improve on this through a “microteaching” exercise I had through Delta (Artifact 5).

Delta requires a “College Classroom” course which provides foundational knowledge of a wide range of pedagogical theories, ideas, and practices. The course is designed for grad students and post-docs and focuses on learner-centered teaching environments. A microteaching exercise featured in the course provides an opportunity to test new teaching approaches on fellow students and receive feedback. For the exercise, a short (15 minute) microteaching lesson is prepared on any topic using a learner-centered approach. 5-10 minutes are allowed after the lesson for feedback and feedback is used to improve the lesson to be given again near the end.
of the course. Individual reflection is used to identify points of improvement and what was done to adjust for shortcomings.

For this microteaching exercise, I continued to improve on my lecturing approach by explaining elements of a lecture separately and bringing it all together with a concise figure rather than slide-by-slide animations (Figure 5). This included providing images depicting complicated steps explained previously in the lecture and tying them into the process using a diagram. The lecture was driven by student participation that included a “Think-Pair-Share” exercise. Based on the feedback I received, the lesson was quite effective and the class performed well on a short quiz I provided after each microteaching lesson to test their understanding of the material.

My first experience as a teaching assistant was truly a learning experience. I attempted to reach the exhausted class with oversimplified slide-by-slide animations and it fell flat. By participating in this microteaching exercise, I had the opportunity to test new teaching approaches and identify a method that allowed me to break down concepts and present them together in a concise fashion. I not only learned a new method to teach but also an effective method of testing teaching approaches with fellow educators.

Figure 5: Example slide from “How to make a GMO” Microteaching exercise.
THEME III
Teaching-as-Research
My teaching experiences as a research mentor and as a teaching assistant in grad school came together through my teaching-as-research project as a post-doctoral fellow. A teaching-as-research internship is required by Delta for certification and is an excellent experience to become a lifelong scholar of teaching.

Artifact 6: 
Teaching-as-Research Project

My teaching-as-research project was embedded within a new course at UW-Madison, HORT/AGRO 360. HORT/AGRO 360 is a course comprised of all undergrad students, primarily juniors and seniors studying natural sciences. Students attend 50-min lectures twice a week and have two writing assignment activities. My teaching-as-research project was to convert one of the writing assignments into a class debate, and I asked if the activity improved student confidence in the course objectives and changed beliefs about course material using pre- and post-surveys. The findings of the study were presented at the Teaching & Learning Symposium at UW-Madison in 2017 (Artifact 7). The following is a summary of the project followed by a Delta required reflection of the experience:

**Project summary:**

**Role playing and structured classroom debate to facilitate knowledge and understanding of the science, regulation and controversy of genetically modified crops**

Nathaniel M. Butler and Jeffrey B. Endelman

Department of Horticulture, University of Wisconsin, Madison, WI.

**ABSTRACT**

*Background:* Socio-scientific issues, such as genetically modified organisms (GMOs) can be challenging for students to understand and discuss given strong feelings they might have and the complexity of the subject (Healey 2012).

*Objective:* The aim of this study was to test if a structured classroom debate (SCD) exercise is effective for helping students analyze content and consider ethical issues in a course covering the science, regulation and controversy of GMOs (Hort/Agron 375).

*Subjects:* 25 undergraduate students, a majority seniors with natural science majors taking Hort/Agron 375 at the University of Wisconsin-Madison, in the Spring 2017.

*Methods:* Students were assigned to either side of a GMO-related debate topic (either “for” or “against”) and were allowed to assign “experts” within groups (each student was given an expert role). Experts within each group investigated sub-topics.
independently and created an expert report. Individual expert reports were then shared with the other members of the group and the opposing group and were used in group discussions. The products of group discussions were then used in a classroom debate in which experts from each group presented their evidence and were questioned by members of the opposing group and the class. Inter-group discussions followed the class debate that allowed experts from each group to finalize ideas and prepare for a final report which analyzes both sides of the debate. Worksheets were used to track attendance and facilitate group and class discussions. Pre- and post-surveys were given before and after the debate activity for data collection.

**Results:** There were no significant differences in student confidence in course learning objectives or beliefs concerning GMOs. However, confidence was increased for all course learning objectives, most notably in confidence about discussing GMOs. Moreover, student opinion of the effectiveness of the assignment for improving learning also increased after the activity. Interestingly, students seemed more opinionated about the subject after the exercise, favoring pro-GMO views that agreed with voting conducted after the class debate.

**Conclusions:** Structured classroom debates (SCD) and role playing provide useful tools to engage students in controversial subjects and improve confidence in course materials.

**INTRODUCTION**

Student understanding and ability to discuss socio-scientific issues (SSIs) is important to prepare students for their careers as well as contributing citizens in society. Studies have shown that STEM (Science, Technology, Engineering, and Mathematics) students are less able to discuss socio-scientific issues (SSIs) than social science students, even though they have taken more STEM courses (Christenson, et al. 2014). This gap in STEM student understanding of SSIs prevent their engagement with current scientific developments, their applications, and the philosophical and ethical issues involved, which is a benchmark for STEM students (QAA 2015). Previous studies have shown that student understanding of GMOs in particular is lacking among college students and typically results in “clear-cut” opinions about GMOs (AbuQamart, et al., 2015). At the college level, teaching SSIs can be challenging since students typically hold personal feelings and these predispositions can prevent students for learning new content or considering opposing sides of the subject. Furthermore, the complexity of SSIs can make topics difficult to understand and take-away information. (Healey 2012).

SCDs provide a useful approach to address socio-scientific issues in the classroom by encouraging student participation, critical thinking, and analysis (Healey 2012). For example, a previous study was carried out where academic debating was used by comparing email-based debate to face-to-face debate in an argumentation course (Marttunen and Laurinen, 1999). Pre- and post-tests showed that compared to the control group, the email-based debate group improved in their ability to choose relevant grounds while the face-to-face group improved in putting forward
counterarguments, which is an important attribute for discussion and retention. In another study, undergraduate STEM students from two cohorts, one that emphasized debate (Cohort 2) and another that emphasized lectures (Cohort 1), were compared in their ability to articulate SSIs in a bioethics course (Figure A; Loike et al., 2013). The cohort with SCDs were substantially more capable of articulating SSIs than the non-SCD cohort in all four bioethical principles, demonstrating the importance of debate and discussion for teaching SSIs.

![Figure A](image-url) Bioethical principles cited in student responses and significant differences between student cohorts who had more class time for discussion (Cohort 2; 75% class time devoted to discussion) compared to cohorts who had less class time for discussion (Cohort 1; 25%) (Loike et al., 2013).

SCDs are exercises in which groups of students debate in class an issue provided in advance. This requires students to conduct research outside of class both individually and as a group, and be capable of discussing the subject during the class debate and reflect afterwards. In addition to critical thinking, SCDs promote students’ learning basic research techniques, developing logical argumentation, improving writing and oral communication skills, and applying course content (Oros 2007). Role playing is a useful compliment to SCDs by giving a real-life situation as the subject of the debate and assigning roles to individuals of each group. The incorporation of role playing gives students purpose for investigating and defending the topic, exposure to a real-life application of the course material, and promotes critical reflection (Belova et al., 2013). SCDs incorporating role playing provides a useful platform to teach about GMOs and accomplish the course objectives of applying course material and understanding ethical issues.

**Teaching-As-Research Questions**

The present study was designed to answer the following Teaching-as-Research questions:

1) Do SCDs improve student understanding of controversial subjects, such as GMOs?
2) Do SCDs affect student beliefs about controversial subjects, such as GMOs?

We hypothesized that students would improve their understanding of GMOs by participating in the SCD and would be become less opinionated, having the opportunity to evaluate both arguments.

**METHODS**
Students in Hort/Agro 360 (Spring 2017 cohort) were used as subjects for the study. HORT/AGRO 360 is a course comprised of all undergrad students, primarily juniors and seniors studying natural sciences. Students attend 50-min lectures twice a week and have two writing assignment activities. Project implementation began after spring break following the mid-term exam and the first writing assignment (Figure B).

**Figure B.** Time-line for implementing teaching-as-research project and Written Assignment #2 activity.

The second writing assignment (Written Assignment #2) is intended to give students an opportunity to synthesize course material and was used for implementing the project. Written Assignment #2 is a written report individual students complete in which they provide a perspective on the GMO controversy, by using course material as evidence. The project was implemented by providing a SCD activity which included role playing, guided group discussions, and a class discussion in addition to the written report. Project implementation began with students taking a Pre-survey. Student were then provided with a list of four controversial topics with supporting statements:

1. **Pesticide safety**: GMO crops have had a beneficial impact on pesticide use.
2. **Food/feed safety**: GMO crops may not be healthy for humans or animals to eat.
3. **Socio-economic impacts**: GMO crops have had negative socio-economic impacts.
4. **Laws/Regulation**: U.S. laws and regulations for GE crops are not sufficient.

Students were allowed to indicate their preferences for each topic/statement. Based on these preferences, four students were assigned to each side of the topic/statement, either “for” or “against.” For example, two groups were assigned to Pesticide safety. The “for” group would argue the statement as written while the “against” group would argue the opposing view of the statement (i.e., GE crops have not had a beneficial impact on pesticide use.”)

Once groups were created, class time was provided to the students to organize and assign “expert” roles within the group. Experts investigated sub-topics/statements that
supported the overall group topic/statement. For example, the Pesticide safety “for” group had experts covering the following subtopics/statements:

1. GMO crops have had a beneficial impact on herbicide usage, as it affects human safety.  
2. GMO crops have had a beneficial impact on herbicide usage, as it affects other organisms.  
3. GMO crops have had a beneficial impact on insecticide usage, as it affects human safety.  
4. GMO crops have had a beneficial impact on insecticide usage, as it affects other organisms.

Once experts were assigned, student were given two weeks to investigate their topics/sub-topics and write a 1-2 page report providing the background and evidence supporting their statement. Students were encouraged to work together outside of class but were not required to do so. After complete expert reports were turned in, they were distributed to fellow group members and members of the opposing group. Students were then given a second class period to discuss the findings of their research and develop an argument to use during the class debate. Worksheets were provided for both group meetings and the SCD to facilitate discussion and track participation. The SCD was done over two class periods as experts from each group presented their evidence and advocated for their position. The class and members of the opposing group were allowed to question the presenting group and an overall class discussion was held once both sides had presented. During the debate, students were asked to vote for the most convincing argument or if undecided, vote for both groups. A post-debate group discussion was also held to allow opposing groups to discuss evidence from the debate and expert reports to write final reports.

The final report required that students give expert evidence from at least one other sub-topic/statement within the group’s topic, provide the opposing group’s argument with supporting evidence, and give an analysis of the debate. A post-survey was given to students after the debate was held and was paired with pre-surveys using anonymous identifiers.

RESULTS
Out of the 32 students enrolled in the class, 25 participated in the SCD and provided both pre- and post-surveys.
14 out of the 25 students were seniors (56%), 8 out of the 25 students were juniors (32%), and the remaining 3 students were either freshman, sophomore, or other (Figure C).

12 out of the 25 students were studying natural sciences (48%), 8 out of the 25 students were studying applied sciences (32%), and the remaining 3 students were studying either humanities, social studies, or other (Figure D).
Student demographics by GPA used in teaching-as-research project. n=25.

18 out of the 25 (72%) held GPAs of 3.00 or higher while the remaining 7 (28%) held GPAs ranging from 2.00 to 2.99 (Figure E). Overall, the class was comprised mostly seniors or juniors studying natural or applied sciences with GPAs of 3.00 or higher.

Which activity is most effective at promoting learning?

Figure E. Student feedback of most effective learning activities (pre-survey) and after (post-survey) the SCD activity. Error bars=standard error. n=25.

When asked to rank from 1-5 (5-Most) “which activity is most effective at promoting learning,” students did not change their opinion about lectures, the preferred activity before and after the SCD (Figure F). However, the largest change observed was for “writing assignment” where there was an average increase from a rank of 2.6 to 3.12. This suggests that although lectures are preferred by students in the class, the SCD activity improved student opinion of the effect of the writing assignments on promoting learning.

A similar effect was seen with student confidence in the course objectives.
The course objectives were:

• Explain how GMOs are made and compare genetic engineering with other plant breeding methods (Figure G, “Science.”)
• Describe federal and state laws and regulations about GMOs (Figure G, “Laws/regulations.”)
• Describe how litigation has been used to advance and obstruct the use of GMOs (Figure G, “Court cases”).
• Evaluate arguments both for and against the safety and sustainability of GMOs (Figure G, “Arguments”).

When students were asked to rank their confidence in the course objectives from 1-5 (5 Most), increases were seen for every course objective following the SCD activity (Figure G). Furthermore, the largest change observed was for “Discussing GMOs” where there was an average increase from a rank of 3.64 to 4.0. This suggests that the SCD activity had an overall positive effect on student confidence in course materials and in particular, discussing GMOs which was most relevant to the SCD.

During the debate, students were asked to vote for which argument they found most persuasive and to vote for both if they were undecided. Across the topics/statements, exactly 53 votes were cast for each the “for” and the “against” arguments (106 total votes) (Table 1). Although the pro-GMO argument failed to get the majority of votes for the Pesticide safety topic/statement (9 versus 17), the remaining pro-GMO arguments did get the majority of the votes (15 versus 13, Food/feed; 15 versus 12, Socio-economic; 14 versus 11; Laws/regulations).

Table 1. Student voting for “for” or “against” arguments (right column) within four controversial topic areas (left column) during the SCD. Students could vote for either
“for” or “against” or both if undecided. Underlined and bolded text indicates a majority of votes. n=27.

<table>
<thead>
<tr>
<th>Topic</th>
<th>For</th>
<th>Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticide Safety</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>GE crops have had a beneficial impact on pesticide use.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food/feed</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>GE crops may be healthy for humans and animals to eat.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio-economic</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>GE crops have had a positive socio-economic impact.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laws/regulations</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>U.S. laws and regulations for GE crops are sufficient.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>53</td>
<td>53</td>
</tr>
</tbody>
</table>

**Figure H.** Student beliefs about GMOs before (pre-survey) and after (post-survey) the SCD activity. Error bars=standard error. n=25. Survey test questions adapted from Bal et al., 2007.

The pro-GMO beliefs of the students were also reflected in the pre/post-survey data where there was a shift from being unsure about GMO safety to being pro-GMO after the SCD (Figure H). This shift in student belief may be due to persuasiveness of the scientific evidence used by the pro-GMO groups and the majority of students coming from natural and applied science backgrounds.

**CONCLUSION**

SCD with role playing provides a useful activity for educators to motivate students and give them confidence with course materials covering controversial subjects. This was demonstrated with an improvement in student confidence across all course learning objectives, and in particular, the objective most relevant to the SCD (Figure G). The positive reception of the activity by the students was also reflected in their opinion of the category of the activity and its role in promoting learning (Figure F). Interestingly, the SCD seemed to make the students more opinionated and support GMO views which could be due to a combination of the activity and their STEM educational backgrounds.
Student learning also improved based on observations in the classroom during discussions and group work. The exchange of ideas between students and as a class seemed to improve student understanding of the material and gave them confidence with the positions they were taking. However, some of this discussion time was wasted and could be improved by reinforcing accountability for participation in group and discussion activities by grading worksheets and increasing points allocated to worksheets.

Overall, the data from this project reinforce the importance of group work and discussion for teaching controversial subjects. Student predispositions can hinder learning of new material if they conflict. Giving students the opportunity to research opposing sides and “air” these predispositions within the classroom can reduce the effects of these predispositions on learning and improve student confidence in material (Figure G). Role playing worked well in this context by not allowing students to act on their predispositions by picking a position they are most comfortable with. SCD and role playing activities seem to work well together to this end and possibly would be beneficial for teaching other controversial subjects.

REFERENCES


Reflection:

As part of the Delta internship, I was asked to provide a reflection about how my project applied the three Delta Pillars.

**Teaching-as-Research**

Teaching-as-research (TAR) is an effective method for gaining insight on the efficacy of different teaching exercises and approaches by collecting and analyzing data from students. My project applied TAR by considering student demographics while interpreting data. Furthermore, pairing pre-/post-survey data allowed connections to be made with individual students and to follow them through the activity.

My internship experience influenced my understanding of teaching-as-research by allowing me to test teaching theory and design and implement a teaching-as-research project. There needed to be a few critical pieces in place before the project would be a success. First, I needed to learn about teaching theory and ways to improve teaching. This was made available through the Teaching in the College Classroom course and was imperative for me to come up with the idea for the project. Second, I needed feedback from other interns conducting teaching-as-research projects to refine my proposed project. This was provided through the Delta Internship Seminar and was invaluable for planning the project and implementing it effectively. Lastly, I needed an internship partner that had practical teaching experience that could help me work the project into his course. This was provided by my internship partner, Jeffrey Endelman who provided much needed input on adjusting the project so that it would be most effective for his course. Having the opportunity to work through these steps has given me a much better understanding of teaching-as-research.

**Learning Community**

Learning communities provide a social network for students and instructors to learn from one another and further explore course topics outside of class. This was a key concept for implementing my project since students were asked to work within groups and analyze their individual research amongst themselves. The group learning community was broadened as part of the structured classroom debate where students shared the findings of their research and incorporated input from the class to complete the assignment.

In addition to implementing my project, I relied on a learning community to design the project and analyze data. The Internship seminar was central to this community and I found it very useful to share ideas about projects and troubleshoot problems. This was critical for me to practically think through every aspect of implementation, ranging from designing the activity to designing tools for collecting data. Survey development was a critical element of the project that I relied on fellow interns to both design and test pre and post-surveys. It was also useful to talk to other interns outside of class and participate in learning community activities. Learning communities are essential tools in teaching and proved to be very helpful for my teaching-as-learning project.

**Learning-through-Diversity**

Learning-through-diversity is an approach to teaching that involves many different ways of delivering and assessing material which allows students from many different backgrounds to think about and explore course material. My project aimed to broaden the teaching approaches use in the course to reach students that learn through interaction and discussion. Interestingly,
the majority of students seemed to prefer lecture-style teaching methods but there was an increase in preference for other types of assignments, including the one used as part of the project.
As far as demographics go, the class was not very diverse in terms of class status and field of study. However, during the debate, students with very different views were able to voice their opinions and share their ideas about the subject. Some students were assigned to groups supporting their own personal views while others were assigned to groups opposing their views. This was a great opportunity for the students to see another perspective and sympathize with others that might oppose their own views. This was carried through to the final report which asked the students to present not only their view but the opposing view and discuss which they found most convincing and why. Identifying diversity is not only useful for teaching but could be effective for students to better learn material and understand different perspectives.

**Artifact 7:**
**Teaching & Learning 2017 Symposium**

The Teaching and Learning Symposium is held annually at the UW-Madison to give an opportunity for the teaching and learning community to share teaching practices, accomplishments, and new learning and teaching methods. The event attracts speakers from across the state and features a poster session. I had the opportunity to present my Teaching-as-Research project results at the poster session (Figure 6) and interact with other presenters and educators. Participating in the Teaching and Learning Symposium was a great opportunity to become familiar with other Teaching-as-Research projects and one project in particular drew my interest.

The NSF has experimented with different programs to partner scientists with K-12 educators. The general objectives of these programs are to empower educators and motivate students to learn by bringing scientists into the classroom. The involvement of scientists in the classroom gives educators confidence in the material they are teaching and also provides a role model for the students. The teaching-as-research project I was interested in asked if these programs are effective and if they should be continued.

This teaching-as-research project really spoke to me based on my interests in connecting teaching to the real world. Similar to shadowing, giving students the opportunity to interact with working professionals gives them tangible goals for applying their knowledge and pursuing different career tracks. The earlier and more frequently these interactions occur—the better. However, college students also can benefit greatly by having more interactions with working professionals and it has given me something to work towards in terms of course design and incorporating these interactions as central course materials. Learning about this project and others at the Teaching and Learning Symposium was an excellent opportunity to network and explore other areas of education as well as share my own teaching-as-learning experience.
Figure 6: Poster for Teaching-as-Research project presented at the 2017 Teaching & Learning Symposium at UW-Madison.
Delta requires certificate recipients to complete a CIRTL Learning Outcomes Matrix in order to align their experiences with the CIRTL learning outcomes. The following is my CIRTL Learning Outcomes matrix:

### CIRTL Learning Outcomes Matrix

#### Associate Level

<table>
<thead>
<tr>
<th>Teaching As-Research Associates can do the following:</th>
<th>How this outcome was met:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe how to access the literature and existing knowledge about teaching and learning issues, in a discipline or more broadly.</td>
<td>Existing knowledge was a core component of the College Classroom course and I assessed and researched literature as part of my teaching-as-research project and Internship (Artifact 6).</td>
</tr>
<tr>
<td>Define and recognize the value of the Teaching-as-Research process, and how it can be used for ongoing enhancement of learning.</td>
<td>These concepts were incorporated in the College Classroom course I took as well as the Internship (Artifact 6).</td>
</tr>
<tr>
<td>Describe a “full-inquiry” cycle.</td>
<td>This was addressed during the Internship (Artifact 6).</td>
</tr>
<tr>
<td>Describe how the integration of Evidence-Based Teaching, Learning Communities and Learning-through-Diversity within Teaching-as-Research can be integrated to implement and advance effective teaching practices for diverse learners.</td>
<td>This was addressed in the reflection for the teaching-as-research project and Internship (Artifact 6) and presentation at the Teaching and Learning Symposium 2017 (Artifact 7).</td>
</tr>
</tbody>
</table>

#### Evidence-Based Teaching

<table>
<thead>
<tr>
<th>How this outcome was met:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe and recognize the value of realistic well-defined, achievable, measurable and student-centered learning goals.</td>
</tr>
<tr>
<td>Describe several known high-impact, evidence-based effective instructional practices and materials and recognize their alignment with particular types of learning goals.</td>
</tr>
<tr>
<td>Describe several assessment techniques and recognize their alignment with particular types of learning goals.</td>
</tr>
</tbody>
</table>
## Associate Level continued

<table>
<thead>
<tr>
<th>Learning Communities</th>
<th>How this outcome was met:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associates can do the following:</td>
<td></td>
</tr>
<tr>
<td>Describe and recognize the value of learning communities, and how they impact student learning.</td>
<td>This outcome was met through the Internship Seminar and College Classroom course as well as through implementation of my teaching-as-research project (Artifact 6) and presentation at the Teaching and Learning Symposium 2017 (Artifact 7)</td>
</tr>
<tr>
<td>Describe several techniques for creating a LC within a learning environment, including strategies that promote positive interdependence between learners so as to accomplish learning goals.</td>
<td>This was a common theme among the Delta courses I took, including College Classroom and Effective Teaching with Technology.</td>
</tr>
<tr>
<td>Describe several techniques and issues of establishing LCs comprising a diverse group of learners.</td>
<td>This was implemented during my teaching-as-research project (Artifact 6) as well covered in the College Classroom and Effective Teaching with Technology courses.</td>
</tr>
<tr>
<td>Recognize the value of and participate in local professionally focused learning communities associated with teaching and learning.</td>
<td>This was addressed during the Internship Seminar when we were asked to lead a discussion and host a learning community event. Also, presenting at the Teaching and Learning Symposium 2017 (Artifact 7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning through Diversity</th>
<th>How this outcome was met:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associates can do the following:</td>
<td></td>
</tr>
<tr>
<td>Describe the scope of diversity in learning environments, of both students and instructor. Including but not limited to backgrounds, race, gender, ability, socioeconomic status, ethnicity, gender preference, and cognitive skills.</td>
<td>There were important concepts in the College Classroom course and Research Mentorship seminar.</td>
</tr>
<tr>
<td>Describe the impact of diversity on student learning, in particular how diversity can enhance learning, and how inequities can negatively impact learning if not addressed.</td>
<td>This was an important component to my teaching assistantships where student diversity in learning styles was an important element in my teaching approach (Artifacts 4 and 5)</td>
</tr>
<tr>
<td>Describe how an instructor’s beliefs and biases can influence student learning.</td>
<td>This was an important consideration when constructing an Individual Development Plan and Student Research Mentee Contract (Artifacts 1 and 2) as well as conducting the undergraduate research project (Artifact 3).</td>
</tr>
<tr>
<td>Describe and recognize the value of drawing on diversity in the development of teaching plans (including content, teaching practices and assessments) to foster learning.</td>
<td>This was central to my teaching-as-research project (Artifact 6) and was covered extensively with syllabus development in the College Classroom course.</td>
</tr>
<tr>
<td>Describe several learning-through-diversity (LtD) techniques and strategies.</td>
<td>These techniques were described in both the Internship Seminar as well as the College Classroom course.</td>
</tr>
</tbody>
</table>
## Practitioner Level

<table>
<thead>
<tr>
<th>Teaching -As-Research</th>
<th>How this outcome was met in the Delta Certificate:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practitioners can do the following:</td>
<td>These were important for developing my teaching-as-research project (Artifact 6).</td>
</tr>
<tr>
<td><strong>Develop and execute a Teaching-as-Research plan for a limited teaching and learning project</strong></td>
<td></td>
</tr>
<tr>
<td>- Find and critically consider the literature and existing knowledge associated with the teaching and learning project</td>
<td></td>
</tr>
<tr>
<td>- Create realistic well-defined, achievable, measurable and student-centered learning goals for the teaching and learning project.</td>
<td></td>
</tr>
<tr>
<td>- Find or develop assessment (measurement) tool(s) that are aligned with the learning goals of the teaching and learning project.</td>
<td></td>
</tr>
<tr>
<td>- Develop a teaching plan (a hypothesis) to accomplish learning goals.</td>
<td></td>
</tr>
<tr>
<td>- Implement the teaching plan and collect some data regarding achievement of learning goals.</td>
<td></td>
</tr>
<tr>
<td>- Analyze the data and draw evidence-based conclusions about the impact on student learning.</td>
<td></td>
</tr>
<tr>
<td>- Complete a full-inquiry cycle for the teaching and learning project by using findings to suggest improvements to the above actions</td>
<td></td>
</tr>
<tr>
<td><strong>Show the integration of Evidence-Based Teaching, Learning Communities and Learning-through-Diversity to accomplish learning goals.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Evidence -Based Teaching</strong></td>
<td></td>
</tr>
<tr>
<td>Practitioners can do the following:</td>
<td></td>
</tr>
<tr>
<td><strong>Access the literature and existing knowledge to develop a deeper understanding of existing evidence-based knowledge concerning high-impact, evidence-based teaching practices.</strong></td>
<td>This important preparation was used for designing my teaching-as-research project (Artifact 6) and within the Internship Seminar.</td>
</tr>
<tr>
<td><strong>Integrate one or more evidence-based teaching strategies into a teaching plan so as to accomplish learning goals.</strong></td>
<td>This was a core concept of my teaching-as-research project and Delta internship (Artifact 6).</td>
</tr>
<tr>
<td><strong>Implement one or more evidence-based teaching strategies for students in a learning experience.</strong></td>
<td>My teaching-as-research project implemented individual, group and class-wide work activities to enrich the student’s learning experience (Artifact 6).</td>
</tr>
</tbody>
</table>
## Practitioner Level continued

<table>
<thead>
<tr>
<th><strong>Learning Communities</strong></th>
<th><strong>How this outcome was met in the Delta Certificate:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Practitioners can do the following:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Access the literature and existing knowledge to develop a deeper understanding of the knowledge concerning LCs and their impact on student learning.</strong></td>
<td>This knowledge of literature was used for preparation of my teaching-as-research project (Artifact 6).</td>
</tr>
<tr>
<td><strong>Integrate one or more LC strategies into a teaching plan so as to accomplish learning goals and learning-through-diversity.</strong></td>
<td>I drew upon this strategy during my teaching assistantship (Artifacts 4 and 5) and teaching-as-research project (Artifact 6).</td>
</tr>
<tr>
<td><strong>Implement one or more LC strategies for students in a learning experience.</strong></td>
<td>This was important during my teaching assistantship (Artifacts 4 and 5) and teaching-as-research project (Artifact 6).</td>
</tr>
<tr>
<td><strong>Contribute to local professionally-focused learning communities associated with teaching and learning.</strong></td>
<td>I conducted a Research Mentorship workshop (11/29/16) and presented my teaching-as-research project through a poster at the Teaching &amp; Learning Symposium at UW-Madison (3/17/17) (Artifact 7).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Learning through Diversity</strong></th>
<th><strong>How this outcome was met in the Delta Certificate:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Practitioners can do the following:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Access the literature and existing knowledge to develop a deeper understanding of diversity and its impact on accomplishing learning goals.</strong></td>
<td>This knowledge of literature was used for preparation of my teaching-as-research project (Artifact 6).</td>
</tr>
<tr>
<td><strong>Examine and describe own beliefs and biases, including how they may influence their students' learning.</strong></td>
<td>This was implemented during my teaching-as-research project (Artifact 6) as well covered in the College Classroom and Effective Teaching with Technology courses.</td>
</tr>
<tr>
<td><strong>Determine the diverse backgrounds among a group of students, and consider the opportunities and challenges of the findings on each student's learning.</strong></td>
<td>These were important themes the in the College Classroom course as well as the Internship Seminar.</td>
</tr>
<tr>
<td><strong>Create a teaching plan that incorporates content and teaching practices responsive to the students' backgrounds.</strong></td>
<td>I accomplished this through development of my Individual Development Plant and Student Research Mentee Contract (Artifacts 1 and 2), as well as designing a syllabus for the College Classroom course.</td>
</tr>
<tr>
<td><strong>Integrate one or more LtD techniques and strategies in a teaching plan so as to use students' diversity to enhance the learning of all.</strong></td>
<td>These were important concepts in the College Classroom course as well as Effective Teaching with Technology. I demonstrated these through a syllabus exercise.</td>
</tr>
<tr>
<td><strong>Implement one or more LtD strategies in a teaching experience.</strong></td>
<td>This was most evident in my teaching-as-research project and Internship (Artifact 6).</td>
</tr>
</tbody>
</table>
## Appendix A: Pre-Survey

Survey given to students before participating in the teaching-as-research project (*Artifact 6*).

This questionnaire is voluntary and will not be shared with Dr. Endelman or have any impact on your grade.

Write the last 2 digits of your phone number, followed by the digits of your house address (e.g. 09-1234) in the box below. This will be used as an anonymous identifier.

**Instructions:** Please fill in one box that reflects your views for each following statement.

1. Genetic engineering improves human life.
   - Agree [ ] Not Sure [ ] Disagree [ ]

2. Genetic engineering can provide opportunities for new discoveries.
   - Agree [ ] Not Sure [ ] Disagree [ ]

3. The genetic engineering studies with plants are beneficial to people.
   - Agree [ ] Not Sure [ ] Disagree [ ]

4. Gene transfer from animals to plants can make plants more animal-like.
   - Agree [ ] Not Sure [ ] Disagree [ ]

5. It is acceptable to express recombinant proteins in sheep.
   - Agree [ ] Not Sure [ ] Disagree [ ]

6. Transfer of carcinogenic (cancer) genes to mice with a medical aim is acceptable.
   - Agree [ ] Not Sure [ ] Disagree [ ]

7. Foods that contain genetically engineered products can be sold without giving any information to the consumer.
   - Agree [ ] Not Sure [ ] Disagree [ ]

8. It is acceptable to express recombinant proteins in corn.
   - Agree [ ] Not Sure [ ] Disagree [ ]

9. It is acceptable to produce vaccines in plants for medical uses.
   - Agree [ ] Not Sure [ ] Disagree [ ]

10. Transgenic organisms are a risk to the environment.
    - Agree [ ] Not Sure [ ] Disagree [ ]

(continued on back)
**Instructions:** Rank your confidence from 1 to 5 (1= Most, 5= Least) by filling in one box for each of the following statements.

1. I can explain how GMOs are made and compare genetic engineering with other plant breeding methods.
   
   [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

2. I can describe federal laws and regulations about GMOs.
   
   [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

3. I can explain how litigation has been used to advance and obstruct the use of GMOs.
   
   [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

4. I can evaluate arguments for and against the safety and sustainability of GMOs.
   
   [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

5. I'm confident with discussing GMO issues with friends and family.
   
   [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

---

**Instructions:** Please fill in one box for each of the following statements.

1. The following best describes my class year at UW-Madison.
   - [ ] Freshman
   - [ ] Sophomore
   - [ ] Junior
   - [ ] Senior
   - [ ] Other: _____________________

2. The following best describes my academic discipline at UW-Madison.
   - [ ] Arts (Performing arts, visual arts)
   - [ ] Humanities (Geography, history, language, theology)
   - [ ] Social Studies (Economics, law, political science, psychology, sociology)
   - [ ] Natural Sciences (Biology, chemistry, earth and space sciences, mathematics, physics)
   - [ ] Applied Sciences (Agriculture, computer science, engineering and technology, medical and health sciences)
   - [ ] Undecided
   - [ ] Other: _____________________

3. The following best describes my current GPA at UW-Madison.
   - [ ] 1.50-1.99
   - [ ] 2.00-2.49
   - [ ] 2.50-2.99
   - [ ] 3.00-3.49
   - [ ] 3.50-4.00
   - [ ] Other: _________________
Appendix B: Post-Test
Survey given to students after participating in the teaching-as-research project (Artifact 6).

This questionnaire is voluntary and will not be shared with Dr. Endelman or have any impact on your grade.

Write the last 2 digits of your phone number, followed by the digits of your house address (e.g. 09-1234) in the box below. This will be used as an anonymous identifier.

Instructions: Please fill in one box that reflects your views for each following statement.

1. Genetic engineering improves human life.

   Agree  Not Sure  Disagree

2. Genetic engineering can provide opportunities for new discoveries.

   Agree  Not Sure  Disagree

3. The genetic engineering studies with plants are beneficial to people.

   Agree  Not Sure  Disagree

4. Gene transfer from animals to plants can make plants more animal-like.

   Agree  Not Sure  Disagree

5. It is acceptable to express recombinant proteins in sheep.

   Agree  Not Sure  Disagree

6. Transfer of carcinogenic (cancer) genes to mice with a medical aim is acceptable.

   Agree  Not Sure  Disagree

7. Foods that contain genetically engineered products can be sold without giving any information to the consumer.

   Agree  Not Sure  Disagree

8. It is acceptable to express recombinant proteins in corn.

   Agree  Not Sure  Disagree

9. It is acceptable to produce vaccines in plants for medical uses.

   Agree  Not Sure  Disagree

10. Transgenic organisms are a risk to the environment.

    Agree  Not Sure  Disagree

(continued on back)
Instructions: Rank your confidence from 1 to 5 (1= Most, 5= Least) by filling in one box for each of the following statements.

1. I can explain how GMOs are made and compare genetic engineering with other plant breeding methods.

2. I can describe federal laws and regulations about GMOs.

3. I can explain how litigation has been used to advance and obstruct the use of GMOs.

4. I can evaluate arguments for and against the safety and sustainability of GMOs.

5. I’m confident with discussing GMO issues with friends and family.

Suggested changes for Written Assignment #2:

Comments about Nathan as an assistant instructor:
Appendix C: Student feedback from Teaching-as-Learning project

“Wish we had a chance to interact with Nathan more and hear about his research. He is a good assistant.”

“Good at explaining the assignment and does well instructing the class.”

“Very helpful; asks good, challenging questions.”

“Very clear in all of his directions in class.”

“I like the group aspect of (Written) Assignment 2, lots of opportunity for feedback/collaboration.”

“Good at asking questions to inspire good discussion.”

“Good organization for the assignment.”

“Good at clarifying things and helpful.”

“Really helpful via email and outside of class and good development of the Writing Assignment (2) and other related activities”

“Enthusiastic, patient, thorough.”

“Clear in his instructions. Kind.”

“Well-done. Always was knowledgeable and prepared to address any answers we had with the assignment.”