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Essay

Educating Young Educators: A Pedagogical Internship for Undergraduate Teaching Assistants

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Although undergraduates have long held a role as teaching assistants for introductory science courses at liberal arts colleges and universities, educational institutions often do not provide these students with opportunities to explore science teaching and pedagogy. At Brandeis University, we designed an internship course to help increase the motivation, understanding, and knowledge of teaching pedagogy for undergraduate teaching assistants that is offered concurrently with their teaching responsibilities. Weekly sessions with faculty mentors are guided by readings in current science education literature, and throughout the semester students are asked to develop new course material based on the pedagogical frameworks discussed. To evaluate the effectiveness of this course, we surveyed students at the close of the semester. We found an overall increase in student confidence levels with regard to teaching and better awareness of the difficulties faced in science education. All students who participated in the course expressed interest in participating in future educational internships. We believe that the Educating Young Educators internship has the potential to be a catalyst for personal and professional growth from a novice into an informed young educator.

INTRODUCTION

In many research institutions, we often do not appropriately support effective and dynamic undergraduate science education. Educators are held in high esteem as the agents of change for our youth, but they are unfortunately resistant to changing their teaching styles and practices (Handelsman *et al*., 2004). Over the past decade, undergraduate educators have recognized the need to shift the theoretical framework of their field, although changes are only slowly coming into practice (Pfund *et al*., 2009). Scientists gain respect and recognition in their field by attending conferences, presenting posters, and publishing primary literature. When expected to teach, however, scientists are often placed into classrooms without proper mentoring or training. Educational researchers have begun to recognize that an ability to educate in the sciences is not inherent and must be cultivated. In 2003, the National Research Council (NRC) published the report Bio2010, Transforming Undergraduate Education for Future Research Biologists, identifying the need for a paradigm shift in undergraduate science education and highlighting the need for expanded teacher education training (NRC, 2003). Several institutes and training opportunities have been developed to assist faculty at research institutions in improving their teaching styles, including the National Academies Summer Institute on Undergraduate Education (Pfund *et al*., 2009). The Preparing Future Faculty Program launched by the Council of Graduate Schools and the Association of American Colleges and Universities has similarly begun programs to train and mentor graduate students in the field of science teaching and education (Pruitt-Logan *et al*., 2002). Despite these efforts, large gaps still exist in the training of traditional science students interested in teaching at the undergraduate level.

Advances in effective teaching methodologies in undergraduate science, technology, engineering, and mathematics (STEM) education have long been discussed. Recently, the NRC held workshops highlighting the best practices in STEM education (reviewed in Labov *et al*., 2009). These best practices included topics such as concept-based teaching, the use of case studies, and the use of effective assessment strategies (Alparslan, 2003; Garvin-Doxas, *et al*., 2007). These

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practices should be emphasized and demonstrated effectively to future science teachers including those students currently serving as undergraduate teaching assistants (UTAs). Data demonstrate both the importance of a cohesive teacher–student relationship to educator development and the deconstruction of that model to a nonhierarchical educator–learner dynamic. Explicit instruction in the theory, practices, and behaviors of effective science educators is critical to achieving the objective of a progressing science educator workforce (Gibbs and Coffey, 2004). Emphasis on the mentorial role of faculty in the perpetuation of these theories and on a passion for education is a necessity in this changing environment. There is widespread support for a focused reformation in the classroom environment as a root intervention to promote more effective education. Pickering (2003) suggests that such change must take place through educator empowerment, providing teachers with the autonomy to be decision-makers, and to develop their own theory of practice.

Undergraduates have long held a role in teaching at liberal arts colleges and universities. They teach for a variety of reasons, including but not limited to: solidification of knowledge, resume building, personal edification, or an interest in a career in education. We believe that the importance of this role is sevenfold: 1) peer-to-peer educational communication can facilitate increased communication between students and faculty (Jabker and Rives, 1974); 2) student-teachers are actively seeking a mentor–mentee relationship and thus can be easily engaged and exposed to educational habits that foster optimal student learning (Prawat, 1992); 3) the challenge of learning the basics of pedagogical theory and practice is eased by doing so in an area with which the young educator is previously well versed (e.g., a class that they have completed in the recent past); 4) creating a conduit for recruitment and proceeding development of young science teachers will increase the innovative capacity of science education; 5) student-teachers allow for increased personalization of education as shown in the case of supplemental instruction sessions (Stone and Jacobs, 2008); 6) by serving as advocates for students to faculty, UTAs increase cohesion in the classroom; and 7) to optimize young teacher educational programs, the novice must be engaged in authentic teaching tasks under the guidance of an expert practitioner; pseudoteaching practices such as role playing and artificial classrooms are insufficient (Brown *et al*., 1989; Ball and Cohen, 1999).

Many teaching assistants (TAs), however, lack sufficient training and supervision (Prieto and Altmaier, 1994). Very little research in TA training is aimed at defining a theoretical model, and few models of training or supervision exist (Prieto *et al*., 2001). In addition, it has been shown that student perception of learning is higher when more prepared and high-quality teaching students are involved in undergraduate biology courses (Casem, 2006). Structured comprehensive TA training programs will enhance the learning experience for students enrolled in TA-facilitated courses and will increase the odds that student-teachers will move into the professoriate.

We are particularly interested in targeting the undergraduate student cohort currently engaged as TAs in the introductory biology laboratory course at Brandeis University. Historically, these students have been asked to instruct their peers with minimal exposure to educational pedagogy and have not been provided training on how to present or explain material in the classroom. The Educating Young Educators Internship (ED92a) was designed to give undergraduate students teaching experience; provide an introduction to evidence-based practices, popular techniques and contemporary educational philosophies used to teach science and biology; and inspire them to think more critically about teaching and learning during their time as TAs. It is our belief that by nurturing young educators, providing didactic exposure to pedagogy in parallel with structured and mentored teaching experience, we may impart useful educational theory and practice upon future generations of teachers at the college level. Through this case study, we intend to demonstrate the validity of such programs and to highlight their importance in a changing educational world.

THE UNDERGRADUATE BIOLOGY LABORATORY COURSE

Undergraduate students at Brandeis University are taught introductory biology laboratory skills over two semesters, usually in their second year of college. Cell and Molecular Biology (Biol18b) is taught in the fall semester, and Molecular Genetics (Biol18a) is taught in the spring. The majority of students enrolled in Biol18 are Life Sciences majors or are fulfilling requirements necessary for pursuing advanced course work in health-related fields. More than 200 students are enrolled in this course annually. Although this course is taught concurrently with traditional lecture courses in Cell Biology and Genetics, Biol18 is self-contained and has independent lecture and laboratory components. Students meet once weekly for 4 h, in 24-student laboratory sections. They also attend 80-min lectures once weekly given by the professor. The laboratory sections are each run by two TAs: a second-year graduate student (GTA) most often in the Life Sciences Ph.D. program and a third- or fourth-year UTA who has previously completed both semesters of the course, receiving at least a "B+" in each respective term.

Historically, the GTA was responsible for teaching the laboratory section, reviewing course information, explaining misconceptions to students, holding office hours, and leading prelaboratory lectures and exercises. The UTA's primary function was to assist the GTA with technical support for the laboratory—drawing upon the experience of having taken the course. UTAs were present for the entirety of lab and were paid modest hourly wages.

Over the past 4 yr, it became increasingly clear that our UTAs wanted a more significant role in the course. Many had specifically expressed interest in teaching and mentoring students and had volunteered to lead prelab discussions and postlab recaps. Although this seemed like a viable option to deepen the potential UTA experience and to relieve a small fraction of the already heavy workload of the GTAs, the UTAs did not have the pedagogical training to provide proper guidance or instruction to students. With this in mind, we have designed an internship experience to train UTAs in pedagogical theory and practice, in parallel with closely monitored teaching experience.

ED92a COURSE GOALS AND MOTIVATION

This course focuses on developing the participants' ability to teach effectively, to recognize student misconceptions, and to foster student understanding and retention of key concepts. Students met once weekly to discuss topics and efforts under way in the biology education field and to put these ideas into practice as TAs of the introductory biology laboratory course.

The ED92a internship was designed to fulfill two primary perceived gaps in the education of undergraduate teachers. The purpose was defined as follows: to provide teaching experience in a closely structured and mentored environment with an emphasis on self- and peer-critique, with constructive feedback and critical integration provided by the course director, and to provide participants with an introduction to evidentiary analysis, popular techniques and practices, and contemporary pedagogical philosophies for science education. Course participants fulfilled the first goal by serving as a UTA for Biol18. The second goal was addressed through weekly "journal club" discussions of primary literature pertaining to science education.

Specifically, the internship was designed with the following learning objectives in mind:

1. To provide participants with an understanding of the importance of concept-based learning in the sciences
2. To teach participants the value of effective assessment including student self-assessment, instructor evaluation of student progress and learning, and assessment of course efficacy
3. To demonstrate the importance of concept integration and of making scientific connections when teaching
4. To expose participants to interactive strategies for teaching science in college classrooms
5. To provide participants with experience reading, discussing, and critically evaluating articles in science education
6. To allow participants experience reading primary literature in biology education and to give them an opportunity to put teaching strategies into practice

It was our hope that students would emerge from the course with a more complete understanding of biological education research and that they would be able to apply these tools in a classroom setting.

ED92a COURSE FORMAT

In its first iteration, ED92a had four primary components: reading of primary literature in science education, discussion of key concepts in select areas of biology, attendance at a weekly TA training session, and teaching a laboratory section of the introductory biology lab course (Biol18a or Biol18b). Students were encouraged to meet with a colleague from the education department at least once during the semester to discuss ideas and reflections on the course material.

Once weekly, the ED92a participants met with the professor to discuss at least one original article of primary education literature. Our goal was to critically analyze these papers. In discussions, we focused on articulating the main points of the paper, identifying conditions under which the data were collected and assumptions used in interpreting the data. We also discussed how the results could be applied to the teaching environment at Brandeis and in particular, Biol18. Starting the third week of the seminar series, course participants were asked to facilitate the literature discussions; each student did so on at least three occasions over the semester.

Because students could enroll in ED92a multiple times, the reading list was changed each semester to provide a diverse array of topics for discussion, although the same overarching thematic topics were held constant. An example syllabus for fall 2008 is given in Table 1.

In choosing literature for the course, we adhered to the following rationale to guide our selections. For the first week of class, we assigned a reading or review that set the stage for educational reform in the sciences. This discussion section invariably led to candid debates between ED92a participants concerning undergraduate science education at Brandeis and generalized opinions of science education across their diverse experiences. We encouraged frank commentary and criticism on the part of the students of their educational experiences and feel that this allowed the students to experience the interactive and open nature of the course. We emphasized the importance of comment and critique in teaching as a discipline during this session.

Because the participants then began teaching in the classroom, we generally selected literature for the following week(s) discussing student learning and concept rather than fact-based teaching. These sessions helped the students recognize the difference between rote memorization and intrinsic understanding on the part of the introductory students, and we hoped it would frame the way in which our participants approached the presentation of information throughout the semester. Before and after the written classroom examinations were given to the Biol18 students, we held a series of sessions concerning different types of assessment and how these strategies can be used both as evaluation tools for students and for course diagnostic purposes. Most of our participants had only experienced straightforward evaluation in their personal undergraduate experiences, and, after reading these papers, would offer suggestions as to how to incorporate ideas such as student self-assessment and reflection essays into the ongoing course. This also provided a timely opportunity for our participants to design a midterm teaching assessment for themselves that all administered to their students. For the remainder of the semester, we selected articles that reflected teaching strategies the professor had begun to implement in the course that particular semester, and those intended for future incorporation. The ED92a participants had sufficient teaching experience such that many positively contributed to dialogue concerning the value and implementation of these techniques.

The final session focused on a topic of particular interest to that semester's cohort. The instructor selected an article concerning a specific topic that had been a focus of discussion throughout the semester. These topics have included such ideas as academic dishonesty, the teaching of evolution, and the medical school entrance criteria. All course readings are periodically discussed with colleagues involved in the Master's of Arts in Teaching at

Table 1. Fall 2008 ED92a topics covered in discussion sessions

Week	Discussion topic	Brief description	Focus article(s)	Topic rationale
1	Reforming Undergraduate Biology Education	How to change, modify, and more effectively teach science as well as problems we will face teaching science at the undergraduate level in the future	Wood (2003). Teaching in a research context. Science *302*, 1510.	To set the stage and context for science educational reform
2	Student Learning and Understanding	Changes made in one college chemistry lecture hall and how these changes either helped or hindered the conceptual knowledge gained by those students	Buchanan *et al*. (2004). Promoting student learning in a large general chemistry course. J. Coll. Sci. Teach. July/Aug.	To help UTAs understand how students learn and to recognize misconceptions when teaching throughout the semester
3	The Role of Assessment	The role of grading in the science classroom	Moore (2004). A's and F's. J. Coll. Sci. Teach. Nov./Dec. Kitchen et al. (2006). Rethinking exams and letter grades: How much can teachers delegate to students? CBE Life Sci. Educ. *5*, 270–280.	To help the UTAs evaluate and design course assessments
4	Formative Assessment	Ways of implementing formative assessment into health science and possible outcomes	Carillo de la Pena *et al*. (2007). Formative assessment and academic achievement in pregraduate students of health sciences. Adv. Health Sci. Educ. *1226*, 134–143. Smith (2007). How does student performance on formative assessments relate to learning assessed by exams? J. Coll. Sci. Teach. July/Aug.	To help the UTAs evaluate and design course assessments
5	Incorporating Primary Literature into the Classroom I	The value of using primary literature articles in the undergraduate classroom	Kozeracki *et al.* (2006). An intensive primary-literature–based teaching program directly benefits undergraduate science majors and facilitates their transition to doctoral programs. CBE Life Sci. Educ. *5*, 340–347.	To encourage UTAs to think critically about and evaluate ongoing course modifications
6	Incorporating Primary Literature into the Classroom II	How faculty members can incorporate primary literature into their classrooms	Taylor (2004). The case of the tainted taco shells. J. Coll. Sci. Teach. Oct.	To encourage UTAs to think critically about and evaluate ongoing course modifications
7	Teaching Developmental Biology	A broad array of different educational pedagogies and how to incorporate them all into one, multilevel classroom experience	Madhuri and Broussard (2008). "Do I need to know this for the exam?" using popular media, inquiry-based laboratories, and a community of scientific practice to motivate students to learn developmental biology. CBE Life Sci. Educ. *7*, 36–44.	To encourage UTAs to think critically about and evaluate possible future course modifications
8	Classroom Clickers	How to effectively incorporate personal response systems in the classroom	Barber and Njus (2007). Clicker evolution: seeking intelligent design. CBE Life Sci. Educ. *6*, 1–8. Caldwell (2007). Clickers in large classrooms: current research and best practice tips. CBE Life Sci. Educ. *6*, 9–20.	To encourage UTAs to think critically about and evaluate possible future course modifications
9	Writing Op-Ed Articles as Part of a Science Curriculum	One example of how to incorporate public awareness strategies into our classrooms	Poronick and Moni (2006). The opinion editorial: teaching physiology outside of the box. Adv. Physiol. Educ. *30*, 73–82.	To encourage UTAs to think critically about and evaluate possible future course modifications
10	Academic Dishonesty in the College Classroom	Why these events occur and how to design strategies to eliminate opportunities for this to happen	French (2006). Cheatin' ain't the cowboy way. J. Coll. Sci. Teach. Nov. Kelly and Chang (2007). A typology of university ethical lapses: types, levels of seriousness, and originating location. J. High. Educ. *78*, 402–429.	To provide UTAs an opportunity to discuss any topic of their choice

Brandeis in the Departments of Education and other sciences to ensure appropriateness and relevance of topic choice.

In addition to our broad-based rationale and topic selection, the following issues were discussed contextually: constructive classroom dialogue, participatory lecturing, making teaching more dynamic while emphasizing productivity, effective evaluation, humor in the classroom, and the use of demonstrations as effective tools for student engagement.

Participants also served as UTAs for individual sections of Biol18. Students were partnered with a GTA who was primarily responsible for giving prelab lectures, but the UTAs enrolled in the course had to independently give the prelaboratory lecture for their section at least three times during the semester. In addition, students enrolled in this course were periodically required to facilitate the postlaboratory discussions in their section, which included posing conceptual questions of Biol18 students to encourage participatory learning.

To prepare for the upcoming laboratory, participants were required to attend weekly training sessions, in which the course professor demonstrated lecturing techniques and strategies, and participants were given advice on how best to encourage student participation and inquiry-based learning in Biol18. On occasion, these sessions consisted of guided exam or lab report grading to help the participants understand the importance of proper assessment—students specifically graded questions that they helped write to understand the entire process of exam writing, implementation, and evaluation.

The ED92a UTAs were asked to keep an informal journal on effective and ineffective aspects of their internship course, as well as constructive critiques of the Biol18 course. This list included notes on how well students performed certain procedures, what (if any) value the exercise added to students' understanding of biology, as well as suggestions for improvement of the laboratories.

The final written assignment for ED92a consisted of a self-designed project. Students were asked to design a new laboratory exercise, a course evaluation, a learning assessment, or a course syllabus based upon classroom experiences and information garnered from the articles read throughout the semester. Participants designed their project independently and subsequently developed and carried out their plans with mentor input. Examples of past projects included the development an introductory biology survey course syllabus; the creation of several different laboratory exercises with potential application for use in Biol18, including both invertebrate and reptilian dissection modules; the design, implementation, and assessment of using Podcasts in Biol18; and the formulation of final biology and chemistry course assessments including practical and theoretical exams.

WHO ENROLLED IN ED92a?

Each semester between eight and 10 UTAs are hired for Biol18. Most remain with the class for three or four semesters spanning their junior and senior years. With two exceptions, all of the 16 UTAs over the past 3 yr have majored in biology, biochemistry, or neuroscience, and none have enrolled in any formal education course during their undergraduate career other than ED92a. Most UTAs who have completed ED92a continue their postgraduate education in basic science research (M.S. or Ph.D.), biomedical sciences, or in medical or veterinary school with the intention of incorporating education into their future career.

Stringent criteria are used to select students to be UTAs for Biol18. UTAs must have completed both semesters of Biol18 with a "B^+" or better and must fill out a detailed application including two lengthy essays. Students are asked to explain why they want to teach and how being a part of the Biol18 staff will be fulfilling, whereas the second essay requires students to respond to the scenario "How will you teach and act in a position of authority over your peers?" UTAs are selected by the professor and course staff based upon their responses, qualitative observation of their performance as students, and their interest in studying science education.

We have now offered ED92a for four consecutive semesters. We have had a total of eight Biol18a UTAs enroll in the course (all re-enrolled at least once). Enrollment has increased progressively from three students in fall 2007 to seven in spring 2009. Students at Brandeis are not allowed to receive credit for more than two semesters of internship classes and, because of this limit, four of the seven current students are enrolled for a third consecutive semester without possibility of receiving credit. Of the eight students, four have been male and four have been female suggesting no gender bias with regard to enrollment. Our current class has six students including two former UTAs of Biol18 who voluntarily attend the weekly journal club meetings, contributing to the education of our enrollees.

REACTIONS AND FUTURE PERSPECTIVES

We have made significant efforts to monitor and evaluate the ED92a initiative. At present, most of our assessments have been qualitative, consisting mostly of open-ended response questions due to the relatively small size of the course (see Supplemental Material). Postassessment surveys were given to each student after completion of the course. To include all students from all iterations of the course, preassessments were not used in this evaluation, although questions reflecting participant self-assessment of confidence changes over the semester were used.

Course surveys have been overwhelmingly positive. UTAs enjoyed their "teaching role," especially directing prelab discussions, designing and implementing interactive exercises, as well as writing and marking exams. Students especially appreciated the integration of their teaching with the pedagogical study of science education. We see TA training, mentoring, and development as a core tenet of the educational success of Biol18, and students have responded in-kind. We conducted a follow-up evaluation subsequent to the fall 2008 iteration of ED92a. Students strongly supported the importance of ED92a pedagogical discussions to their UTA experience. No students had any previous formal education training. All students were satisfied by the topics covered as assessed by the question "What topic would you like to see removed from the syllabus?" to which all students responded "none." All students rated the discussion sessions of primary literature "exceptionally helpful."

Participants reported an increased confidence in their ability to write and use a grading rubric (100%), to prepare lesson plans (71%), and to provide one-on-one tutoring to the Biol18 students (85%) after taking the course. ED92a also increased their awareness of the challenges of such tasks. As one student wrote in an evaluation "I think this course helped me realize how difficult it is to do these things effectively. Whereas the various aspects of teaching seemed

Table 2. Summary of ED92a student responses to evaluation questions

Survey question	Student responses
What were some significant difficulties you encountered during teaching?	"Getting students to listen, given that I was teaching my peers." "Communicating in a wide-open area like lab." "Continuing to teach even when I lost my students attention." "Trying to make sure that my mini-lectures were not too easy or too difficult, not too fast or too slow for my students."
What were some of the most rewarding aspects of teaching?	"Successfully explaining a concept to a student who was having problems." "When students are really interested in understanding the topics—not just for sake of completing the exercise, but just out of pure curiosity." "Finally figuring out how to explain a concept without just giving away an answer."
What are additional topics/exercises that you would like added to the course?	"I would like to see a written 'journal entry' assignment for each discussion that recapitulates the important issues discussed in each meeting, solutions or possible developments on these issues," "I would like to discuss student collaboration and how it both negatively and positively effects a student's level of work and understanding."
How has this course affected your future career plans?	"This course has made me look forward to the teaching aspect of my future career in academic science. It has made me aware of issues pertaining to learning and education that I would not have known otherwise. The topics we've discussed in the class are definitely going to stick with me for a long time."

straightforward before the class, learning about doing them effectively in ED92a in a way made me less confident simply because I became more aware of how much thought goes into each issue." Regarding the importance of concept-based learning, one commented, "by being aware of how students perceive a complicated concept, you realize how to develop it from the foundation up, so that it becomes easy to understand. Before I learned about this, I would explain things as I understood them without realizing that what seems straightforward to me is not necessarily so for my audience." Students unanimously identified the discussion sections as the most helpful aspect of the course, and the predominant criticism was a request for more discussion sessions. All students rated themselves extremely likely to pursue additional education training, and although many entered the course with a strong interest in teaching (71%), this experience cemented that predilection. All students expressed interest in participating in teaching opportunities beyond Biol18, and all students would take another semester of ED92a. Other examples of feedback are included in Table 2.

CONCLUSIONS

In part, this course was created in response to a call from UTAs in the Biol18 course who were seeking more responsibility in the classroom as well as the training necessary to support such a changing role. We saw this call as an opportunity to begin a paradigm shift in the recruitment, training, and retention of a committed and innovative undergraduate science professoriate. Given the overall number of UTAs used in undergraduate science courses nationwide, albeit in different capacities, we see the need for such training throughout the basic sciences (and indeed in other allied fields).

Based upon qualitative and quantitative feedback from the instructors and the UTAs, ED92a is highly successful. The most helpful aspect of the course was the weekly discussion sessions, which students praised as "a forum for integrating actual issues faced in their classrooms with issues of national education policy and pedagogy." In the four semesters in which we have taught ED92a, the UTAs have been better prepared than ever before, and mentor–mentee relationships between students and faculty have improved. ED92a was highly praised by the enrolled students, who sought more opportunities to integrate their pedagogical training with their teaching experiences. One student stated "I would like to discuss concrete advice on how to incorporate some of the points we discussed into the scope of our own lectures or teaching styles . . . Some small specific things. So that when we reconvene every Friday, we can say, this week I did this differently and this was the result." It is this, and other valuable student perspectives, that will continue to drive our improvement of ED92a.

To increase cohesion between the pedagogical and the practical, we are considering the integration of case studies based upon Biol18 experiences. We are committed to the importance of UTA training and will continue to refine the formula until we get it just right. Data from our exit-surveys suggest that enrollment figures will remain stable, if not increase. Enrollment for the iterations assessed in this paper was contingent upon teaching Biol18. To increase the size of the class and to determine whether our internship model is appropriate for other courses, we have begun to allow students who are UTAs for other Brandeis science courses to enroll. During the 2009 spring semester, one student teaching an advanced biochemistry course and one student TA from a nonmajors science course were enrolled in ED92a. To maintain mentor–mentee ratios, this required recruiting faculty from other courses, although the students were still primarily mentored by the professor of Biol18. We believe that in addition, scalability is realistic within the context of our syllabi as long as the faculty maintains programmatic interest. Over the coming years, we will continue to analyze the success of ED92a by tracking the professional development of course graduates. We are eager to demonstrate our strong belief that completing this course will strongly

benefit our UTAs in their future careers, as members of the professoriate or otherwise.

Above all, this course has provided an extraordinary experience for us as educators. We have been privileged with the opportunity to enrich our work by harnessing the passion and innovation of the next generation of science teachers. We provide students the opportunity for empowerment in their teaching, the confidence to seek the limits of their knowledge, the ability to learn how to teach, and the access to life-long mentors in science education.

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