Joshua M. Rosenberg—Teaching Statement

My teaching is oriented around a set of core ideas and practices that I flexibly draw upon, adapt, and supplement based on my experience and knowledge of my students as unique individuals and a unique group. The core ideas and practices that I use are a), planning a series of lessons around important concepts and motivation for learners to work to understand them, b) finding out what learners already think and know, c) supporting learners to change their conceptual understanding in a variety of ways, and d) providing summative opportunities for learners to demonstrate (and formalize) their new understanding (Windschitl et al., 2020). Though these practices that have come to be known as *Ambitious Science Teaching* developed as a way to plan and teach professional learning for science teachers, I find these four practices flexible enough (and informed by research from across educational research sub-disciplines) that they can usefully guide my teaching of both science teachers and students learning to use data science methods in their data analyses and research. Furthermore, my supplementation of these practices facilitates my process of teaching in a way that suits my strengths.

As I discuss in this document, I have developed a set of principles that have guided my teaching of five classes predominantly for pre-service science teachers in undergraduate and graduate degree programs, two for pre-service science and mathematics teachers in an undergraduate degree program, and two for graduate students in varied degree programs interested in using educational data science methods in their research. I describe each of these principles next, with examples and evidence that demonstrate their effectiveness as a teacher at the undergraduate and graduate levels.

1. **Plan classroom activities around challenging concepts and practices**. I plan my classes around activities that students might find difficult to do on their own, without the support of me, students' peers, and the structure of a semester-long course. As an example, in science teaching methods classes, I do not only ask students to read about or view examples of how expert science teachers orchestrate classroom discussions; I have had students practice launching and orchestrating a discussion about a science concept with their peers in the context of a series of lessons they develop. In the educational data science courses I teach, this principle has been reflected in an emphasis on using real, complex educational data sources for examples and homework, and students' course projects.
2. **Start class with what students will primarily do.** I tell students in both my teaching methods and educational data science classes that they may be learning ways of teaching or doing research that may be different to them. For future science teachers, for example, their experiences as science learners are often very salient, especially when they are still taking science coursework for their major. This means that new approaches to science teaching may be initially unwelcome by students. To show students from the outset what it can look like to teach and learn science in a new way, I have allocated time to a science modeling activity on the first day. In this activity, students express their ideas about a scientific phenomenon by developing a diagrammatic model (like a logic model). Though future high school science teachers may initially see such an activity as creative but not rigorous, the challenge of explaining a scientific process such as how and why water condenses through such a model can be surprisingly challenging—and useful as a way of demonstrating the topic of the class. This principle also applies in data science-focused classes, where students have created data visualizations even before they fully understand the details of how the code they use works.

3. **Structure course activities so students receive early feedback on their ideas**. For many, creating a substantial product such as a course paper can be challenging, in part because some undergraduate students have limited experience with the processes of planning, drafting, revising, and editing a paper. While graduate students have likely had these experiences, they may find them more challenging when the ideas they are synthesizing or the findings they are reporting are their own. For these reasons, I take steps to structure the activities in my courses at any level so students receive formative, low-stakes feedback on their writing long before they submit the final product. As an example, in educational data science courses, students start by describing a possible course project topic in a discussion post and receiving feedback from peers. Then, they write a one-page overview of the project on which I provide feedback. Students then have a mid-semester check-in and presentation on which they receive substantive feedback prior to submitting their final papers. Evidence of the effectiveness of this approach was found in the work of the 21 students in my Spring 2021 educational data science course: Though few students had experience coding in R at the start of the semester, every student (including four classroom teachers) reported on a complete data science analysis they did, using either research data or data from their classroom.
4. **Respond to students' ideas and goals.** While I plan classes around difficult activities and provide a structure that affords students ample feedback on important course assignments, I also am responsive to students' ideas and goals. Within classes, I make an effort to listen to what students express interest or wonder about and dedicate time for students and me to discuss those topics, even if such time is not planned. For instance, following a conversation about communicating effectively with their student's parents, students in my science teaching methods class discussed the role of religion in their science classes. This was not a planned conversation, nor one I was fully comfortable orchestrating, but this was an important connection and issue for my students to discuss with one another. A different way I respond to students' ideas and goals is by requesting students complete a pre-course survey about their goals for the course, how they like to participate in the course, and what their preferences are regarding their participation. In the first class, I share the results from this survey and describe how I will make efforts to respect their wishes.
5. **Support sustained, positive relationships.** Following from responding to students' needs and goals in different ways, I work to develop sustained, positive relations both among students and between students and me. A key way I support positive relations among students is by using base groups (groups or students that are maintained throughout the semester) in both my science teaching methods and educational data science classes. These groups of four to five students check in at the start of each class, typically responding to questions about readings or sharing progress updates on assignments. Though it is a small step, I provide a structure for students that provides a subtle way for students to get to know one another as people: I typically ask students to share with one another in a particular order, such as by beginning with the person with the most family members (or the person who slept the most during the previous night). Evidence for the effectiveness of this principle is found in the results of the quantitative end-of-course ratings provided by students: On a 1-5 scale, with five indicating the greatest agreement, for no class was the mean rating below 4.78 for the statement "The instructor created a respectful and positive learning environment."
6. **Expand the boundaries of the classroom.** In all of the classes I teach, I identify ways for students to do or share coursework outside of the formal course environment. The purpose of this is to spark students' development of a wider professional learning community. One way I have supported science teaching methods students to do this is by providing several means of connecting with the wider science education community, including joining the Tennessee Science

Teachers Association or the National Science Teachers Association and participating in the events they host, and joining an informal, social media-based community. Many of my students have participated in the Twitter-based #NGSSchat community, where science educators learning about or teaching in ways that are aligned with the Next Generation Science Standards discuss their successes, challenges, and questions. For students in educational data science courses, joining the code repository website GitHub to contribute to a class collection of resources not only introduces them to a new data science-related technology but also to a community learning about and using data science techniques. A different way I expand the boundaries of the classroom is by inviting students to participate in my ongoing research projects. Students who I initially had in teaching methods courses have presented and published research in a range of venues, including the *AERA Open* journal (Michela et al., 2021) and the *Social Media & Society* (Burchfield et al., in press; Thomas et al., in press) conference. One undergraduate student received the conference-wide Best Poster Award for the International Conference on Educational Data Mining (Burchfield et al., 2021). In addition to gaining research experience, these students are often introduced to collaborators who can serve as mentors as they consider graduate school or career options.

To summarize, my teaching is structured around ideas drawn from both *Ambitious Science Teaching* and my experience as an educator in multiple contexts: I structure courses in such a way that students work toward substantial, challenging projects that may require them to either teach or analyze educational data in a different way. I work to balance the importance of having a clear structure for my courses with responding to and respecting students' ideas. Last, to foster positive relationships among students, I organize many activities around students' interactions with one another within base groups. Both these relationships and those that students form when they join or participate in communities outside the classroom are intended to support sustained relationships that can benefit students professionally and personally. I note that these principles do not wholly apply to my advising (of four Ph.D. students—and co-advisor for one) and students' master's (17 students), specialist in education (two), and doctoral (seven) degree committees, but they partially do, especially regarding the importance of providing structure for students to make progress on key program requirements, responding to individual students' goals, supporting a positive learning and working environment, and expanding students' programs by involving them in collaborative research projects.

References

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