Unit Plan Reflection - Nicholas Merrill

For my unit plan I covered electrostatics and its associated phenomena. I thought the unit to two separate periods consisting of mostly 10th grade students. Each class period was divided into 50 minutes, but the lessons varied in length from a single period up to three for more complex subjects. The unit mainly focuses on explaining a set of electrostatic phenomena shown to the students by developing a model of understanding. The model involves the atomic nature of charge and the idea of an Electric Field to explain action at a distance. A secondary goal was to have students revisit Newtons Laws and vector addition in the context of Electric Forces. There were certain topics that are typically associated with electrostatics that I chose not to cover, including induction, band theory, a quantitative description of electric potential energy, work, and electric potential, equipotential lines, and two and three dimensional problems. Though I personally value the importance of these topics, they were not necessary to explain the phenomena and many do not fit well into a non-calculus based physics class.

The NSTA standard 8a asks students to evaluate students a variety of ways using multiple tools of assessment. I began my unit plan with a 15 question multiple choice test on electrostatics.The test was designed to mirror the Force Concept Inventory (FCI) which is frequently given to physics students. It focuses on specific misconceptions involving electrostatics. At the end of the Unit the students were given the same test to make a measurement of their progress. A Unit exam was also written which included True/False, Multiple Choice, and both Qualitative and Quantitative free response questions. Multiple Exit slips were used at the end of more conceptual difficult periods as a formative assessment to track student progress. Classwork and homework were periodically collected for participation grades to measure student engagement in the material. I multiday homework project provided an

opportunity for students to write a variety of different exam questions, providing insight as to what students thought was important topics. The conclusion and analysis sections of the labs provided an opportunity to answer open ended, challenging questions following their observations. The idea of most of these assessments was to dig up and address misconceptions and student difficulties.

The multiple forms of assessment acknowledges diversity in the classroom and helps to address Standard 6a. In addition providing multiple forms of assessment for students to demonstrate their knowledge, a classroom website was kept updated with the previous day's assignments and lectures to help the students who had difficulties staying organized or taking careful notes. I also made myself available before and after school to help answer questions and provide assistance on assignments. Several students who were uncomfortable seeking help during class expressed their gratitude for the opportunity to do so in a different setting. The 5E model implemented varied the instruction each day to maintain student engagement by targeting different learning styles and abilities.

Standard 1a, 1c and 2c, which focus on the unification of concepts, the nature of science and inquiry based learning, were easy to address in the context of electrostatics. The unit began with a lab where students cataloged observations of electric phenomena, no explanation was offered to the students, instead they had interpret the results and form a model to connect the observations. Many students were surprised to discover that the definition of negative comes from Benjamin Franklin model rather than a deeper meaning behind the words. The students were also surprised to find that the same method could be used as evidence for a third type of charge if a certain set of observations were made. In the introduction to Coulomb's law, students were surprised to find that the power of two in the inverse square law was a result of experiment,

and not something that is “proved” to be true. A demonstration of such an experiment was provided to give students a reference. The Electric Field was introduced as a hypothetical mechanism proposed by Faraday. No direct proof of it was provided, but it’s mathematical usefulness was shown.

Standards 1b was touched on at several points by discussing the technological application of technology. Electric shielding and was mentioned in the context of electric field line diagrams not penetrating a conducting sphere. Parallel plate capacitors were also shown in examples. Grounding was heavily emphasized and included several real world examples and applications. Dielectrics were introduced in the context of polarization. The concept of semiconductors was shown in a Van de Graaff demonstration involving conductors and insulators.

I acknowledged my part of a scientific and educational community and addressed Standard 6b in my preparation for the unit. Two books, *Five Easy Lesson* by Randall D. Knight and *a Guide to Introductory Physics Teaching* by Arnold B. Arons served as constant references in the creation of my lessons. These two sources highlighted common misconceptions and provided ideas for demonstrations and labs in addition to providing example reading and test questions. These resources helped me better expect the questions and understanding of students.