

## Meeting NSTA Preservice Science Teacher Standards with Online Science Courses and Non-Traditional Labs

Jim Brinson, *Ph.D., School of Science, Technology, Engineering and Math, American Public University System*

**Summary.** This discussion will practically demonstrate how online science courses that align with National Science Teachers Association (NSTA) standards and criteria for science teacher preparation and certification, and that utilize alternative laboratory learning spaces, can be delivered in a non-traditional and asynchronous format that allows for a wider demographic of students (i.e. non-traditional students) the opportunity to become science teachers.

**Extended Abstract.** National Science Teachers Association (NSTA) Secondary Content Analysis was used to demonstrate the alignment and mapping of the B.S. in Natural Sciences program courses at American Public University System (APUS) to state and national certification standards for teaching licensure. Current NSTA Preservice Science Standards language does not preclude the use of non-traditional lab environments that retain the use physical manipulatives to meet standards related to content knowledge (Standard 1) and professional knowledge and skills (Standard 6) [1]. Non-traditional labs, such as kits, also do not contradict the knowledge base used to support these standards [2].

Digital data acquisition instrumentation and custom laboratory kits containing green chemicals, specimens, glassware, instrumentation, hardware, etc. is shipped to students worldwide, and examples of such kits will be shown and demonstrated. This presentation will also discuss how it is possible to overcome the financial and logistical barrier of meeting international shipping regulations and delivering laboratory equipment and materials across international waters and borders, and even into remote regions of military deployment. Liability, materials warehousing, and inventory transfer away from the university will also be discussed.

As will be demonstrated, to preserve academic integrity and maintain records of student identity, students are required to take pictures and videos at various benchmarks within the laboratory procedures (i.e. practical skills, laboratory setups, measurements, product validation, observation validation, and post-lab content assessments). All pictures additionally require the student's face, and a label with lab name, date, lab title, and description of the picture. Videos require students to pan the laboratory workspace, and the student must be visible as he/she starts the recording, films the required footage, and then be visible again as the recording is stopped. The video cannot be edited or spliced during the recording.

Tables, graphs, charts, and statistical analysis are collated and uploaded into the virtual classroom. Post-lab assessments involve submission of data in the aforementioned formats, benchmark and identity verification using digital media (pictures or video), mathematical calculations involving student-generated data, self-analysis of performance, assessing pronunciation of scientific terminology (via audio submission), and textual responses.

The interactive presentation offers dialogue with the presenter about the aforementioned alignment data that supports the efficacy of non-traditional labs as a means to meet state and national science teacher standards. Charts, tables, graphs, and summaries of data will be available electronically and as a handout. The presenter has a strong background in instructional technology, as well as science education, and can thus field all questions related to the laboratory technology and all related science pedagogical questions. Additionally, physical examples of the kits, instrumentation used, student assessments, and samples of student work will be available for participants to view and manipulate.

In summary, this presentation practically demonstrates how science content courses that align with state and national content standards and criteria for science teacher preparation and certification can

be delivered in a non-traditional and asynchronous format that will allow non-traditional students (NTS) the opportunity to become science teachers.

**Implications for Science Education Policy.** NTS are a growing demographic of college/university students that offer unique challenges for teacher education programs. Due to their responsibilities and unpredictable schedules, coupled with their geographical, temporal, technological, accessibility, and logistical limitations, NTS are often unable to participate in traditional, synchronous face-to-face classroom events and schedules [3-4], and thus increasingly rely on online education [5]. NTS require a separate subset of online teaching best practices [6-7]. This is particularly challenging for science teacher preparation programs wherein laboratory experiences are not only required, but critical to science teacher preparation [8-14]. So providing a means by which online NTS can complete science coursework that meets all state and national science educator standards without attending a traditional campus/lab environment is critical.

Though current research suggests it is possible to meet laboratory learning objectives using virtual or remote laboratory methods [15-19], blending them with a traditional hands-on option, such as a lab kit, caters more to the multi-modal needs of NTS [5], and perhaps more clearly fulfills state and national science teacher content certification standards. This blended approach was used to design the laboratory course components in the Bachelor of Natural Sciences degree at APUS.

**Outcomes and Goals.** The interactive presentation offers dialogue with the presenter about the aforementioned alignment data that supports the efficacy of non-traditional labs as a means to meet state and national science teacher standards. Charts, tables, graphs, and summaries of data will be available electronically and as a handout. The presenter has a strong background in instructional technology, as well as science education, and can thus field all questions related to the laboratory technology and all related science pedagogical questions. Additionally, physical examples of the kits, instrumentation used, student assessments, and samples of student work will be available for participants to view and manipulate.

By the end of the presentation, participants will have data to support using distance education science courses to satisfy science content requirements for science teacher certification aligned to the NSTA Preservice Science Standards. They will also have both a conceptual and practical template on which to begin developing such courses or a science teacher preparation program that incorporates such courses. Science content courses, due to their required lab component, are those that typically prevent non-traditional students from completing a science teacher preparation program.

**References:** [http://bit.do/2018\\_PSO\\_refs](http://bit.do/2018_PSO_refs)