

**Stony Brook University  
The Graduate School**

Doctoral Defense Announcement

**Abstract**

**Professional Development for Secondary Science Teachers to Improve Engineering Knowledge, Pedagogy, and Career Advisement**

By

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This quasi-experimental, mixed-methods observational study reports the design and implementation of an NGSS-aligned engineering workshop series for middle and high school educators focused on the science and engineering practices. The workshop structure and data analysis were based on the interconnected model for professional growth and supported by the situated learning and knowledge integration perspectives on cognition. University-based science, engineering, and science education faculty developed two workshop series in 1) electrical engineering and physics, and 2) biotechnology and biology. Each series provided teachers with instruction in the engineering design process, science and engineering integration, and engineering career advisement. In each workshop, teachers engaged in science content-specific engineering activities that were designed to simulate the secondary classroom experience.

Science teachers ( $n=37$ ) voluntarily participated in the workshops and completed pre- and post-workshop surveys. Comparisons of means indicated teachers reported statistically large improvements in their ability to: 1) use engineering activities in the classroom successfully, 2) increase student interest in engineering, 3) help students apply engineering to real-world situations, and 4) advise students on different engineering disciplines and careers, as well as how to prepare students for engineering before college. Pre- and post-workshop interviews with six of these teachers revealed an expansion of teachers' perceived value of engineering in science and an increased confidence and ability to incorporate engineering and provide guidance to students interested in pursuing a future in engineering. Teachers also expressed their continuing concerns related to the school environment regarding engineering and science alignment.

The results from this study demonstrate that a university-based professional development workshop series is an effective intervention to improve the engineering knowledge and skills of secondary science educators, ultimately increasing NGSS adoption in science classrooms. Professional development programs such as this can serve as the foundation for increasing student exposure to engineering and interest in engineering careers.

**Date:** November 21, 2019

**Time:** 10:00am

**Place:** Life Sciences 063

**Program:** Science Education

**Dissertation Advisor:** Dr. Angela Kelly