

**Stony Brook University  
The Graduate School**

Doctoral Defense Announcement

**Topic Specific Pedagogical Content Knowledge (TSPCK) in Redox and  
Electrochemistry of Experienced Chemistry Teachers**

By

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Topic specific pedagogical content knowledge (TSPCK) is the basis by which knowledge of subject matter of a particular topic is conveyed to students. This includes students' prior knowledge, curricular saliency, what makes a topic easy or difficult to teach, representations, and teaching strategies. The goal of this study is to assess the pedagogical content knowledge of chemistry teachers in a professional learning community in the areas of redox and electrochemistry, as this has been determined in previous literature to be conceptually challenging for students. By acquiring information regarding the PCK development of experienced chemistry teachers, the education and practice of all science teachers can be advanced. This study builds upon previous research that developed validated instruments to evaluate TSPCK. The research questions sought to determine which components of TSPCK were evidenced by the instructional design decisions teachers made, what shared patterns and trends were evident, and how TSPCK related to student learning outcomes. To answer the research questions subjects completed a background questionnaire, a TSPCK assessment, and interview tasks to elicit information about pedagogical decision-making and processes that influenced student learning in their classrooms. The TSPCK exam and interview responses were coded to align with thematic constructs. To determine the effect of TSPCK on student learning gains, pre-/post-assessment data on redox and electrochemistry were compared to teachers' TSPCK. The chemistry teachers displayed varying levels of TSPCK in redox and electrochemistry, as evidenced by their knowledge of student learning obstacles, curricular saliency, and teaching methodologies. There was evidence of experienced teachers lacking in certain areas of TSPCK, such as the ability to identify student misconceptions, suggesting the need for programmatic improvements in pre-service and in-service training to address the needs of current and future chemistry teachers. While the current certification system requires teachers to complete separate exams in pedagogy and content, this research provides a rationale for changing the means by which teachers are evaluated through the completion of TSPCK assessments. In-service teacher TSPCK training is limited yet desired by the teachers. To facilitate TSPCK development, new methods need to be explored to connect chemistry education research to practice.

**Date:** July 20, 2017

**Program:** Science Education

**Time:** 10:30am

**Dissertation Advisor:** Dr. Angela Kelly

**Place:** Life Sciences, Room No. 038