Continued scientific and technological innovations are critical to fostering sustained economic growth, global competitiveness, and, most importantly, meeting an increased demand for STEM talent. To harness the nation's great scientific and technological potential, attention must be given to improving the state of STEM education and to build a robust STEM workforce (PhRMA, 2014). As noted by the President's Council of Advisors on Science and Technology, "the most important factor in ensuring excellence in K-12 STEM education is great STEM teachers" (PCAST, 2015). Compounding this demand for high-quality STEM teachers is the introduction of new academic standards (NGSS Lead States, 2013). Reform documents such as *A Framework for K-12 Science Education* (NRC, 2012) and the *Next Generation of Science Standards* (NGSS Lead States, 2013) highlight the significant role science and engineering practices play in building students' early understanding of the world around them. The *Framework* indicates that all children should develop competencies in engineering design, and the *NGSS* explicitly includes a "conceptual shift" toward "the integration of engineering and technology into the structure of science education." However, such an imminent shift cannot be realized without adjustment of K-12 science curriculum and pedagogy and a national ***transformation in the preparation of K-12 teachers*** so that teachers possess the knowledge and skills necessary to include the discipline of engineering in their classrooms. This is especially important at the elementary school level where teachers tend to have the most limited academic preparation in science (Abell, 2007; Appleton, 2007; Mellado, Blanco, & Ruiz, 1998) and essentially non-existent formal exposure to engineering (Cunningham & Carlsen, 2014; Wendell, 2014).

To fill this void in professional training of elementary science teachers, considerable national strides have been made to integrate engineering design for *inservice* elementary science teachers (Capobianco & Lehman, 2015; Capobianco & Rupp, 2014; Sargianis, Yang, & Cunningham, 2012; Yasar, et al., 2013; Yoon, at al., 2014). Programs such as the University of Texas's *UTeach Engineering*, Boston's Museum of Science's *Engineering is Elementary*, Purdue University's *Science Learning through Engineering Design (SLED) Partnership*, The John Hopkins University's *STEM Achievement in Baltimore Elementary Schools (SABES)*, and University of Minnesota's *Engr: TEAMS* are grounded in the delivery of high-quality, content-rich, engineering design-based experiences for inservice elementary science teachers. Results show strong proof-of-concept that elementary teachers can effectively translate engineering basics into the classroom environment. The successful NSF-funded SLED Partnership, for example, demonstrated that elementary inservice science teachers can develop deep conceptual knowledge of engineering practices, translate knowledge into teaching that facilitates students' science learning, and address both first and second-order classroom challenges with implementing engineering design-based science instruction (Capobianco & DeLisi, 2015; Capobianco, Lehman, & Kelley, 2015).

While such inservice training has had strong impact on students and teachers across various elementary school settings, a significant gap remains in developing a nationally scalable and sustainable solution. Current inservice efforts rely on an existing base of teaching experience, require continual district resourcing for on-site or workshop-oriented training, and have limited capacity to reach the more than 1.6 million elementary science teachers nationwide (NCES, 2015). We lack a strategic, research-based nationwide process for elementary science teacher preparation programs to answer the call for implementing new engineering standards (Capobianco, 2012, 2015; Wendell, 2014).

To address this gap in engaged student learning, we propose a research-based project that will create an innovative, scalable, and sustainable model for elementary science teacher preparation that can address the unprecedented need to prepare elementary science teachers to teach engineering practices nationwide. In our *IUSE Using Principles of Design to Advance Teacher Education (UPDATE)* project, we will draw on STEM and education expertise to collaboratively transform elementary science teacher preparation by immersing preservice teachers in authentic engineering design-based science learning tasks in a sequence of core required undergraduate science content courses. We will utilize the constructs of *situated learning* and *teacher as learner* to uncover, evaluate, and explain the multiple and diverse ways preservice elementary teachers learn engineering practices, how they begin to conceptualize engineering design, and how they most effectively teach elementary school science using engineering practices.