

ChANgE Chem: Transforming Chemistry with Cognitive AppreNticeship for Engineers

ChANgE Chem will improve the quality of STEM education by applying a unique approach to transform the curriculum of undergraduate general/freshman chemistry to a more contextually relevant and engaging experience for engineering students. The transformative power involves **designing for recruitment and retention of underrepresented student groups** with the rich context of real-world engineering challenges. We will use cognitive apprenticeship, a transformative educational framework that is steeped in our understanding of how students learn, to develop a sequence of activities that emulate and make explicit, an engineer's way of thinking, knowing and working. This transformed curriculum will situate water, air, waste and energy as fundamental organizing principles in practical engineering problems, communicated as human-interest stories. In addition, we will support student success with design elements that engage deep learning strategies that embody our understanding of effective learning. The project applies a unique approach to create new learning materials and teaching strategies, develop faculty expertise, implement an educational innovation and assess student achievement. Project goals are organized around the three overarching themes of the Design, Develop, and Test components of the research and development cycle.

Intellectual Merit

Engineering education cannot hope to meet the demands of a diverse, global, knowledge-based society without addressing the well-known issues of student recruitment and retention. To this end, this transformative curriculum will contribute new knowledge about how to design for recruitment and retention, in particular, women and individuals from diverse cultural and ethnic backgrounds. This design knowledge will apply to materials, processes and transferrable models. The unique approach of ChANgE Chem involves the distinctive blend of expertise and passion of the interdisciplinary Project Team and our use of an engineer's perspective to organize general chemistry, an intervention that has not been previously funded or attempted. The project advances our understanding of how people learn chemistry and develop the skills for addressing engineering design problems. Collectively, the Project Team has extensive experience with instructional materials development, innovative pedagogical practices, and the use of technology as a learning tool. Individually, the team includes deep expertise in chemistry, environmental engineering, chemical engineering, chemical education, and STEM education. The on-going and deep institutional commitment to STEM at the University of Florida (UF) strongly supports the research and development of ChANgE Chem by institutionalizing the products and providing the venue and resources for long-term data collection to assess the impact of a transformative curriculum that targets the retention of women and students from underrepresented populations.

Broader Impacts

ChANgE Chem advances discovery and understanding by designing to transform teaching, training and learning. The transformative knowledge from this project will contribute to the national focus on STEM. Through development and promotion of a university-wide community of practice for engineering education, ChANgE Chem targets to increase the capacity and diversity of the STEM education community. This project broadens the participation in STEM by designing for the recruitment and retention of women and individuals from underrepresented populations. Designing for a transferable model and communicating results through established networks with socially adopted technologies affords broad dissemination. The interdisciplinary collaboration supporting the full fruition and materials, processes and models as outcomes significantly enhance the infrastructure for continued and ongoing research and education in STEM at UF. By contributing a more diverse and better-qualified engineering workforce, ChANgE Chem serves society by facilitating sustained economic growth, national security, and an informed electorate.