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| University of Florida IRB-02  ChANgE Chem Lab: Cognitive Apprenticeship for Engineers in Chem Lab |
| 1. **Background:**  * ChANge Chem Lab will build on the success of the NSF-funded TUES project (DUE-1245068; PI-Crippen, co-PIs Brucat & Wu) to improve the quality of STEM education by applying a unique approach to transform the laboratory curriculum of undergraduate general chemistry for engineers to a more contextually relevant and engaging experience for students. This transformed curriculum will use the Engineering Grand Challenges  (e.g., provide access to clean water, engineer the tools for scientific discovery) as fundamental organizing principles in practical engineering problems, communicated as human-interest stories. We will support student success with design structures that engage deep learning strategies that embody our understanding of effective learning. |
| 1. **Specific Aims:**  * ChANgE Chem Lab will substantially inform our understanding of how to actualize the potential of laboratory activities for broadening participation in STEM. ChANgE Chem Lab will leverage and build upon the intellectual merit from prior support (NSF-1245068: PI-Crippen, co-PIs Brucat & Wu), which includes a validated model of project-based learning of general chemistry for engineers that is proven successful for supporting the retention of underrepresented students. ChANgE Chem Lab’s unique potential for generating new knowledge is based upon the deep experience and expertise of the interdisciplinary project team, the access to high-quality resources (human and physical), and an ongoing and deep institutional commitment at the University of Florida. A laboratory curriculum based in the rich context of real-world engineering coupled with design elements that support the retention of all students is a distinctively transformative approach. |
| 1. **Research Plan / Study Description:**    * + As recommended by the *Common Guidelines for Educational Research and Development*, this project will use design-based Research as our research and development framework. Evaluation of the curriculum design will focus on usability—the extent to which students, TAs and instructors can use the materials to achieve the course goals, feasibility—the potential for success, and fidelity—the degree to which the materials are used as planned. In the culminating quasi-experimental pilot study, measures will be employed to assess the effect size on the outcomes for participating students.      + **Usability** - Usability testing will be conducted to evaluate how well the ChANgE Chem Lab materials work with the intended users – students and instructors. We will use video recorded sessions as well as pre and post interviews to analyze students’ and instructors’ user experience goals and expectations and how these goals and expectations are met as a result of interacting with the materials. Video data will capture participants' interaction with the materials. We will use these analyses to answer: ***What factors contribute to the usability of the ChANgE Chem Lab materials?***      + **Feasibility** - Feasibility will be examined using an *in-situ* comparative case study to understand implementation patterns in the participating chemistry courses relative to appropriateness of content, ease of use, and existing (and potentially needed) student, teaching assistant and instructor supports. Data sources will include observations, interviews with instructors, focus groups with students, and field notes. We will use these analyses to answer: ***What factors contribute to the feasibility of the ChANgE Chem Lab materials?***      + *The following types of data will be collected:*      + *Survey:*      + *Artifacts: A variety of artifacts will be collected to document the perspective and practices of all project participants. These may include but are not limited to homework assignments, reflective journal, papers and projects completed to meet course requirements.*      + *Online archives: Comments and responses that are posted to the Canvas may be archived.*      + *Observations: Observation data in the form of field notes or video recordings may be collected to document the interactions with the instructor or teaching assistants during class times.*      + *Semi-structured interviews: Interviews lasting approximately 20-30 minutes may be conducted to gain insight into the perspective and practices of a very small sample of project participants (approx. 5%). Interviews will be audio or video recorded and transcribed. Interviews will focus on the following kinds of questions:*        - *Describe what you are expected to do in this laboratory experience.*        - *What has been challenging for you? Please explain.*        - *What have you learned as a result of your participation in this laboratory experience?*        - *How has your participation impacted the way you think about chemistry?*        - *How has your participation impacted the way you think about engineering?* |
| 1. **Possible Discomforts and Risks:**    * + Our research involves understanding the needs of students and faculty regarding a transformation of the curriculum of undergraduate general chemistry. As such, we envision minimal risk or harm associated with participating in this project. Confidentiality cannot be guaranteed, but every effort will be made to protect participants. |
| 1. **Possible Benefits:**    * Our motivation is to improve the teaching and learning of engineering at the University of Florida. Results of this research will be used for the continual design and development of chemistry for engineers. The study participants represent the target audience for this intervention that intends to improve the experience and outcomes for all involved. Thus, during and following development, they may experience direct benefits in the form of increased engagement, performance and satisfaction with general chemistry. |
| 1. **Conflict of Interest:**    * No real or potential conflicts of interest are perceived by the PIs. |