Development of an innovative learning experience on plasmid isolation and protocol optimization for freshman students in a pilot laboratory course

Problem & Justification:
The vision and change initiative in life science education has charged universities with rethinking how undergraduate curriculum is presented and taught to students. For my Honors project, I designed and taught an innovative learning experience for freshman students in a pilot laboratory course. The course goals were to introduce and build basic microbiological, molecular genetic and biochemical engineering laboratory techniques, while empowering our students to undertake independent research in their first year. The topic of my module was plasmid isolation and protocol optimization from E. coli, a technique that would reinforce the independent problem solving and wet-lab skills needed for the duration of the course.

Objectives:
- Help students understand a basic principle in bioengineering (the plasmid) by diving into a protocol and optimizing it
- Design a module to introduce and refine students’ basic laboratory skills to lay the foundation for more advanced techniques needed for independent research projects
- Explore an innovative laboratory teaching style for freshman students to promote development of creative thinking and problem solving skills

Method:
• Several students used the original protocols
• Students made improvements
• Students had to figure out how their changes improved or decreased the DNA isolation

Results:
- Student population: Multidisciplinary (Chemical/Biological Engineering, Biochemistry, and Bioinformatics and Computational Biology)
- How do we build a base of foundational knowledge that blends biology and strain engineering along with literature review, wet-lab proficiency, and experimental design?

Conclusions:
- Students learn more when challenged rather than spoon fed
- Students think more critically when challenged with a problem
- Organization is key for running a laboratory effectively and efficiently
- Literature reviews are very helpful when deciphering what types of research can help to advance the field of synthetic biology