Miller Faculty Fellowship Grants Academic Year 2016-2017

Developing an instructor survey to measure the key principles of team-based learning instruction, $15,000

Faculty team: Cassandra Dorius, Sarah Bickelhaupt, Meghan Gillette and Jeanna Nation, human development and family studies; Lisa Orgler, horticulture; Melissa Rands and Sandra Gahn, School of Education; Michael Dorneich, industrial and manufacturing systems engineering; Monica Lamm, chemical and biological engineering; Jane Rongerude, community and regional planning; Laura Bestler, CELT; Ann Smiley-Oyen, kinesiology; and Holly Bender, veterinary pathology

Though US employers praise universities for teaching field specific knowledge, they increasingly identify serious deficits of soft skills such as critical thinking, complex problem solving, communication and teamwork (AACU, 2015). Currently, 173 ISU faculty are addressing these deficits by attending CELT training and ongoing support for Team Based Learning (TBL), a methodology that simultaneously enhances field specific training and soft skill development. However, it is unclear how and to what extent TBL is implemented by the various faculty. The goal of this project is to develop a research-based survey for 173 ISU TBL instructors to complement a previously developed and validated student survey. This instructor survey will be used to link instructor and student class experiences, thereby enabling TBL instructors to make evidence-based, data-driven course improvements for enhancing overall student learning potential. Over 2100 ISU students are taught using TBL each semester.

Integrating computational design and digital fabrication technology, $12,380

Faculty team: Nick Senske and Shelby Doyle, architecture

Developing technologies are transforming the design and construction of contemporary architecture. Notably, computational design and digital fabrication have transitioned from periphery specializations to essential design skills. Contemporary architecture schools are tasked with introducing these technologies as they are changing, creating an opportunity at Iowa State University to develop innovative curricula and democratize access to these skills. To ensure that every architecture student at ISU learns essential computational design and digital fabrication skills, we propose to redesign the required communication course ARCH 230 with the objective of introducing and promoting advanced digital design workflows to 85-100 students a year. The requested funding of $14,601 will be used to produce engaging, student-focused course materials, generate formative and summative assessment criteria to assist in the evaluation of computation and fabrication work created by students, and explore the integration of computation and fabrication in across nine electives and required architecture courses within the curriculum.

Implementing the assessment of cooperative learning in a large engineering course, $14,600

Faculty member: Benjamin Ahn, aerospace engineering

Literature shows that a student-centered instructional approach, such as cooperative learning (CL), has numerous benefits over teacher-centered approaches (e.g., lecturing) on engineering students’ learning. At ISU, the student-centered approach is widely used in introductory-level courses and low-enrollment discipline-focused engineering courses. However, this approach is rarely used in basic sophomore-level engineering courses (e.g., Mechanics of Materials [MoM], Statics), which have high enrollments, cover complex topics, and attract students from a wide variety
of engineering disciplines. The purpose of this proposed project is to (1) implement CL pedagogy in a required sophomore-level course (MoM) for students from multiple engineering disciplines at ISU and (2) to assess the effect of CL on student learning. The project will investigate whether CL can be successfully implemented in a large sophomore-level engineering class and whether CL improves student learning.

**Genetics laboratory: Integrating training in molecular techniques and bioinformatics tools to promote deeper understanding of core biology concepts,** $8,700

Faculty team: Jelena Kraft and Marna Yandeau-Nelson, genetics, development and cell biology

Diverse methods of instruction can be used to enhance student understanding of fundamental genetic concepts and techniques that are critical for basic knowledge and career development. An effective way to teach core concepts to students majoring in agriculture and life sciences is to provide hands-on laboratory experiences that allow immersion in authentic research activities. We seek to integrate a series of bioinformatic exercises using the molecular biology software, SnapGene, which is widely used by researchers to perform routine and essential tasks in molecular genetic experiments. Integration of lecture with hands-on bioinformatic exercises that conceptually describe lab experiments and core genetic processes will enable students to achieve a level of mastery over these essential professional skills. Effectiveness of these exercises will be evaluated via three assessments.

**Research, teaching and community engagement: Experiential learning through field ecology,** $8,000 (65 percent of request)

Faculty team: Timothy Stewart, Janette Thompson, Cassandra Nuñez, Michael Rentz and Peter Wolter, natural resource ecology and management; Joanne Olson and Kristina Tank, School of Education

We propose to develop a new course, “Field ecology research and teaching practicum” to enhance student skills in conducting research and communicating results, and increase youth/citizen knowledge and interest in environmental issues. Under faculty supervision, collaborative teams including natural resources and science education students will engage in inquiry-guided learning to conduct ecological research (biodiversity, habitat quality, pollution) at a local site (Ada Hayden Park), and develop related teaching modules/lesson plans. Objectives, methods, and results of research and teaching activities will be communicated by students to mentors and stakeholders as presentations and manuscript-format reports. Student teams will engage external audiences (K-12 students, general public) in teaching/outreach activities via field days and school/youth-oriented institution visits. Course design, outcomes, and projects will be disseminated through conference presentations and refereed publications. Information generated will be made broadly available on a dedicated website.