Science Education

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MaryKay Orgill

Professor
Department of Chemistry and Biochemistry

- Ph.D., Chemistry, Purdue University
- Fellow, Royal Society of Chemistry
- Former Chair of the American Chemical Society Division of Chemical Education
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Areas of Expertise

- Chemistry Education
- Biochemistry Education

Research Summary:

I am interested in using qualitative research techniques to examine and improve undergraduate chemistry teaching and learning. Currently, this involves looking at how students understand concepts explained in chemistry classes, how they solve chemistry-related problems, how they visualize different chemical concepts, and how they use language to make sense of chemical concepts. I have also been involved in a number of projects that provide professional development opportunities to faculty and K-12 teachers

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Undergraduate Education

Kurt M. Regner, Ph.D.

Professor in Residence

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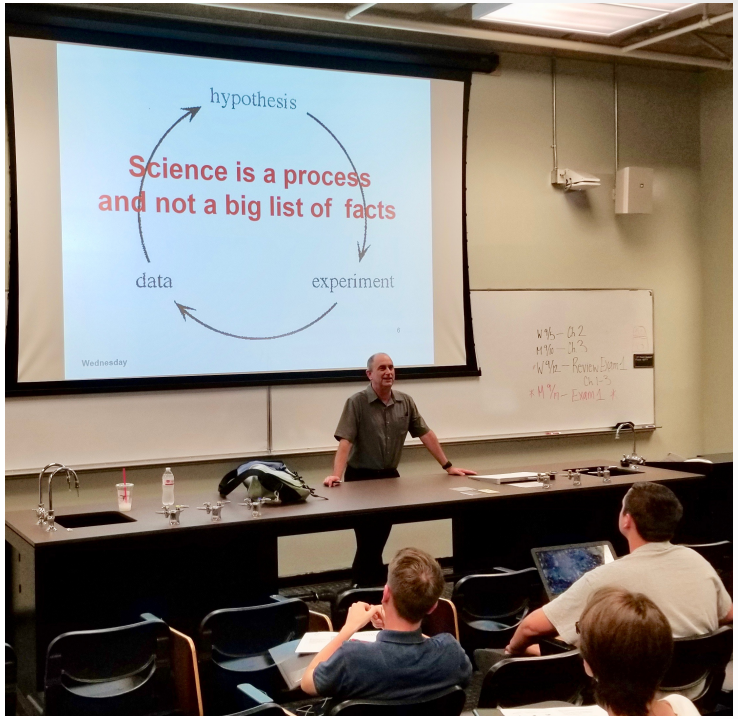

Expertise

- Plant Pathology
- Microbiology education
- Active learning
- Problem-based learning
- Undergraduate Research Programs
- Classroom based research experiences

https://www.unlv.edu/lifesciences/moereu

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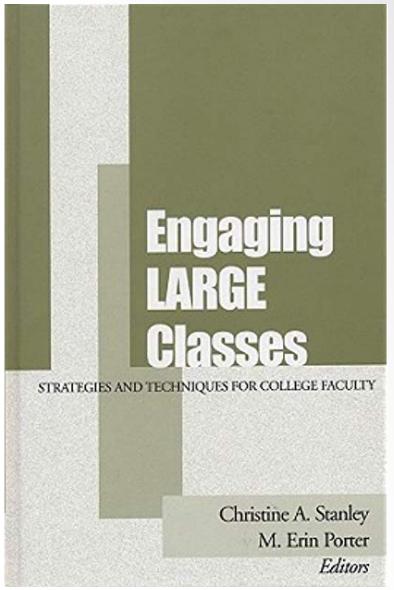
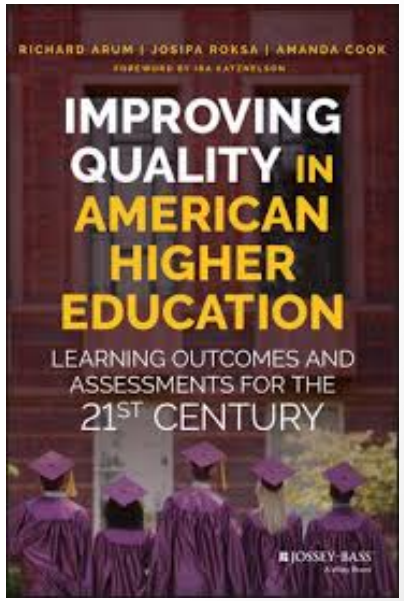
Teaching Approach

Challenge the students to take responsibility for their learning

Professor's responsibilities

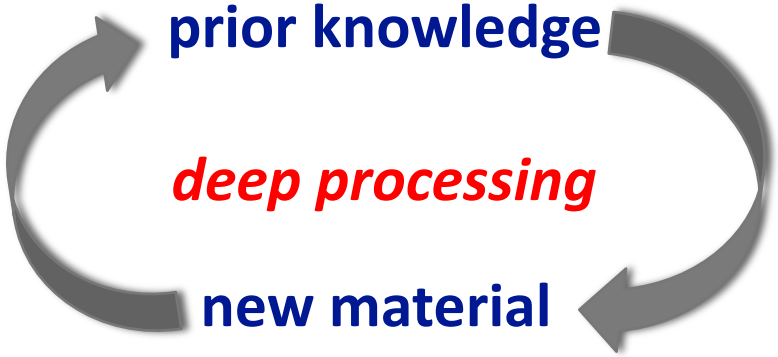
- Integrate concepts
- Explain the relevance
- Manage content
- Provide resources
- Evidence-based practices
- Active and engaging lectures
- Implement a variety of assessment
- Provide timely feedback
- Treat the students with respect
- Fosters Educational Equity

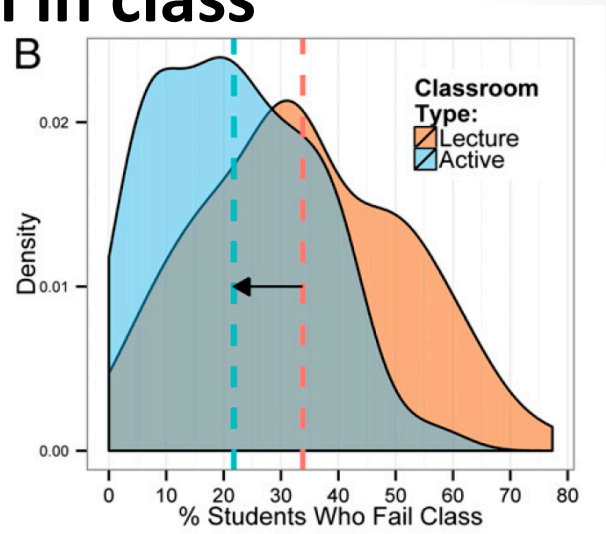




Active Learning

Writing, thinking and discussion in class





Low stakes methods

- Discussions
- Minute Paper
- Murkiest Point
- Draw and Explain
- Class Participation
- Think Pair and Share

- Meta-analysis of 225 studies
- Active learning improved exam scores by 6.0%
- Active learning resulted in increases of a half grade: C- to C
- Students were 1.5x more likely to fail in traditional lectures

Tanner, K.D., 2013. Structure matters: twenty-one teaching strategies to promote student engagement and cultivate classroom equity. CBE-Life Sciences Education 12(3):322-331

Freeman, S., et al. 2014. Active learning increases student performance in science, engineering, and mathematics. PNAS 111(23):8410-8415

Biol 207 Phage Discovery (4 cr)

Bacteriophage biology is used as a model to introduce science students to the process of science, developing communication / collaboration skills and employing quantitative reasoning.

Course-based Research Experience

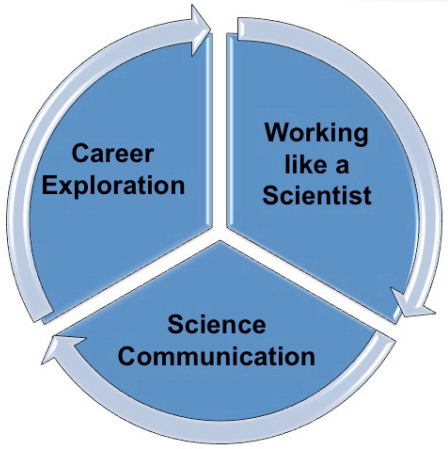
- **Attracts students to STEM careers**
- **Improves freshman retention and graduation**
- **Largest gains are from students traditionally underrepresented in science**

US needs 1 million STEM graduates for a competitive global economy

Jordan, T.C. 2014. A broadly implementable research course in phage discovery and genomics for first-year undergraduate students. *MBio*, *5*(1), pp.e01051-13.

Research Experiences for Undergraduates

Mechanisms of Evolution



- 10-wk summer research internship
- Research opportunities for students underrepresented in science
- Professional development activities
- Raise public awareness of evolution as a critical component of science literacy
- Enhance UNLV research infrastructure

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STEM Education Research

Dr. Jenifer C. Utz

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Expertise

- Undergraduate STEM education
- Digital learning resources
- Mammalian hibernation

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Facilitating academic achievement for a diverse undergraduate population

- Effects of self-testing:

Voluntary Web-Based Self-Assessment Quiz Use is Associated With Improved Exam Performance, Especially for Learners with Low Prior Knowledge

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Abstract
This study examined students' voluntary use of digital self-assessment quizzes as a resource for learning in a large anatomy and physiology lecture course. Students (n = 238) could use 16 chapter quizzes and four analogous unit quizzes to rehearse and self-assess knowledge. Most students (75%) engaged in occasional use of self-assessment quiz items; repeated use was uncommon (12%), as was lack of use (13%). Exam performance differed between quiz use groups. Quiz use improved exam performance more among students who entered the course with low prior knowledge of concepts from the prerequisite course. Cumulatively for all students and all exams, repeated self-assessment quiz users significantly outperformed occasional users (+7.5%) and non-users (+11.9%) on course exams. Incorporation of optional learning resources can enhance the learning success of students.

- Effects of skill training:

American Psychological Association
Journal of Educational Psychology

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2020, Vol. 112, No. 4, 765–781
http://dx.doi.org/10.1037/edu0000405

Can a Brief, Digital Skill Training Intervention Help Undergraduates "Learn to Learn" and Improve Their STEM Achievement?

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University of Nevada, Las Vegas

Students who drop out of their science, technology, engineering, and math (STEM) majors commonly report that they lack skills critical to STEM learning and career pursuits. Many training programs exist to develop students' learning skills and they typically achieve small to medium effects on behaviors and performance. However, these programs require large investments of students' and instructors' time and effort, which limits their applicability to large lecture course formats commonly employed in early undergraduate STEM coursework. This study examined whether brief, digital training modules designed to help students apply learning strategies and self-regulated learning principles effectively in their STEM courses can impact students' behaviors and performance in a large biology lecture course. Results indicate that a 2-hr *Science of Learning to Learn* training had significant effects on students' use of

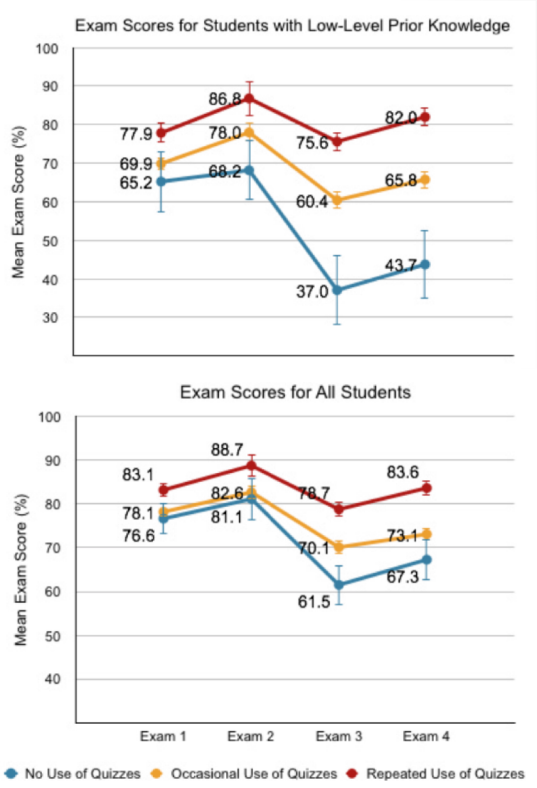

Figure 3. Effect of Self-Assessment Quiz Use on Exam Performance Symbols represent means ± standard error of the mean.

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Developing the Skill and Will to Succeed in STEM Scholarship Program

A primary goal of this scholarship program is to diversify and increase the number of students entering STEM professions

- The School of Life Sciences welcomed the first cohort of 17 Succeed in STEM Scholarship recipients in 2019
- Over $420,000 of scholarship support will be distributed across the lifetime of this 5-year program

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Hibernation physiology

- Rewarming from torpor:

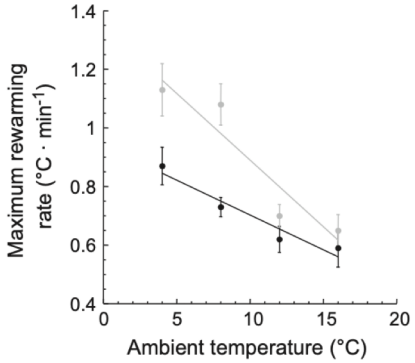


Fig. 3. Effect of ambient temperature on maximum rate of rewarming for natural and prematurely induced arousal from torpor. Symbols represent means ± SE for natural (black) and induced (gray) arousal; $n=5$. There is a significant effect of T_a on the maximum rate of rewarming for both natural and induced arousals, $p < 0.05$, $r^2=0.93$, $r^2=0.88$ respectively. There is a significant effect of arousal type on the maximum rate of rewarming, $p < 0.05$.

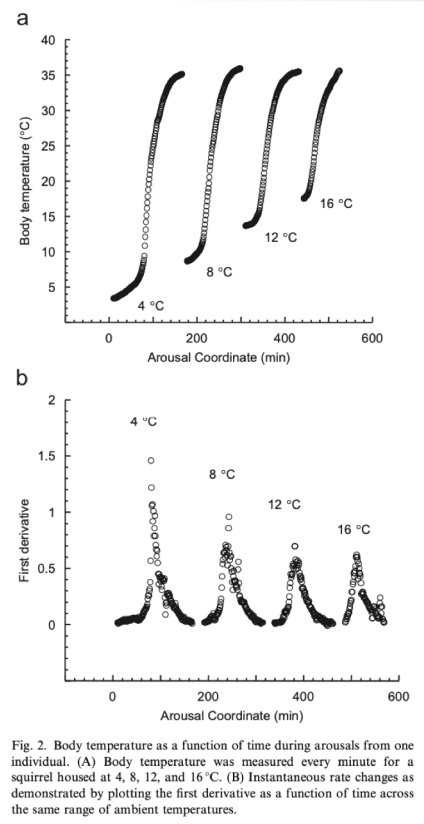
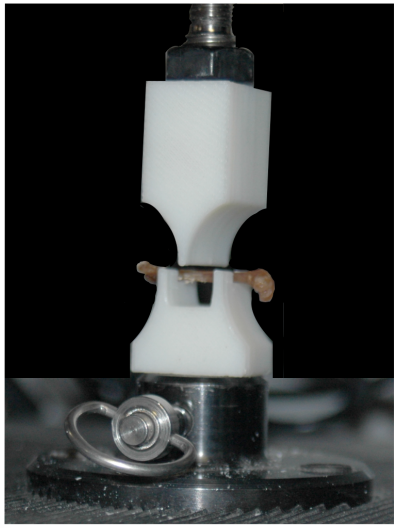
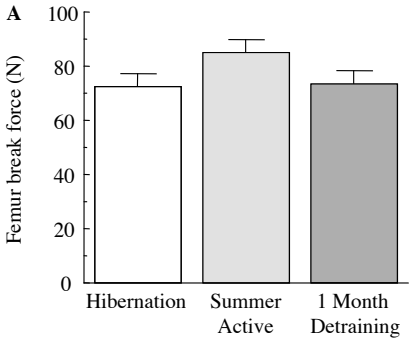
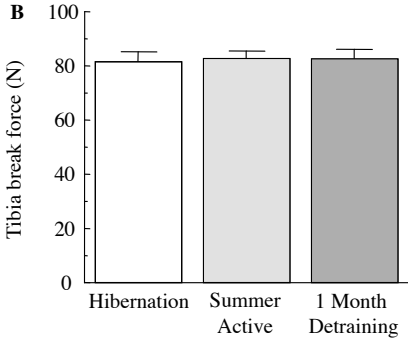


Fig. 2. Body temperature as a function of time during arousals from one individual. (A) Body temperature was measured every minute for a squirrel housed at 4, 8, 12, and 16 °C. (B) Instantaneous rate changes as demonstrated by plotting the first derivative as a function of time across the same range of ambient temperatures.

- Resistance to bone disuse atrophy:







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