Stem Teaching Symposium

Date & Time: Friday, Sept. 27, 9:00 am - 4:00 pm
Location and Building: Maraschi Room, Fromm Complex

AGENDA

9:00 - 9:30 AM: BREAKFAST

SESSION 1

9:30 - 9:45 AM: James Sikes (BIO), Experiential Learning - creating active classrooms, planning field immersions, & reinventing lab modules

9:45 - 10:00 AM: Michael Stevenson (CHEM): Using reflection to boost student learning in chemistry courses

10:00 - 10:15 AM: Alark Joshi (CS): Towards Equitable Teaching practices - Specifications grading, flexible deadlines, and assignment retakes

10:15 - 10:30 AM: Kae McCarty (KIN): Active Learning Pedagogy for Increased Engagement in the Classroom

10:30 - 10:45 AM: Genna Smith (ENGR): Flipped introductory physics classroom and strategies for valuing process in addition to product

10:45 - 11:00 AM: BREAK

SESSION 2

11:00 - 11:15 AM: David Wolber (CS): Create Gen-AI Chatbot and Debate apps for your students

11:15 - 11:30 AM: Karen Francis (KIN): Introducing and integrating AI into the classroom

11:30 - 11:45 AM: Shan Wang (MSDS): Improve STEM Diversity and Workforce Readiness through AI-Focused Internships in Tech Education

11:45 - 12:00 PM: Cody Carroll (Math / MSDS): Data Science Here and Now

12:00 - 12:15 PM: Chris Brooks (CS): Using Reflective Activities to Incorporate Real-world Applications and Issues

12:15 - 1:15 PM: LUNCH & ACTIVITY

SESSION 3

1:15 - 1:30 PM: Marcelo Camperi (PHYS): Peer Instruction in Physics Lectures

1:30 - 1:45 PM: Akshay Pattabi (ENGR): Interactive demonstrations and quizzes in a flipped introductory engineering physics class.

1:45 - 2:00 PM: Cary Lai (BIO/BIOTECH): Biotechnology project lab course: original research projects in a lab class setting

2:00 - 2:15 PM: Christina Tzargarakis-Foster (BIO): Building Impactful Partnerships - CEL experience in Biology of Cancer course

2:15 - 2:30 PM: Nour Al-muhtasib (BIO): The use of iClicker to increase student engagement in an introductory physiology course

2:30 - 2:45 PM: BREAK

SESSION 4

2:45 - 3:00 PM:

3:00 - 3:15 PM: Jennifer Tripp (CHEM): Using Green Chemistry and the UN SDGs to connect science content to global sustainability

3:15 - 3:30 PM: Herman Nikolayevskiy & Sangman Kim (CHEM/BIO): A CURE for Bacterial Infections: A Cross-Disciplinary Antimicrobial Experience

3:30 - 3:45 PM: Lou Sassoubre & Genna Smith (ENGR): Iteration, rapid prototyping and reflection in project-based courses to help students be more comfortable with ambiguity and experimenting

3:45 - 4:00 PM:

4:00 - 4:15 PM: REFLECTION & CLOSING REMARKS

ABSTRACTS

James Sikes (BIO), Experiential Learning - creating active classrooms, planning field immersions, & reinventing lab modules

While active learning is often discussed in modern pedagogical practice, experiential learning is another high impact way to engage students. Experiential learning emphasizes learning through meaningful participation in and structured reflection on real or simulated experiences while active learning often builds on prior knowledge and experiences. In immersion field experiences to varied locations (Galapagos Islands / California tidepools) as well as discovery-based laboratory modules in embryology, we have developed experiential learning strategies that incorporate authentic learning experiences where students gain knowledge or develop skills by actually doing rather than reviewing content. Together with active learning strategies in the classroom, these activities have transformed my courses.

Michael Stevenson (CHEM): Using reflection to boost student learning in chemistry courses

In the upper-division chemistry course Inorganic Chemistry, students explore previously studied concepts in greater detail while integrating them to build new paradigms that are often challenging to learn. Based on instructional activities learned at the 2023 SEPAL Scientific Teaching Summer Institute, metacognitive and active learning strategies were incorporated into Inorganic Chemistry in Fall 2023 - challenge statements, cognitive rehearsal time, and retrospective post-assessments. These activities took minimal time in class but had far reaching effects on student learning and bolstered test scores by 20 percentile points showing that small, intentional changes can have significant positive effects on student engagement and comprehension.

Alark Joshi (CS): Towards Equitable Teaching practices - Specifications grading, flexible deadlines, and assignment retakes

Today, 70 percent of full-time college students work (on campus or off campus) to make ends meet. They also are more likely to be black or hispanic, older and female. In this presentation, I will share the strategies I have used to change my approach to teaching to be more equitable to all students. The first strategy is called Specifications Grading. Specifications grading provides students with agency on which aspects of an assignment to work on, but also allows the instructor to maintain a minimum level of difficulty for all students. The second strategy is geared towards students who may experience life events that have a significant impact on their semester. Flexible deadlines for low-stakes assignments and a fixed number of late days for the entire semester allows students to survive life events and turn in high-quality work. The last strategy is related to allowing assignment retakes. The process of allowing students to retake assignments not only encourages students to learn the material better but they feel more empowered and engaged in their learning.

Kae McCarty (KIN): Active Learning Pedagogy for Increased Engagement in the Classroom

Revitalizing engagement in today's classroom can be a difficult task, particularly in STEM fields. Class-long lectures become less effective as higher education becomes more accessible, inviting a diverse student body of learners. Blending research in attention as well as active learning has created an innovative pedagogical strategy (i.e., The 20 minute Lecture) which can be used alongside grounded learning activities each class period. This session will

detail the logistics of this strategy, giving concrete examples of activities used, and share student feedback.

Genna Smith (ENGR): Flipped introductory physics classroom and strategies for valuing process in addition to product

By flipping my classroom, I've moved content-heavy lectures to an offline format that allows students to take as many breaks as they need in order to absorb the dense information provided. Knowledge checks embedded throughout the pre-recorded lectures allow me to see where students are struggling and make real-time adjustments to the in-person activities that follow. By utilizing a variety of learning activities (group quizzes, individual quizzes, reading notes, in-person problem solving sessions, self-designed lab experiments, etc.) students are given many ways to demonstrate their knowledge beyond the standard exam. Students are also rewarded for learning how to learn and learning how to approach physics problems, and not solely on the end product (a correct final answer).

David Wolber (CS): Create Gen-AI Chatbot and Debate apps for your students

Calling all Teachers: You can create Gen-AI apps for your students which let them have conversations and debates with AI experts in your fields. Blocks Coding with Thunkable opens up software creation to everyone, and now you can access the super brain (OpenAI). Come check out the demo and build your first educational app in less than an hour, even if you've never coded before!

Karen Francis (KIN): Introducing and integrating AI into the classroom

Embracing AI in the classroom can be an interesting and inclusive experience. After experimenting with a couple of AI engagement activities last year, I decided to embrace AI more holistically in my classroom this semester. My approach includes a basic introduction, breakout discussions on the ethics of AI and student comfort level with AI, and a series of activities ranging from team-based research questions (reflect/analyze/critique) to choosing a research topic for their podcast.

Shan Wang (MSDS): Improve STEM Diversity and Workforce Readiness through AI-Focused Internships in Tech Education

MSDS provides a 9-month internship program where students are guaranteed to work with one of our industrial partners to gain real-world experience as a data scientist. This has been the top abstraction of the program, as well as the most valuable job experience that helps hundreds of our graduates to land a full-time job. In the recent years, we have extended our scope to include more non-profit sectors or projects that focus on ADEI and social impact. Together with other admission and curriculum efforts, we have seen great improvements in the students' diversity as well. In this talk, I will introduce this program and discuss the challenges too.

Cody Carroll (Math / MSDS): Data Science Here and Now

We propose and discuss the idea of teaching data science through a "here and now" approach— a method which uses current events and our common university setting to contextualize data science as a subject that is immediately relevant to students' lives. Examples of this style include engaging with citizen science projects in the community,

discussing weekly data visualizations in the news, and exploring and visualizing survey data collected from USF students themselves. We argue that this approach lowers entry barriers and promotes inclusivity in a technical field, exposes students to more sides of the data science life cycle, and prepares students to evaluate evidence critically in an increasingly data-driven world.

Chris Brooks (CS): Using Reflective Activities to Incorporate Real-world Applications and Issues

I will show how I use structured reflective activities to supplement in-class learning on technical topics. These reflections encourage students to engage more deeply with ethical and social implications of AI technology and think more carefully about real-world controversies and issues. I will also show how I use specifications grading to keep the focus on the students' ideas and avoid creating anxiety about writing and composition skills.

Marcelo Camperi (PHYS): Peer Instruction in Physics Lectures

Peer instruction is an active learning technique used in physics and other science classes. It is an easy way to add interactivity to a traditional lecture course, which can get students engaged and allow instructors to identify and respond to what students are thinking about a topic, leading to improved student learning. At its core, it involves small group discussion of carefully constructed conceptual questions interspersed with lectures.

Akshay Pattabi (ENGR): Interactive demonstrations and quizzes in a flipped introductory engineering physics class.

Engineering majors take two semesters of physics – PHYS 150 and PHYS 151 – by their sophomore year, and come into the class with a vast range of math and physics preparedness from high school. We design these two courses to equip engineering students with rudimentary problem-solving skills that will be built on in later courses.

I designed the first course PHYS 150, which deals with Newtonian mechanics, based on Prof Gennifer Smith's flipped classroom-based PHYS 151, which focuses on electromagnetism and circuit analysis. In addition to the usual flipped classroom elements – pre-recorded lecture videos, in-class quizzes and worksheets – I introduce an element of interactive physics demonstrations in the class. Since a lot of Newtonian mechanics is experiential and "physical", this gives students the opportunity to meaningfully engage with concepts such as motion, inertia, forces and friction. I also design short conceptual quizzes around these demonstrations, on which students work individually and in groups, an activity that seems to enhance student engagement and learning.

Cary Lai (BIO/BIOTECH): Biotechnology project lab course: original research projects in a lab class setting

Our second year Master's in Biotechnology students take BTEC 688/689: Advanced Research Methods as their capstone laboratory course. BTEC 688/689 is different from most lab courses in that pairs of students choose independent projects that they choose, design, and execute during the semester. Some students develop projects from scratch whereas other students work on projects in collaboration with biotech companies. While teaching this projects-based lab class has its challenges, the main benefit is developing the students' training as young scientists - being able to not just follow protocols in the lab, but to design, develop and analyze experiments semi-independently.

Christina Tzargarakis-Foster (BIO): Building Impactful Partnerships - CEL experience in Biology of Cancer course

I will discuss the impact of community-engaged partnerships as a component of my UD biology course, which can be applied to other science courses. The integration of community insights and collaborative relationships between local organizations and our students provides an important element to this course and allows for a more holistic approach to teaching the topic of cancer biology. I will provide examples of establishing relationships with various community organizations and how the CEL experience, especially in our science courses, makes a lasting impression on our majors.

Nour Al-muhtasib (BIO): The use of iClicker to increase student engagement in an introductory physiology course

Human Physiology (BIOL115) is a prerequisite course for several majors at the University of San Francisco including, nursing, kinesiology, and public health.. For the past two semesters, we have used the polling technology, iClicker. It is used to ask students check-in questions at the beginning of each class and content knowledge questions throughout the lecture. The check-in questions range from simply asking students how they are doing to questions about their favorite color. The content knowledge questions checked student understanding of the material. This was also used to grade students on participation.

Jennifer Tripp (CHEM): Using Green Chemistry and the UN SDGs to connect science content to global sustainability

Several new projects coordinated by the American Chemical Society provide instructors of chemistry and related subjects with ready-made curricula for teaching science content in the context of global sustainability, showing how the chemical enterprise relates to health, environmental, economic, and regulatory considerations. I'll provide specific examples of curriculum modules and case studies that connect course topics such as thermochemistry, molecular structure, and electrochemistry to the Principles of Green Chemistry and the United Nations Sustainable Development Goals, and allow instructors simple ways to engage students in thinking more broadly about the specific course topics they're learning.

Herman Nikolayevskiy & Sangman Kim (CHEM/BIO): A CURE for Bacterial Infections: A Cross-Disciplinary Antimicrobial Experience

Undergraduate research experiences (UREs), in combination with proper mentoring, are associated with higher academic achievement in science courses and increased persistence in STEM fields. These experiences are particularly beneficial to underrepresented minority and first-generation students, who traditionally struggle in introductory STEM courses and have lower STEM persistence rates. Although the majority of faculty in the Chemistry and Biology departments at USF are research-active, the number of Chemistry and Biology majors far outstrips the number of available positions in research labs. One scalable approach to address the problem of insufficient research access is the introduction of course-based undergraduate research experiences (CUREs) into the curriculum. Towards this end, a cross-disciplinary CURE project focusing on the synthetic development of novel antibiotics (performed by students in Advanced Organic Chemistry Lab; CHEM 333) and their evaluation using disc diffusion assays (performed by students in General Microbiology Lab; BIOL 347) was test-run in Spring 2023. Student evaluations suggest that students appreciated the collaborative nature of the experience, and achieved a greater degree of proficiency in

experimental techniques and critical thinking skills. Students also provided constructive feedback concerning experimental timing, guidance, and the amount of cross-lab interaction, which will be incorporated into a future iteration of this CURE module.

Lou Sassoubre & Genna Smith (ENGR): Iteration, rapid prototyping and reflection in project-based courses to help students be more comfortable with ambiguity and experimenting

Experimentation and iteration are important skills for engineering students and many other STEM majors. The first idea a student has for a project is not always the best final idea. In ENGR 210: Project and Design II, we work with students to build their rapid prototyping, experimentation and iteration skills. Starting Day 1 with improv activities, we encourage students to have strong ideas held lightly, think creatively, be flexible and celebrate mistakes. Students are given four design challenges over the course of a semester. Something is due before and after every class to help students structure their design process (grading is de-emphasized). Students design for a clearly identified user and in a specific social and environmental context. Each team must design, prototype and test at least three ideas before choosing a final design that is often tested and iterated on again based on additional data and feedback. Key to learning from each design challenge is reflection. Students are asked to reflect visually with a journey map tracking learning and emotions throughout the process. By the end of the semester, students have learned to let go of their first idea, navigate ambiguity in the design process, rapidly prototype, test ideas and reflect on the inverse relationship between learning and emotions during the design process.