2025-26 Strategic Instructional Innovations Program

The Grainger College of Engineering at the University of Illinois Urbana-Champaign

Competitively awarded grants enable faculty teams to accelerate best practices for teaching, develop new best practices, and reimagine what it means to educate our students.

Faculty communities • Amplifying student learning • Curriculum • Technology • Teaching at Scale • Innovation

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Implementation & Exploration Track

Service-Learning Ecosystem (Year 3)*

The project connects university students in the Grainger College of Engineering, pre-licensure education students, and K–12 partners in a service-learning ecosystem to develop and deliver new STEM education modules, with emphasis on the Entrepreneurial Mindset Learning (EM) framework, to K-12 students across Illinois.
Blake Johnson (MechSE), Yuting Chen (ECE), Hyena Cho (Education), Yael Gertner (CS), Lara Hebert (GCOE & FACES Center), Joshua Katz (Education), Sihui Ma (Food Science and Human Nutrition), Marcia Pool (BioE/Illinois Cancer Center), Saadeddine Shehab (SCD) Liaison: Katy Huff

Redesigning Design: Incorporating HCD and the 3 C's in Capstone Design Courses (Year 3)*

This team plans to incorporate an entrepreneurial mindset (EM) framework in the design process by incorporating HumanCentered Design (HCD) elements into capstone projects to to complement the core competency learners have developed over their early course of study. Through a growing community of practice, the team will support the department to create a vision and framework for incorporating EM and HCD into future lower-level courses.
Matthew Goodman (MatSE), Blake Johnson (MechSE) Jessica A. Krogstad (MatSE), JC Stinville (MatSE), Saadeddine Shehab (SCD), Taylor Parks (SCD) Liaison: Chandrasekhar Radhakrishnan

Intervention After Failure and Success in ECE Circuits Courses (Year 3)

This team seeks to better understand students' ability to navigate and respond to failure as an opportunity for growth and learning through the scientific enterprise. With little engineering education research on how students respond to failure, the team will try to better understand the range of student responses to failure before considering any future work that could help build resilience to failure and ways in which we can help students learn from failure.
Juan Alvarez (ECE), Jessica Gladstone (EPSY), Jennifer Cromley (EPSY) Liaison: Katy Huff

Using a Human-Centered Engineering Design Framework to Co-Design Aerospace Engineering Courses (Year 3)*

This team will utilize the HCD framework to a) build a curriculum map to identify possible HCD activities and learning progressions for aerospace students to develop human-centered engineering design knowledge, skills, and mindsets, b) collaborate with additional faculty members to evaluate existing courses and co-design changes, and c) identify connections between course learning objectives and activities and students' learning outcomes that are defined in the ABET and KEEN frameworks.

Timothy Bretl (AE), Elle Wroblewski (AE), Saadeddine Shehab (SCD), Taylor Parks (SCD) Liaison: Chandrasekhar Radhakrishnan

Game for Community Resilience-Based Decision-Making Education and Entrepreneurially Minded Learning (Year 3)*

This team is advancing an engineering decision-making game as an instructional module on societal impact–based structural engineering risk management. Building on earlier pilot testing, the project now includes refined board and computer game versions with integrated instructional materials. Current efforts focus on: (1) expanding dissemination through board game distribution, AWS-hosted computer games, and outreach events; (2) strengthening assessment to evaluate learning outcomes across diverse student populations; and (3) formalizing a reusable design framework for broader adoption. Aligned with the KEEN Network's 3C's - Curiosity, Connections, and Creating Value - the project fosters entrepreneurially minded learning while promoting systems thinking, community resilience, and equitable decision-making.

Eun Cha (CEE), Eric Shaffer (ECE), Luc Paquette (Edu) Liaison: Jay Mann

Enhancing Project Management Skills in Engineering Curricula and Beyond (Year 3)*

This team aims to better understand the current level of project management knowledge and skills of engineering students and non-engineering students both early and late in their programs of study. Individual students will be tracked over time and throughout their program of study to assess what is most impactful for project management learning. The project also aims to assess the current satisfaction of alumni and potential employers with project management skills of our graduates. This effort will be expanded to other majors at UIUC as well as peer institutions.

Paul Davidson (ABE), Travis Johnson (ABE), Molly Goldstein (ISE) Liaison: Matt Goodman

TheorieLearn: Autograded Resources for Theoretical Computer Science (Year 3)

This team will develop resources on the PrairieLearn platform to support the teaching of algorithms, data structures, and other theoretical aspects of computer science, at several different levels of the computer science curriculum. The project extends an existing effort to develop PrairieLearn resources for CS374 and expands this effort to include CS 225 in the first year, and to include CS277, CS401, and CS 403 in future years.

Jeff Erickson (CS), Carl Evans (CS), Yael Gertner (CS), Brad Solomon (CS) Liaison: Chris MIgotsky

Computational Tools for Dynamics and Control (Year 3)

This team will enhance and modernize key undergraduate courses serving students in the Grainger College of Engineering by incorporating meaningful elements of computational tools and exercises. This includes flexible Colab/Python exercises and homework projects in ME 340 and ME 360 with the intention of presenting more realistic problems to students (e.g. signal processing of acoustic signals, interactive visualization of dynamical systems), as well as the development of Condynsate, a combined physics simulation and 3D visualization tool for use in AE 352 and AE 353. Both approaches incorporate programming elements designed to enhance student understanding beyond running pre-programmed tools. Major year-3 taks are the documentation, sustainability, dissemination, and expansion to new fields of application of these tools.

Sascha Hilgenfeldt (MechSE), Timothy Bretl (AE), Wayne Chang (AE), Siegfried Eggl (AE/Astronomy), Thomas Golecki (MechSE), Prashant Mehta (MechSE), Melkior Ornik (AE), Srinivasa Salapaka (MechSE), Matthew West (MechSE) Liaison: Katy Huff

Test Anxiety and the CBTF (Year 3)

This team will explore the state of testing anxiety experienced by students who take their midterm and final exams in the Computer-based Testing Facility (CBTF). The Project will serve multiple objectives: (1) establish baseline data concerning the extent of testing anxiety related to CBTF exams and factors contributing to that test anxiety; (2) inform the development of policies and procedures aimed at mitigating testing anxiety related to CBTF exams; and (3) facilitate the development of educational and training materials for faculty and students that are aimed at reducing testing anxiety in the CBTF.

Mariana Silva (CS), Julie Baker (ATLAS), Geoffrey Herman (CS), Dave Mussulman (iSchool), Jim Sosnowski (CBTF), Matthew West (MechSE), Craig Zilles (CS) Liaison: Jay Mann

Exploring the Impact and Potential of Generative AI in Engineering Education (Year 2)*

This project aims to explore the impact and potential of generative AI in engineering education. In particular, the team seeks to integrate generative AI into STEM higher education curricula to cultivate the entrepreneurial mindset advocated by the KEEN 3 C's: curiosity, connections, and creating value.

Abdu Alawini (CS), Volodymyr Kindratenko (NCSA), Sotiria Koloutsou-Vakakis (CEE), Tomasz Kozlowski (NPRE), Meredith Blumthal (ACE), Maryalice Wu (CITL) Liaison: Sascha Hilgenfeldt

Enabling the Learning and Practice of Effective Teamwork Behaviors using Cross-Tool Log Data (Year 2)

This project will ensure every graduate of the Grainger College of Engineering learns the necessary skills to become a successful team player in industry. Teamwork is important in engineering classrooms to satisfy industry demand for proficient team players and harness the pedagogical benefits of collaborative learning, and the team plans to leverage log data captured by digital collaborative tools to enable students to view, compare, and reflect on their teamwork behaviors using visual evidence and support instructors to diagnose and provide evidence-based feedback for improved teamwork at scale.

Brian Bailey (CS), Darko Marinov, (SCDS), Hari Sundaram (SCDS), Wendy Shi (SCDS), Yifan Song (SCDS), Emma Mercier (Curriculum and Instruction) Liaison: Rebecca Reck

Designing a New CS1 Course for Engineering Students (Year 2)

This project is the second year of a comprehensive redesign of CS 101, focusing on re-establishing basic programming fundamentals (CS1) during lectures while integrating diverse engineering applications into lab sections and bi-weekly mini-projects to improve the rigor and relevance of the course for all students. Year two is predominantly focused on ensuring cohesion between direct instruction and the updated labs/projects, exploring collaboration mechanisms for labs, and boosting Matlab/Octave resources for projects and labs to serve interested student populations.

Max Fowler (SSCDS), Mariana Silva (SSCDS), Nico Ritschel (SSCDS), Wayne Chang (AE), Brian Mercer (MechSE), Ke Tang (MechSE), John Popovics (CEE) Liaison: Jacob Henschen

Incorporating Entrepreneurial Mindset into Circuits Curriculum (Year 2)*

This project will incorporate Entrepreneurial Mindset (EM) based methodology across the curriculum that uses circuit concepts both in the Department of Electrical and Computer Engineering as well as the Department of Mechanical Engineering. The project goal is to enable students to go beyond problem solving, and develop a creative mindset. This project will bring instructors together to create modules, activities, demonstrations, and reflection exercises that will make students curious, help them connect knowledge gathered from different courses, and create an aspiration for lifelong learning.

Chandrasekhar Radhakrishnan (ECE), Chris Schmitz (ECE), Arjit Banerjee (ECE), Jonathon Schuh (ECE), Olga Mironenko (ECE), Nenad Milijkovic (MechSE), Victoria Shao (ECE) Liaison: Chris Migotsky

Adopting an Entrepreneurial Mindset via the Lab and Design Community of Practice (Year 2)*

This project will promote and emphasize EM in lab and design courses through (1) growing the GCoE Lab and Design CoP and (2) strategically implementing EM projects and studies into CoP member courses. The CoP will continue to include faculty and staff who teach or support traditional laboratory courses, design courses (e.g., capstone, first-year experience), and similar courses with large design projects. All of these courses have significant experiential learning components that closely align with objectives of curiosity, connections, and creating value, the 3Cs of EM.

Rebecca Reck (BioE), Holly Golecki (BioE), Christopher Schmitz (ECE), Katie Ansell (Phys), Chandra Radhakrishnan (ECE), Jessica TerBush (MatSE), Caroline Cvetkovic (BioE), Dave Mussulman (iSchool) Liaison: Chris Migotsky

Design Choices You Can "Feel": Creating Value with Structural Systems in Virtual Reality (Year 2)*

This team will develop a set of VR immersive experiences within structural systems and reinforced concrete modules with design options and consequences. This proposal builds on three years of work by the PIs on VR to now better support students' curiosity and ability to make connections and create value through learning experiences in VR modules.

Ann Sychterz (CEE), Marci Uihlein (Architecture), Jacob Henschen (CEE), Eric Shaffer (CS), Mohamad Alipour (CEE) Liaison: Jay Mann

Crystal Vision: "A Video Game to Enhance Student Learning Outcomes on Engineering Materials" (Year 1)

This project proposes the development of a cloud-based 3D educational video game to enhance student engagement and learning in CEE 300: Behavior of Materials and MSE 280: Engineering Materials at UIUC. Building on prior VR-based educational tools, which improved learning outcomes but faced scalability and user comfort challenges, the new platform will be built on WebGL for broad accessibility and incorporate machine learning algorithms to adapt difficulty based on user performance. The game will cover key materials science topics, including stress-strain behavior, fracture mechanisms, phase diagrams, and XRD analysis, with a narrative-driven, exploratory structure to promote systems thinking, critical analysis, and entrepreneurial mindset habits.

Nishant Garg (CEE), Jacob Henschen (CEE), Jenny Amos (BioE), Matthew Goodman (MatSE), Eric Shaffer (CS) Liaison: S. Lance Cooper

SIIP and Share: Podcasts to Connect to Engineers to Grainger COE (Year 1)*

This team will convene a faculty community of practice to advance excellence in teaching methods through a podcasting (digital storytelling) medium. The team plans to establish a Grainger COE-based podcast that engages Grainger community members (faculty, staff and students) to share best practices.

Holly Golecki (BioE), Jenny Amos (BIOE), Wayne Chang (Aerospace Engineering), Ramez Hajj (Civil and Environmental Engineering), Blake Johnson (Mechanical Science and Engineering), Colleen King (Journalism, College of Media), Saadeddine Shehab (Siebel Center for Design), Ashleigh Wright (IDEA Institute), Lewis Lehe (CEE) Liaison: Yael Gertner

Developing an Advanced Integrated Engineering Course on Community Resiliency and Disaster Planning (Year 1)*

This team will continue to integrate the PrairieLearn platform in two core CEE courses– facilitating new approaches in content and best pedagogical practices..
Sotiria Koloutsou-Vakakis (CEE), Mani Golparvar Fard (CEE), Jacob Henschen (CEE), Hannah Horowitz (CEE), Eleftheria Kontou (CEE), Helen Nguyen (CEE), Megan Matthews (CEE), Hadi Meidani (CEE), John S. Popovics (CEE), Ashlynn Stillwell (CEE), Chris Tessum (CEE) Liaison: Yael Gertner

Artificially Successful? Investigating and Responding to Generative AI's Capability to Solve Course Assignments (Year 1)

This project will launch a comprehensive redesign of CS 101, focusing on re-establishing basic programming fundamentals (CS1) during lectures while integrating diverse engineering applications into lab sections and bi-weekly mini-projects to improve the rigor and relevance of the course for all students.
Melkior Ornik (AE), Abdussalam Alawini (SSCDS), Jennifer Cromley (EdPsy), Siegfried Eggl (AE), Max Fowler (SSCDS), Kellie Halloran (MechSE), Bin Hu (ECE), Keilin Jahnke (TEC), Tawnya Means (Gies), Jamie Nelson (CITL, Gies), Abhishek Umrawal (ECE), Lav Varshney (ECE) Liaison: Olga Mironenko

Active Learning for Entrepreneurial Mindset at Scale (Year 1)*

This project is working to create demos connected to real-life applications for courses in the TAM 2XX curriculum chain. These demos will be focused specifically on engaging students in large lecture-style courses, and will be used multiple times in each course, each time highlighting a different course concept or problem. The team will also evaluate ways to engage students in lecture halls and discussion sections with demo content. Both the active learning activities and demos will be focused on guiding students to develop entrepreneurial-minded habits that last beyond the TAM 2XX courses.
Kellie Halloran (MechSE), Tom Golecki (MechSE), Mariana Kersh (MechSE), Brian Mercer (MechSE), Emma Mercier (Curriculum and Instruction, Educational Psychology), Mariana Silva (CS), Kevin Wandke (MechSE), Matt West (MechSE) Liaison: Sascha HIlgenfeldt

Automatic Short Answer Grading at Scale Using Large Language Models (Year 1)

This project supports the development and integration of a scalable ASAG system into the PrairieLearn platform, initially targeting a diverse array of disciplines. The team hopes to enable instructors, irrespective of their familiarity with LLM technology, to utilize our ASAG system for grading free-form textual short answers. The system will leverage pretrained models such as OpenAI's GPT variants, as well as specialized locally trained models, to provide accurate, fair, and timely feedback on student submissions.
Mariana Silva (CS), Matthew West (MechSE), Jeff Erickson (CS), Yael Gertner (CS), Seth Poulsen (USU) Liaison: Mattox Beckman

Highlighting Course Connections (Year 1)*

This team's goal is to improve students' interdisciplinary problem-solving skills by highlighting the dense web of connections between courses across Grainger, noting that courses across disciplines rely on very similar concepts, tools, applications, methods, learning objectives, etc. The project will make these or connections across the engineering curriculum more widely known, discussed, and highlighted by faculty.
Ke Tang (MechSE), Tom Golecki (MechSE), Jennifer Amos (BioE), Jacob Henschen (CEE), Abdussalam Alawini (CS), Matthew Goodman (MatSE), Molly Goldstein (ISE), Jason Merret (AE), Eliot Bethke (BioE) Liaison: Jay Mann

X70i (Re)Design (Year 1)*

This team seeks to integrate core design thinking principles from the Entrepreneurial Mindset as an integral part of the Mechanical Science and Engineering (MechSE) design sequence, known as the X70 sequence. In addition to

targeted learning activities across the design sequence, the project will work to unify expectations and procedures across the sequence, enhancing cohesion. A final focus will be to develop standardized design challenges that will be used to directly assess student learning across the course sequence.
Kevin Wandke (MechSE), Kellie Halloran (MechSE) Lee Clemon (MechSE), Blake Johnson (MechSE), Brian Mercer (MechSE), Keilin Jahnke (TEC) Liaison: Matt Goodman

Startup Track

Developing Conceptual Problems for Instruction in Foundational Computer Science Courses

This team will devise and implement early instructional materials that focus on conceptual understanding. They will use interviews to assess students' conceptual understanding and using a compare and contrast approach to instructional design to create new materials.
Yael Gertner (CS), Eric Kuo (physics), Nirvaan Khera (physics), Chandra Chekuri (cs), Lance Cooper (physics), *Liaison: Mattox Beckman*

Engineering Mentorship Program: A Scalable Model for Undergraduate and Graduate Students

This project offers a course with training and guided feedback on mentoring practices, drawing from both academic and industry contexts to help students build the interpersonal and leadership skills essential to being effective mentors. By focusing on mentorship theory, hands-on skill development, and reflective practice, this course bridges the gap between academic learning and professional growth. Participants will gain practical experience in areas such as trust-building, communication, goal-setting, and inclusive engagement skills that can be applied in research labs, student organizations, and future workplaces.
Hadi Meidani (CEE), Maryam Ghadiri (CEE), Jacob Henschen (CEE), EJ Ignacio (CEE) Liaison: S. Lance Cooper

Grainger Engineering First-Year Course Harmonization and Infusion of Entrepreneurial Mindset Learning*

This team seeks to create a more cohesive community of practice among the first-year instructors to identify best practices in EML for first-year courses and disseminate them across the College.
Brian Woodard (AE), Molly Goldstein (ISE), Kellie Halloran (MechSE), Jacob Henschen (CEE), EJ Ignacio (CEE) Liaison: Olga Mironenko

Adaptation Track

Developing Online Reference Pages for Structural Mechanics, Dynamical Systems, and Control Systems Courses in Aerospace Engineering

This team will develop comprehensive reference sheets for CS/ECE 374: Introduction to Algorithms and Models of Computation. The project will create three different sets of reference sheets: one per midterm content (four midterms), one per lecture, and small reference sheets (cheat sheets) for the four midterms and the final exam. These reference sheets will enhance student learning by providing quick access to key concepts, formulas, and examples, fostering an entrepreneurial mindset by stimulating curiosity, building connections, and creating value.
Wayne Chang (AE), Timothy Bretl (AE), and Siegfried Eggl (AE)

Context Rich Reference Pages for Mechanical Design

This team will develop Engineering Design reference pages following the model and practices established in the "Developing Open Educational Resources for Fundamental Engineering Mechanics Courses" SIIP project, which provided content reference pages for students in the TAM 2XX sequence. Student engagement with these resources shows strong success in providing a utilized tool (Raymond-Bertrand, 2025)
Lee Clemon (MechSE), Kevin Wandke (MechSE), Kellie Halloran (TEC), Brian Mercer (MechSE), Blake Johnson (MechSE)

Creating an Introductory MatSE Online Reference Page

MSE 280 is an introductory materials science and engineering course for non-majors. Aerospace engineering students, as well as those minoring in MSE and a few other specializations (e.g., System Engineering), make up the majority of the course population, typically 150 in the fall semesters and 100 in spring semesters. Due to the non-major nature of the course, the majority of students do not engage with the textbook, especially due to the online nature of assessments via PrairieLearn. By adapting the previous SIIP project and developing reference pages for MSE 280, the hope is to further engage the students outside of formal class time. I plan to implement these reference pages by focusing on the KEEN Entrepreneurial Mindset (EM), specifically promoting the EM habits, the first being curiosity. Colloquially, there is a term named "wiki rabbit hole" where one starts looking into a reference (typically on Wikipedia) and then continues further exploration via clicking links on the original webpage. On subsequent pages, another link is clicked and thus creates a repeating pattern. I aim to replicate this pattern, as the creation of these online reference pages enables one's natural curiosity through clicking on related topics. The important aspect of this mindset is the ease with which students can navigate different topics. By utilizing the previous SIIP team's framework of pages, this should naturally enable their curiosity.
Matthew Goodman (MatSE)

Adapting Open Education Resources for Fundamental Bioengineering Courses (ILLINOISref Pages for BIOE)

BIOE Reference Pages will serve to streamline the BIOE curriculum and show students where reinforcement and reiteration occur for each concept. In doing so, instructors can point to prerequisite classes where students may have learned the material, or to future classes where they will use this concept again. As courses may change instructors and therefore notations and nomenclature, providing a constant throughline between the courses would be a great benefit to the department as well as the Grainger College of Engineering as students from other disciplines connect their work to the ever-growing field of Bioengineering. Both BIOE faculty and their hundreds of students would benefit from this solution, and as such, would be users of this system. Moreover, as this resource will support students who transfer into our program from others on campus or other institutions, BIOEref pages will help students in our department to see connections among courses and to their future careers.
Caroline Cvetkovic (BIOE), Holly Golecki (BIOE), Jenny Amos (BIOE), Ali Ansari (BIOE)

Adaptation of Web-based Reference Pages: The Cheat Sheet Your Students Didn't know they Needed to CS 199 CSX: CS Beyond STEM w/ Python

The project will adapt Web-Based Reference Pages. The idea behind this project is to create reference pages for material that goes together with a course. Usually, instructors use a textbook or create lecture notes for a course that contains many examples and exercises along with accompanying narrative that includes motivation

and applications. When students wish to review this material when studying for an exam they would benefit from a reference page that contains the topics that will be covered for an exam along with the relevant definitions and examples of worked out exercises. This reference page can be created via making a more concise version of the lecture notes. The Web-based reference pages project designed an efficient model for how to create such reference pages. In addition, this project created a simple way for creating a webpage from the reference pages. The website can be used on a phone and is not behind a firewall which makes it easier for students to access. The Web-based reference page project encourages EM based content development. The EM framework focuses on 3 Cs: Creating Value, Connections, Curiosity.
Yael Gertner (CS)

Developing Reference Sheets for Undergraduate Algorithms Course: Enhancing Student Learning through Entrepreneurial Mindset

This project will develop comprehensive reference sheets for CS/ECE 374: Introduction to Algorithms and Models of Computation. The project will create three different sets of reference sheets: one per midterm content (four midterms), one per lecture, and small reference sheets (cheat sheets) for the four midterms and the final exam. These reference sheets will enhance student learning by providing quick access to key concepts, formulas, and examples, fostering an entrepreneurial mindset by stimulating curiosity, building connections, and creating value.
Abhishek Umrawal (ECE)

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