Materials Education SYMPOSIA

14th North American Materials Education Symposium

August 4-6, 2025

Georgia Institute of Technology, Atlanta, GA, USA

This symposium is coordinated by

Georgia Tech College of Engineering
School of Materials Science and Engineering

Sponsors:

Ansys part of Synopsys

Georgia Tech College of Engineering

CITRINE INFORMATICS

We are grateful for the help and advice of the Symposium Academic Advisory Committee www.materialseducation.com

Program-At-A-Glance

Section 1: Welcome

Dear Attendees,

It is with great enthusiasm that we welcome you to the 2025 NAMES (North America Materials Education Symposium) – hosted for the very first time in the Southeast, here on the Georgia Tech campus in Atlanta! We are thrilled to partner with you, part of a vibrant and growing community of materials educators, for two days of engaging discussions, interactive sessions, and meaningful collaborations. This year's symposium features a dynamic lineup of panels, workshops, and presentations—all taking place in the ***Klaus Advanced Computing Building*** in 1116 East & West Seminar Room.

Details on directions, agenda and other logistics can be found on ***NAMES25 website***.

A few highlights we're especially excited about:

- ***Materials Educator Banquet*** on Tuesday (8/5) evening, hosted at the ***Center for Puppetry Arts***. This unique venue will offer a behind-the-scenes look into the creative and material challenges of puppet-making—a truly interdisciplinary experience!
- ***Invited pre-symposium presenter's dinner*** at ***GT Hotel & Conference Center*** on Monday (8/4)
- An exclusive visit to The MILL, our student-run makerspace at Georgia Tech. It's a showcase of hands-on learning and student initiative in action.
- A ***strong representation from regional institutions*** including the University of Alabama, University of Florida, University of South Florida, NC State, Vanderbilt, and many more—our wonderful neighbors and collaborators in the Southeast.
- ***Diverse lineup of speakers***, covering a wide spectrum of topics—from the edible materials to reverse engineering as pedagogical tool to integration of AI tools.

We hope you'll find inspiration, forge new connections, and take away ideas that spark innovation in your own classrooms and programs.

On behalf of the scientific committee, welcome once again to NAMES 2025—we're so glad you're here. Thank you!

Himani Sharma & Mary Lynn Realff (Co-Chairs)

We are grateful for the support from our event organizers and sponsors:

Ansys part of Synopsys · Georgia Tech College of Engineering · Citrine Informatics

and for the help and advice of the following organizations:

ASM Materials Education Foundation · ASEE Division of Materials

Section 2: Agenda

TIME	EVENT	VENUE
Monday, August 4th		
9:00am-3:30pm	Ansys, Part of Synopsys Workshop: Teaching Sustainable Product Design with Ansys tools Level 1	Klaus 1446 (classroom wing)
9:00am-3:30pm	Citrine Informatics Workshop: Introduction to Materials Informatics	Klaus 1120A
6:00pm	Presenters Dinner (By invitation only)	GT Hotel & Conference Center Conference A
Tuesday, August 5th: Symposium Day One		
8:45am	Registration opens*	Klaus Computing 1116 East & West Seminar Room *Registration at Venue
8:55-10:05am	Symposium Day One Session 1 Part 1	
10:05-10:40am	Coffee Break	
10:40am-12:10pm	Symposium Day One Session 1 Part 2	
12:10pm	Symposium Photograph	
12:20pm	Lunch	
2:00-3:15pm	Symposium Day One Session 2 Part 1	
3:15-4:00pm	Coffee Break & Poster Session	
4:00-5:20pm	Symposium Day One Session 2 Part 2	
6:00pm	Bus Pickup for Dinner	GT Hotel & Convention Center
7:00pm	Symposium Dinner	Center of Puppetry Arts
Wednesday, August 6th: Symposium Day Two		
8:45am	Registration opens*	Klaus Computing 1116 East & West Seminar Room *Registration at Venue
9:00-10:05am	Symposium Day Two Session 3 Part 1	
10:05-10:40am	Coffee Break & Poster Session	
10:40am-12:10pm	Symposium Day Two Session 3 Part 2	
12:10pm	Lunch & Posters	
1:10-2:00pm	Learn By Doing Lab Tour- MILL & GT UG Lab *Tour the Materials Innovation and Learning Laboratory at Georgia Tech where students can make and measure things from materials*	
2:00-3:05pm	Symposium Day Two Session 4 Part 1	
3:05-3:50pm	Coffee Break	
3:50-5:10pm	Symposium Day Two Session 4 Part 2	

Please see ***Section 7*** for maps, and more venue details

Symposium Day One: Tuesday, August 5th, 2025

Welcome Address	
8:55am	**Natalie Stingelin, Chair,** Georgia Institute of Technology MS&E Department
9:00am	**Session 1: Innovations in Materials Science Education**
9:05am	**Mark Losego**, Georgia Institute of Technology *From Passive Demos to Active Mini-Projects: How to Further Amplify the Impact of material science demos*
9:25am	**Haoxue Yan and Anna-Katharina Preidl;** Stanford University *Edible Materials: An Experiment in Experiential Learning in the Kitchen*
9:45am	**William Callister,** University of Utah *Concept-Based Learning and Understanding for Materials Courses*
10:05am	*Coffee Break*
10:40am	**Ronald Kander and Dana Scott,** Jefferson University *William Finn Student Leadership Program: Preparing Students for the World of Work*
11:00am	**Alison Polasik,** Campbell University *Exploring the Relationship Between Programming Motivation and Intended Major in First-Year Engineering Students*
11:20am	**Karla Wagner,** Cornell University *Students background, learning, and outcomes for a new course in the Cornell MSE department, MSE 5530*
11:40am	*Table Discussion and Action Items, Chair*
12:10pm	*Lunch Break & Symposium Photograph*
2:00pm	**Session 2: AI and Machine Learning in MSE Part 1**
2:05pm	**Yaroslava G. Yingling,** North Carolina State University *Preparing an AI-Ready Workforce in Materials Science and Engineering Through Generative AI*
2:25pm	**Shana L. McAlexander, Richard J. Sheridan, L. Catherine Brinson,** Duke University *Instilling AI and Materials fluency in graduate students to power rapid research innovation*
2:20pm	**Gulfem Ipek Yucelen,** University of South Florida *The Materials Learning Exchange: A Collaborative Platform for Creative Teaching in Materials Science and Engineering*
3:15pm	*Coffee Break & Poster Session*
4:00pm	**Wenhao Sun,** University of Michigan *"Vibe Coding" your way to phase diagrams with ChatGPT*
4:20pm	**Gurudutt Chandrashekar,** Trine University *Aerospace Composites Course – How to establish a composites lab with limited budget?*
4:40pm	**James Saal,** Citrine Informatics, Inc. *Teaching Materials Informatics with the No-Code Citrine Platform*
5:00pm	*Table Discussion and Action Items, Chair*
5:20pm	*End of Day 1*

9:00am	**Session 3: High Impact Practices in MSE Education**
9:05am	**Franklin Hobbs**, University of Wisconsin-Madison *Materials of the Modern World: Materials Science for the Masses - Lessons Learned and Reflections*
9:25am	**Steve Yalisove,** University of Michigan *Grading for Growth approach to teaching introductory materials science and engineering*
9:45am	**Meisha Shofner,** Georgia Institute of Technology *Introducing the ordinary-Using familiar materials to teach about flow and deformation of soft matter as in-class laboratory modules*
10:05am	*Coffee Break & Poster Session*
10:40am	**Session 4: AI and Machine Learning in MSE Part 2**
10:40am	**Amir Saeidi,** University of California Davis *Development and Implementation of an Investigative Assignment in Failure Analysis Using AI*
11:00am	**Blair Brettmann,** Georgia Institute of Technology *Introducing data-driven materials informatics into an undergraduate course through a polymer science activity*
11:20am	**Tim Chambers,** University of Michigan *A New Math Methods Course in MSE: Equity-Centered Instruction Meets GenAI*
11:40am	*Table Discussion and Action Items, Chair*
12:10pm	*Lunch Break & Posters*
1:00pm	**Tour of Georgia Tech UG Labs and the MILL**
2:05pm	**Session 5: Creative Pedagogies for Early Materials Science Education**
2:05pm	**Jacob Kelter *et.al.*,** Northwestern University *Engaging Introductory MSE Students in Creating Computational Models*
2:25pm	**Eduardo Vitral, Calvin Liu, Allen White,** Rose-Hulman Institute of Technology *Introducing entropy as a measure of energy dispersion to engineering sophomores*
2:45pm	**Di Wu, Ruihang Gao, Pavel Belakurski, Purnendu, Nitvedita Arora,** Northwestern University *Teaching soft Robotics Through Co-Design of Materials, Mechanics, and Electronics: A Focus on Electrohydraulic Artifical Muscles*
3:05pm	*Coffee Break & Poster Session*
4:10pm	**Sravya Tekumalla,** University of Victoria, Canada *Reverse Engineering as a Pedagogical Tool: Teaching Advanced Materials through Failure Analysis*
4:30pm	**Carrie Wilson,** ASM International Materials Education Foundation *Year-Round Professional Development Expansion*
4:50pm	**Sarah Goodman,** Georgia Institute of Technology *Design and Implementation of a Virtual Reality Crystal Structure Module in an Introductory Materials Science and Engineering Course*
5:10pm	*Table Discussion and Action Items, Chair*
5:40pm	*End of Conference Announcements*

Section 3: Participants

Name	Affiliation	Workshop	Talk	Poster
Dilpuneet Aidhy	Clemson University			
Savannah Barnett	University of Alabama			X
Blair Brettmann	Georgia Institute of Technology		X	
Mary Kate Broadway	Georgia Institute of Technology			
William Callister	University of Utah		X	
Timothy Chambers	University of Michigan			X
Gurudutt Chandrashekar	Trine University		X	
Ruihang Gao	Northwestern University			
Sarah Goodman	Georgia Institute of Technology		X	X
Jaclyn Grace	University of Connecticut			X
Robert Heard	Carnegie Mellon University			X
Sheldon Hewlett	University of Delaware			X
Franklin Hobbs	University of Wisconsin-Madison			
Ronald Kander	Thomas Jefferson University		X	
Jacob Kelter	Northwestern University		X	
Nabil Kleinhenz	Jackson State University			
Rachna Lnu	University of Florida			
Mark Losego	Georgia Institute of Technology		X	
Chris Luettgen	Georgia Institute of Technology			
Shana McAlexander	Duke University		X	
Hesam Moghaddam	Ansys, Part of Synopsys	X		
Chris Montgomery	Syensqo			
Rick Neu	Georgia Institute of Technology			
Tanju Ozdemir	Georgia Institute of Technology			
Madelyn Payne	University of California, Berkeley			X
Alison Polasik	Campbell University		X	X
Mary Lynn Realff	Georgia Institute of Technology			
James Saal	Citrine Informatics	X	X	
Amir Saeidi	University of California, Davis		X	X
Himani Sharma	Georgia Institute of Technology			X
Richard Sheridan	Duke University			
Meisha Shofner	Georgia Institute of Technology		X	
Vincent Sokalski	Carnegie Melon University			
Wenhao Sun	University of Michigan		X	

Name	Affiliation	Workshop	Talk	Poster
Sravya Tekumalla	University of Victoria		X	
Lily Turaski	Georgia Institute of Technology			X
Kaitlin Tyler	Ansys, Part of Synopsys	X		X
Eduardo Vitral	Rose-Hulman Institute of Technology		X	
Karla Wagner	Cornell University		X	
Rebecca Welch	Alfred University			X
Carrie Wilson	ASM Materials Education Foundation		X	
Steve Yalisove	University of Michigan	X		X
Haoxue Yan	Stanford University		X	
Yaroslava Yingling	North Carolina State University		X	
Gulfem Ipek Yucelen	University of South Florida		X	

Section 4: Presentation Abstracts

From Passive Demos to Active Mini-Projects: How to Further Amplify the Impact of Materials Science Demos

Mark Losego
Georgia Institute of Technology

Many materials science courses use physical demonstrations to better illustrate abstract concepts. While these demonstrations can be considered high-impact practices that add physical understanding to student learning, about a decade ago we asked whether more engagement and quantitative interaction could be incorporated into in-class demonstrations, moving them from than just an "oh wow" observation to an actual "numerical calculation" or "measurement" that connects the physical phenomenon to the mathematical underpinnings. This presentation will discuss the evolution of these in-class demos, specifically for an introduction to materials science class that is broadly oKered to many engineering disciplines. At first, data was attempted to be collected during the experiment, and students were then provided this data to answer questions about the demonstration. These practices have further evolved into crowd-sourced data collection, guided learning modules to gain new skills (e.g., using crystal maker or ImageJ), and full "take-home mini-projects" using common items that are easily obtained by all students. Besides discussing best practices for implementing these "more active" demonstrations, several specific examples will be discussed including mini-projects on temperature responsive bi-material strips, analysis of surface energies, and 2D symmetries of cultural patterns.

Edible Materials: An Experiment in Experiential Learning in the Kitchen

Haoxue Yan, Anna-Katharina Preidl
Stanford University

Beyond topic-specific expertise, a non-negligible aspect of materials science education lies in material scientists' unique way of thinking. A trained materials scientist often subconsciously thinks through the lens of the materials science tetrahedron, which offers them a special sense of appreciation of everyday experiences and life-hacks. Ever wondered why recipes sometimes specifically call for parchment paper rather than aluminum foil?

But the average first and second year students will often struggle to appreciate the structure-property-application relationships as they lay in plain sight. We believe that accessible, engaging, and low-stakes experiences which are closely tied to students' everyday lives can foster a deeper appreciation for materials science among these learners. At Stanford University, we developed an introductory course designed to promote curiosity and student inquiry and introduce the materials science mindset within the familiar context of food, utilizing the traditional kitchen as a laboratory setting.

Through hands-on culinary experiments, students engage with foundational concepts such as elasticity, surface energy, diffusion, and melting-point suppression, while simultaneously developing essential laboratory (and even culinary) skills. This experiential learning approach encourages students to develop and practice observational and analytical thinking skills which are often emphasized in advanced materials science courses.

In this presentation, we will outline the strategies implemented to create an intellectually stimulating learning environment for students from diverse backgrounds. We will discuss the challenges encountered in balancing the rigor of scientific topics with the engaging nature of an interactive curriculum. We invite the broader materials science community to join us in exploring this innovative pedagogical approach and consider ways to transform introductory materials science education. Our goal is to promote greater student engagement, broaden the visibility of materials science and engineering discipline, and cultivate a lasting appreciation for the connections between materials science and everyday life.

Concept-Based Learning and Understanding for Materials Courses II

William Callister
University of Utah

This paper is a revised and upgraded version of the one presented at NAMES 2024. It discusses a teaching/learning approach that incorporates features not found in traditional introductory courses. As its name suggests, this approach centers on promoting the learning and understanding of concepts and concept relationships in materials science. Concept understanding is cultivated by requiring students to define, explain, and describe (in writing and their own words) material concepts found in the course textbook and/or other reference materials. Creation of concept maps and explanations of concept associations lead to understanding of relationships between/among concepts.

Another set of assignments that also elicits student concept-relationship understanding involves the Paradigm of Materials Science and Engineering: the performance (or applications) of materials depend(s) on their properties, properties depend on structural elements, and structure depends on how the material is processed. Assignments require written narrations (or vignettes) that explain/describe interrelationships (dependencies) between pairs of Paradigm components.

Important student outcomes using this approach are (1) a sense of relevance of course topics (real-world applications); (2) a realization of how topics are organized (fit together); (3) how to think conceptually, a mindset for solving real-life and complex problems; and (4) improved writing skills.

William Finn Student Leadership Program: Preparing Students for the World of Work

Ronald Kander and Dana Scott
Jefferson University

Professional leadership skills (often pejoratively referred to as “soft skills”) are one of the key indicators of success in the world of work. Engineering students and students in STEM-related disciplines are typically not given the opportunity to learn and practice these “hard skills” to a sufficient degree during their academic tenure. Through a generous (7-figure) alumni endowment gift, Kanbar College had the opportunity to create a novel student leadership program that recruited its inaugural cohort of students in 2024.

Modeled after the highly successful Schottland Scholars program at the College of Charleston, the William Finn ’67 Leadership Program at Thomas Jefferson University is a prestigious opportunity offering academically talented, driven, and intellectually curious Kanbar College students substantive curricular and co-curricular experiences in organizational leadership, innovation, mentorship, and creativity, ensuring direct and meaningful contact with engaged faculty, alumni mentors, outstanding peers, and industry leaders.

Through a competitive application and interview process, a cohort of 10 students are selected to participate in the 2-year (junior-senior year) program that includes: intimate dinner discussions with c-suite leaders, one-on-one mentors selected from practicing professionals in their discipline, formal leadership training seminars, weekend leadership retreats, and many more co-curricular experiences to practice leadership skills. These activities, combined with peer-to-peer learning within the cohort, will prepare these students to strive toward leadership roles in their disciplines at a much quicker pace than others without these targeted leadership skills.

In this presentation I will describe the development of the program along with positive and negative lessons learned during the inaugural year of the program. I will highlight some of the first-year activities and summarize the feedback received from the inaugural cohort of students and the expectations expressed by the recently-selected second cohort of students that will enter the program this fall.

Exploring the Relationship Between Programming Motivation and Intended Major in First-Year Engineering Students

Alison Polasik
Campbell University

Learning to program presents significant cognitive challenges, and student motivation plays a critical role in their success. This study uses the expectancy value model to investigate whether variations in first-year engineering students' motivation related to programming are associated with their intended major. Surveys conducted over three consecutive years at three institutions revealed no consistent relationship between students' academic interests and their programming motivation. However, follow-up interviews provided insights into the underlying reasons for this disconnect. The presentation will conclude with a reflection and discussion on the implications of these findings for teaching integrated computational materials engineering (ICME) topics at the undergraduate level.

Students background, learning, and outcomes for a new course in the Cornell MSE department, MSE 5530

Karla Wagner* and Kintu Early
Cornell University

Pedagogical research specific to materials science and engineering (MSE) is an ongoing field of study, especially considering the learning of higher-level cognitive skills such as design, troubleshooting, and critically, problem-solving. The purpose of this research is to survey students regarding their background, learning, and outcomes for a new course in the Cornell MSE department, MSE 5530: Materials Design and Processing for Industry. Unlike a typical lecture-based course, in MSE 5530 groups of students will investigate case studies regarding relevant product failures due to flaws in materials or process design. Each case study is presented by an industry professional familiar with the product, its mode of failure, and the historical engineering solution to the problem. We will compare the learning and student outcomes of traditional, lecture-based courses to a novel, industry case-study based course on materials design & processing. Initial results suggest that the use of case studies and industry professionals is both engaging for students and highly impactful on their learning.

Preparing an AI-Ready Workforce in Materials Science and Engineering Through Generative AI

Yaroslava G. Yingling
North Carolina State University

As artificial intelligence (AI) rapidly reshapes the scientific landscape, preparing an AI-ready workforce has become essential—particularly in the field of Materials Science and Engineering (MSE), where the ability to navigate large datasets, computational tools, and machine learning (ML) models is becoming foundational. Generative AI is reshaping how students engage with machine learning (ML) and coding in materials science and engineering (MSE), offering dynamic pathways for faster, more intuitive skill acquisition and real-world application. At NC State, we are integrating GenAI tools, such as large language models, coding assistants, and synthetic data generators, into both coursework and research environments. These tools empower students to develop coding fluency, explore ML concepts, and receive real-time support in scripting, modeling, and data visualization. By embedding GenAI directly into the learning process, students can accelerate skill acquisition, optimize experimental design, and deepen their engagement with materials challenges ranging from DFT simulations to image-based property prediction. While recognizing the importance of teaching responsible and informed use of AI, we see these tools as a valuable addition to the educational toolkit. Our goal is to help students build confidence and competence in applying AI approaches to materials challenges, preparing them for a professional environment where AI will likely play an increasingly important role.

Instilling AI and Materials fluency in graduate students to power rapid research innovation

Shana L. McAlexander, Richard J. Sheridan*, L. Catherine Brinson
Duke University

The NSF NRT Programs focus on supporting interdisciplinary graduate research. The Harnessing AI for Understanding & Designing Materials (aiM) NRT Program at Duke University is a training program at the intersection of AI/Machine Learning and materials science. The program currently supports 32 PhD students representing 9 departments including engineering, physical sciences, computer science, and statistics. In this presentation, we will highlight the key features of this successful program to train graduate students to be innovative leaders in the rapidly growing and evolving space of AI + Materials Science. Key to the program is ensuring students from all disciplines have a solid grounding in fundamentals of both AI and materials. Upon those fundamentals, we build a scaffolded training model for interdisciplinary convergence that includes an introduction to Team Science, a rapid proposal design workshop, reproducibility exercises to develop best practices for data (e.g. FAIR, Open Science), and a year-long project course. The project course brings together small teams across disciplines working together on a project that becomes a chapter in their theses and ideally submitted for publication in a journal. The highly relevant research tasks of the project and the final stages of writing and revision for journal publication incentivize and bond these collaborations beyond the duration of the course. This scaffolded training model experience may be scaled or modified for use within various educational contexts, but a salient, relevant, and achievable research goal drives engagement and success.

The Materials Learning Exchange: A Collaborative Platform for Creative Teaching in Materials Science and Engineering

Gulfem Ipek Yucelen
University of South Florida

This presentation introduces the *Materials Learning Exchange*—a new idea for an open-access online platform where instructors and students can share creative and effective ways to teach Materials Science and Engineering (MSE). The goal is to build a global collection of teaching tools that help explain complex topics in a visual, engaging, and easy-to-understand way.

The platform will include a wide variety of resources, such as:

- 3D printable educational models (e.g., crystal structures)
- Songs and poems recorded as videos to explain core concepts
- Theatrical demonstrations that act out atomic behavior or materials phenomena
- Educational memes to spark interest and aid retention
- Simple classroom-ready visuals, projects, and activities

All shared materials will be organized by topic (such as crystal structures, diffusion, or imperfections), by student level (K–12 or undergraduate), and by format (e.g., video, printable file, demo). Instructors will be able to browse, download, and adapt these tools to fit their own courses. The platform is designed to save time, spark new teaching ideas, and make engineering concepts more engaging—both in college classrooms and in K–12 outreach.

What makes this project unique is that it features student-created content alongside instructor contributions. Many of the resources will be developed through class assignments that ask students to design educational tools for college classrooms or younger learners.

For example, students might 3D print a model of a crystal lattice or produce a short video theatrically demonstrating how atoms behave during a phase change by acting as atoms themselves. These activities help students learn the material more deeply while also building creativity, communication, and teamwork skills.

Contributors may choose to use AI tools to support content creation. For example, AI can help simplify technical terms for K–12 learners, generate visuals or animations, create conceptual memes, or assist in writing songs and poems that explain Materials Science and Engineering topics in fun and engaging ways. These creative, AI-enhanced materials can make learning more accessible and memorable for a wide range of audiences.

This idea stands out because it:

- Supports both undergraduate education and K–12 STEM outreach
- Highlights creative, hands-on, and visual ways of learning
- Promotes meaningful student contributions through class projects that result in educational tools
- Connects instructors across institutions and provides a shared library of ideas and materials that they can adopt in their own teaching
- Incorporates AI to assist in creating engaging, accessible content

The Materials Learning Exchange is not just a website—it's a collaborative space where ideas can grow and inspire others. This presentation will share the vision for the platform, showcase sample projects, and invite others to join the effort to make materials science education more visual, interactive, and fun—for everyone from future engineers to curious kids.

“Vibe Coding” your way to phase diagrams with ChatGPT

Wenhao Sun
University of Michigan

The advent of AI has led to great panic in higher education, as tools like ChatGPT can routinely solve the homeworks and assessments that we have relied on for decades. While many educators are trying to ban ChatGPT from the classroom, these AI tools in fact afford an interesting opportunity for students to tackle far more challenging problems than they have traditionally been assigned. I will share a curriculum that infuses ChatGPT throughout the course, asking undergraduate juniors to leverage ChatGPT and ‘Vibe Coding’ to tackle computational projects traditionally considered beyond their reach. Using these tools, undergraduates have successfully coded binary phase diagrams, carried out kinetic Monte Carlo simulations of diffusion, and performed Avrami temperature-time-transformation analyses. As a result, they have developed greater confidence in their computational abilities. By embracing ChatGPT as a pedagogical tool, we can elevate our coursework to target higher levels of Bloom’s Taxonomy, thereby enhancing the scope and depth of our undergraduate materials education.

Aerospace Composites Course – How to establish a composites lab with limited budget?

Gurudutt Chandrashekar
Trine University

With an ever-increasing need of engineers with knowledge of composites for aerospace applications, it's required to introduce concepts of composites theory and fabrication in the mechanical engineering undergraduate program. To this end, a new course called 'Aerospace Composites' was taught at Trine University in Fall 2024. The focus of this course was tailored towards introducing theoretical concepts in the first half of the semester while the second half involved hands-on labs and projects in the newly established composites lab on campus. Since the primary goal of this course was to allow students to learn composites by hands-on fabrication and testing, it was required to set up a lab with a budget of $15000. Based on the lessons learned from teaching this course, this presentation will focus on (a) broad outline of aerospace composites lab activities, (b) ideas and costs associated with establishing a composites lab on campus with a budget of $15000, (c) ideas to minimize material wastage during lab activities to achieve sustainable composites fabrication and (d) bridging the gap between composites theory and practice in a manner that will not overwhelm students at the undergraduate level. Furthermore, an example demonstrating the direct benefit of this hands-on course as applied to the AIAA Design Build Fly senior design aircraft competition project will be presented.

In conclusion, this presentation will serve as a guiding tool for the creation of new aerospace composites course and establishment of composites lab on any campus with a minimal budget. Additionally, based on the lessons learned during Fall 2024, the lab modifications planned for Fall 2025 will be presented.

Teaching Materials Informatics with the No-Code Citrine Platform

James Saal
Citrine Informatics

Materials informatics is becoming an increasingly essential skill in the materials industry. Understanding materials data, statistical analysis, machine learning methods, experimental design, and best practices for these methods must be included in modern materials education curricula, and conveying the concepts behind these topics is often more important than the use of specific codes. To that end, we'll be sharing how a no-code materials informatics software suite, the Citrine Platform, can be a powerful tool in the classroom to provide undergraduate students hands-on experience and a deep understanding of the underlying concepts.

Materials of the Modern World: Materials Science for the Masses - Lessons Learned and Reflections

Franklin Hobbs
University of Wisconsin-Madison

Materials science is one of the most fundamental disciplines to the human experience. From the first ancient human picking up a rock to the marvels of smartphone technology, we have been interacting with and benefiting from materials across our species' existence. Not only is it a scientifically, anthropologically, and sociologically important discipline, but it is also wonderfully physical and can (and should!) be explored on a hands-on level.

For the last three years I have been developing and teaching an introductory-level class on materials science with no prerequisites and a hands-on, non-mathematical approach to students outside of the college of engineering. The course started as an online asynchronous course (with at-home demos) and has been taught in-person for the first time this spring.

Our department has invested in this course to increase visibility of the department and the discipline. In this talk, I will present the top-down style approach to this course that was guided by Stuff Matters (Miodownik, 2013) and The Alchemy of Us (Ramirez, 2020). Additionally, I will share personal reflections on the successes and shortcomings of the course, along with challenges and hopes for further development.

Grading for Growth approach to teaching introductory materials science and engineering

Steve Yalisove
University of Michigan

This past year I revamped my team based-project based intro to MS&E course using the principles in the recently published book "Grading for Growth" by Robert Talbert and David Clark. This is an alternative grading approach as well as pedagogical methodology. Implementation requires quite a bit of course redesign. I will present the ways I replaced the traditional weighted average with a grading table. I will also discuss how each assessment was modified to ensure there were feedback loops to help students learn as well as reassessment without penalty. I will also talk out how I developed module level standards for assessing learning gains. In addition, I will talk about why, after 12 years of eschewing exams, I gave a final exam - but only for those students who earn the right to get an A. Finally I will talk about the challenges and successes that this approach produced and what I would do differently next time. The quick summary was that I believe that students genuinely learned more with this approach. But, students were quite upset that I was not using the weighted average that they are used in and is hard baked into just about all learning management systems. The biggest success was that I was able to use a suggestion in the book to permit retakes of quizzes but only if the students came to my office hours. This let me give the retakes as oral quizzes and students ended up learning much more in this process. I will also discuss how I scaled this for my class size of 40 and how I would be able to scale it up to a class size of 150.

Investigating the ordinary: Using familiar materials to teach about flow and deformation of soft matter as in-class laboratory modules

Meisha L. Shofner
Georgia Institute of Technology

Laboratory learning is a critical part of a Materials Science and Engineering (MSE) education, and like other engineering majors, laboratory learning occurs through the classes in the curriculum and through individual student experiences. Formal laboratory classes in MSE undergraduate programs are invaluable ways to teach foundational concepts and provide contextual examples of industrial practices students may encounter in their future careers. Additionally, individual student experiences in maker spaces and undergraduate research can supplement these laboratory experiences, building further technical skills. On the other side of the laboratory learning spectrum, in-class demonstrations are frequently used to illustrate important concepts to students in the classroom and can provide a way to break up lecturing to enhance learning. In my teaching, I have sought a middle ground for laboratory learning between a dedicated laboratory class/experience and an in-class demonstration by dedicating full class periods to in-class laboratory modules for the past ten years in an undergraduate rheology class. This course is required for MSE undergraduate students pursuing the polymer and fiber materials concentration and is typically taken by junior and senior students in MSE as well as some students in other engineering majors. These in-class laboratory modules work well as a way to provide tangible examples of the course content, develop critical thinking skills, and have fun. The topic, rheology, also lends itself naturally to in-class experimentation since the course is oriented toward polymers and soft matter, and a wide variety of polymeric materials are all around us in everyday household products and food. I have used accessible, familiar products to conduct in-class laboratory modules in order to encourage the students to apply a scientific lens to the ordinary. These modules include lecture and experiments; sometimes at the same time. Previous experimentation has used detergents, gelatin desserts, and processed cheese products to demonstrate rheological concepts. In addition to making the experiments accessible, the use of ordinary products allows the experiments to be performed in the classroom, encourages curiosity, reduces safety concerns, and if they so desired, allows them to replicate the experiment outside the class. Often these experiments can have complications or be messy scientifically (which is part of the fun), giving them an opportunity to think critically about how these factors have affected their data and the conclusions that can be made. Overall, these in-class laboratory modules have been beneficial in conveying class content, building student confidence in engineering concepts, and bringing some joy to learning and teaching.

Development and Implementation of an Investigative Assignment in Failure Analysis Using AI

Ameir Saeidi
University of California Davis

Failure Analysis, a senior-level course, integrates core concepts from structure, processing, and characterization topics covered in previous years to teach students how to determine the root cause of failure and design components for future use without failure. An inquiry-based learning activity is implemented in class, where students analyze a real-world failure scenario by asking investigative questions, gathering relevant information, applying their prior knowledge, and determining the root cause of failure. The instructor's role in this activity is to address misconceptions and guide students toward asking relevant questions. This activity promotes higher-order cognitive skills as defined by Bloom's taxonomy, specifically application, analysis, and evaluation. However, this in-class activity is limited in frequency and student participation, as not all students engage equally in the process.
To extend the benefits of this inquiry-based approach beyond the classroom, a homework assignment was developed using an AI tool powered by OpenAI's GPT. This tool allowed students to investigate the Comet Jet crash, applying their materials science knowledge, analyzing available information, formulating additional questions, and ultimately determining the cause of the crashes. Given the generative nature of GPT models, the tool was explicitly instructed not to infer or guide conclusions but to provide information only if it was part of the provided facts. The Comet Jet case study was selected as a classic example where the investigation led to the redesign of jet windows into an oval shape to prevent future failures. Students' responses to a survey, the nature of their questions, and the tool's responses were analyzed to evaluate the tool's effectiveness.

In this talk, we will discuss the successes of this AI-based tool and share key lessons learned from its implementation. While students demonstrated high engagement with the tool, they expressed dissatisfaction with its non-human-like responses. Improving this AI-driven tool has the potential to create a more interactive and engaging learning experience that fosters inquiry-based learning. Additionally, it highlights how AI can be leveraged to enhance assessment methods, addressing emerging challenges in engineering education resulting from advancements in AI.

Introducing data-driven materials informatics into an undergraduate course through a polymer science activity

Mona Amrihesari and Blair Brettmann*
Georgia Institute of Technology

The discovery of new materials and material property improvements are important components of materials science, both in academia and industry, but the process to reach these improvements is slow. Artificial intelligence (AI) and machine learning (ML) have the potential to increase the pace of material discovery and development, in particular when large data sets are combined with AI/ML algorithms to predict properties or optimize material design. Materials scientists and engineers will play an important future role in defining standards for generating data sets, collecting and documenting the data, designing ML algorithms to process the data and interpreting and using the outputs. Thus, a literacy in the basic concepts of ML for materials informatics is needed for this generation of materials science and engineering (MSE) students. Here, we present an activity-based module for introducing materials informatics to undergraduate students through integration with existing courses. We focus on the three general topics of 1) cross validation methods, 2) evaluating performance through accuracy, precision, recall and the confusion matrix, and 3) decision tree classifier models, with specific interactive exercises using prepared python code selected for each topic to keep the module length to 1.5 hours. We implement the activity in our MSE Introduction to Polymer Science Class, which is comprised of MSE, chemical and biomolecular engineering, chemistry and mechanical engineering 3rd and 4th year undergraduate students. To integrate these topics, we use the example of predicting polymer solubility, with the activity directly following the introduction of solubility parameters in the course. We show that student interest in ML and materials informatics increases modestly, while their familiarity with the core topics increases significantly after completion of the activity. Overall, the short-activity approach increases student literacy in ML/AI topics, while being readily integrated into an existing MSE undergraduate class.

A New Math Methods Course in MSE: Equity-Centered Instruction Meets GenAI

Tim Chambers
University of Michigan

This talk describes a newly-piloted course for teaching mathematical methods to MSE students. Fields such as physics have discipline-specific undergraduate math methods courses, but few MSE programs offer one. We find that many MSE students lack sufficient math preparation to excel in advanced coursework, despite multiple semesters of college math. As such, we created a new course to support underprepared students while teaching essential math topics in MSE not included in the standard calculus sequence. This course deploys generative AI tools to engage students in learning and using numerical methods for computational MSE alongside traditional analytical math. Also, the pedagogy leverages a flipped format and undergraduate instructional aides to emphasize individualized instruction. Students are assessed via a combination of short pen-and-paper quizzes to probe conceptual understanding, and collaborative homework sets combining analytical and numerical methods for solving MSE-themed problems. Student feedback on the course was extremely positive, especially regarding the flipped format and the frequent connections to MSE topics. This talk shares lessons learned from piloting the course, and plans for iteration for next year.

Engaging Introductory MSE Students in Creating Computational Models

Jacob Kelter, *et.al.*
Northwester University

Model building is a core practice in science and engineering. As such, many have argued that science education should center around modeling, including in materials science and engineering (MSE). This presentation will share findings from a pilot study of students engaging in computational modeling projects in an introductory materials science and engineering course (MSE). The students took a redesigned introductory MSE course which centers atomistic computational modeling in nearly every unit of the course. As a result, all students in the course were exposed to three modeling techniques: molecular dynamics, Monte Carlo, and random walk. Students were given the option of completing a computational modeling project instead of a final exam. The project involved taking one of the computational models from the course and modifying or extending it to address a different phenomenon. Modeling was carried out in NetLogo, a modeling platform and language designed to be "low threshold, high ceiling" meaning that it is easy to get started with while still being powerful enough for advanced modeling. None of the students had prior experience with NetLogo, but all were able to quickly learn enough to make substantial modifications to a model from the course, run a computational experiment with it, and write up the results in the form of a short research paper. This involved engaging in multiple core scientific practices at a level that is rare in introductory courses. In addition to presenting examples of student projects, we will present the kinds of support students required and a number of recommendations for how large numbers of students could realistically be engaged in this type of modeling project in introductory MSE.

Introducing entropy as a measure of energy dispersion to engineering sophomores

Eduardo Vitral, Calvin Liu, Allen White
Rose-Hulman Institute of Technology

Entropy is a challenging concept to convey to undergraduate engineering students. The physics background required to understand what it measures, at a fundamental level, is an obstacle for both students and instructors. However, the classical thermodynamics approach involving axiomatic second law statements, heat engines, and Carnot cycles leave students without a clear understanding of the physical meaning of entropy. In addition, many of them graduate with a misconception that entropy is a measure of disorder or chaos in an engineering system. To address this issue, we have redesigned a course on conservation principles and thermodynamics for sophomores by focusing on the core concept of entropy. The introduction starts at the molecular level and involves a few ideas from quantum and statistical mechanics. This way, energy dispersion, and, consequently, entropy can be properly communicated and understood. Images and examples used in the lecture notes rely as much as possible on classical mechanics to keep the molecular level discussion enjoyable and familiar for students and instructors. In-class activities are used as students start from the microstate Boltzmann definition of entropy and move to the more familiar expression of change in entropy as a function of heat and temperature. Other lecture days are interconnected to these molecular concepts, especially on sources of irreversibility, helping students reinforce their understanding of energy dispersion. In-class and pre-lecture quizzes are used to assess pre-conceptions and follow how well students can learn these topics. Results indicate enhanced comprehension of an abstract concept at the introductory level.

Teaching Soft Robotics Through Co-Design of Materials, Mechanics, and Electronics: A Focus on Electrohydraulic Artificial Muscles

Di Wu*, Ruihang Gao, Pavel Belakurski, Purnendu, and Nivedita Arora
Northwestern University

Replicating the biomechanics of living organisms has been a long standing goal in robotics research [1]–[3]. Achieving this vision hinges on the development of 'soft artificial muscles [4]'–actuators that mimic the force generation and fine-grained motion of biological tissues. Foundation for such innovation begins in the classroom, where robotics curricula must highlight the interplay between material choice, input stimulus, and mechanical output in an actuator. This work creates an education module with the following contributions:

1. An Easy-to-Fabricate Electrohydraulic Actuator
2. Experimental Characterization of Actuator Behavior
3. Finite Element Simulation of Electrohydraulic Actuation
4. Material–Mechanics–Electrical Co-Design Analysis
5. Application Exploration in Soft Robotics

This module empowers students to bridge theory and practice in soft robotics by co-designing materials, mechanics, and electronics—grounded in hands-on fabrication, simulation, and application of electrohydraulic artificial muscles.

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Reverse Engineering as a Pedagogical Tool: Teaching Advanced Materials through Failure Analysis

Sravya Tekumalla
University of Victoria

This educational initiative introduces a reverse engineering framework in a senior-level *Advanced Materials and Processes course*, aimed at providing a holistic, life-cycle understanding of complex material systems. Student teams begin by voluntarily selecting a failed advanced material component from real time—examples include a cracked Damascus steel knife from their home kitchen, faulty printed circuit boards from their devices, or damaged aerospace parts that have been handed to them. Through a structured, staged approach, students physically disassemble the component, identify failure modes, characterize constituent materials, infer processing histories (including surface treatments), and evaluate end-of-life recyclability.

This methodology shifts focus from isolated material behavior to the interactions within multi-material assemblies in complex real-life parts. The project bridges theory with hands-on exploration, deepens understanding of material selection rationale, and emphasizes sustainability. By positioning failure not as an endpoint but as a gateway to understanding materials science, this approach is intended to cultivate critical engineering insight essential for future materials innovators where parts are becoming increasingly complex.

Year-Round Professional Development Expansion

Carrie Wilson
ASM Materials Education Foundation

For 25 years, ASM Materials Education Foundation has honed their ASM Materials Camp for Teachers and students. The organization reviewed the challenges in having teachers implement the content learned in the one-week program over the summer and found that year-round support would increase implementation. Now, as funding allows, ASM MEF is beginning to offer year-round professional development, supply grants, and other year-round support to assist teachers in bringing materials science and engineering content to their middle school and high school students. How can universities partner with ASM MEF to support educators throughout the school year?

Design and Implementation of a Virtual Reality Crystal Structure Module in an Introductory Materials Science and Engineering Course

Sarah A. Goodman*, Valerie Dumova, Wei Li, Matthew Hartzler, George Ortiz, Stephanie Helmy, Ryan Piedrahita, Ian Lozano Valerio, Justerini Mejia, Orlando Osorio Garcia, Joel S imon, Jeong Ji Ryu, Aiden McNamara
Georgia Institute of Technology

Virtual Reality (VR) has become an increasingly popular pedagogical tool in STEM courses to allow students to immerse themselves in environments that would either be impossible to achieve in reality, too dangerous, or too expensive. VR is well-suited as a tool to teach crystal structure because not only would it be impossible for students to venture inside real crystals, but crystals are complex 3D systems that can be difficult for students to visualize on a 2D paper or screen.

In this work, we collaborated with undergraduate summer researchers in various engineering departments and a computer science senior design team to develop a gamified VR app that teaches the basics of using Miller Indices to identify planes in the cubic crystal system. First, our summer researchers used the 3D design tool Gravity Sketch to create a VR module for students to explore simple cubic (SC), body-centered cubic (BCC), and face-centered cubic (FCC) crystals, as well as practice drawing and labeling planes in these systems. While this module allowed students to practice crystallography skills in a 3D environment, students could not receive automatic feedback on their work. To create a module that offered immediate feedback, we worked with a senior design team to develop a gamified crystal structure VR app in Unity. The goal of both of these modules is for students to gain experience with three crystallography skills: 1) Draw a crystal plane given its Miller Indices, 2) Identify the Miller Indices of a plane from a drawing, and 3) Identify the most densely packed plane in SC, BCC, and FCC crystals.

We tested the Gravity Sketch version of the VR module in an introductory MSE course at Stevens Institute of Technology in Fall 2023 (320 students) and Spring 2024 (85 students). Students completed the VR module in teams of three in 12-person lab sections, using one headset per team. Laptop casting allowed students outside the headset to collaborate with the student in the headset. Students completed a short pre- and post-activity survey to assess their perceptions of the VR module.

In Fall 2023, 84% of the 300 students who completed the survey indicated that the VR module contributed somewhat or significantly to their understanding of each of the three crystallography skills. In Spring 2024, we improved the module to allow for easier visualization of crystal cross-sections. In this iteration, 98% of the 67 respondents indicated that the VR module contributed somewhat or significantly to their understanding of the content, demonstrating the enhancement of our students' experience and success. Across both semesters, we received 350 open ended responses regarding the most helpful components of the module and aspects that could be improved.

Currently, we are in the process of testing and collecting student and instructor feedback on the gamified version of our VR crystal structure module. This talk will share insights from our journey implementing VR into a large-format course, and how we engaged undergraduate researchers in this project-based learning experience to deliver a collaborative, high-impact lab for introductory MSE students.

Section 5: Poster Overview and Abstracts

#	Poster Presenter, Affiliation, and Title
1	**Ioanna Fampiou and Sheldon Hewlett,** University of Delaware *Molecular Dynamics (MD) Simulations in the Undergraduate Materials Science and Engineering Junior Lab: Nanoparticle Melting using LAMMPS and HPC Resources*
2	**Sarah Goodman,** Georgia Institute of Technology *Diffraction Detectives: Exploring Crystallography with K-12 Students*
3	**Lily Turaski,** Georgia Institute of Technology *Partial mastery grading in a large, introductory MSE course to improve student experience and outcomes*
4	**Alison Polisak,** Campbell University *Integrating Additive Manufacturing Simulations into Introductory Materials Science Courses*
5	**Dilpuneet Aidhy,** Clemson University *Fast-Evolving Generative AI Tools for Materials Science Content Development for MSE Awareness and Education*
6	**Himani Sharma,** Georgia Institute of Technology *Implementing mini-CURE (course-based undergraduate research experience) in processing lab*
7	**Rebecca Welch,** Alfred University *Reaching Rural Neighborhoods with Materials Science Outreach Programs*
8	**Kaitlin Tyler* and Elisabeth Huelse,** Ansys *Bringing Craft Time Back to the College Classroom: Exploring Material Choices via Musical Instrument Creation*
9	**Susannah Cooke and Kaitlin Tyler*,** Ansys *Annealing, Scanning Electron Microscopy, and More: Enhanced Processing and Characterization Data in Ansys Granta EduPack 2025R1*
10	**Savannah Barnett and Gregory B Thompson,** University of Alabama *Educational Research Activities at the Alabama Materials Institute*
11	**Jaclyn Grace,** University of Connecticut *Constructivism through Academic Makerspaces: Addressing Modern Science and Engineering Education with Student Centered Learning*
12	**Madelyn Payne,** University of California Berkeley *A practical course for first-year PhD students conducting characterization of deformation in structural materials using Universal Design for Learning (UDL) principles*

Poster #1

Molecular Dynamics (MD) Simulations in the Undergraduate Materials Science and Engineering Junior Lab: Nanoparticle Melting using LAMMPS and HPC Resources

Ioanna Fampiou and Sheldon Hewlett
University of Delaware

In our materials science and engineering curriculum at the University of Delaware, students take a required computational materials science course which covers a variety of materials modeling techniques. Outside of this course, the curriculum has minimal computational materials modeling. Thus, our students have a lack of practical skills in using MD simulations to investigate structure-property relationships. To address this, we have designed and implemented a hands-on laboratory module that integrates MD simulations into the modern undergraduate materials science curriculum. This lab activity was designed for a second-semester junior lab and directly addresses the following key educational goals: (1) to familiarize students with computational modeling of nanoscale materials, (2) to introduce LAMMPS and high-performance computing (HPC) workflows, (3) to explore thermodynamic properties of materials via simulations, and (4) to develop students' skills in interpreting structure-property relationships at the nanoscale.

Students use the LAMMPS simulation package and access HPC resources on campus to conduct MD simulations of gold nanoparticles of various sizes under varying thermal conditions. The lab includes visualization of nanoparticles, radial distribution function analysis and interpretation of the melting behavior of the nanoparticles as a function of nanoparticle diameter. Annealing simulations are also performed to provide insights into the thermodynamic stability of nanoparticles. Students collaboratively synthesize and present their results to draw conclusions about trends in size-dependent melting and nanoparticle stability.

The lab can be scaffolded according to student skill level and ability. Student survey results demonstrate that computational labs can effectively reinforce theoretical concepts in thermodynamics and material behavior, while also equipping students with transferable skills relevant to research and industry.

Poster #2

Diffraction Detectives: Exploring Crystallography with K-12 Students

Sarah A. Goodman
Georgia Institute of Technology (work done while at Stevens Institute of Technology)

What do you do when something is too small to see with the naked eye? Too small to see with a magnifying glass, or even a microscope? How do we know what the structure of matter looks like at the tiniest length scales — how atoms arrange themselves in crystals, or what biological molecules look like? This poster will describe a K-12 outreach module that explores how materials scientists use diffraction to reveal hidden structures in nature and in everyday objects. This module was developed in collaboration with the National Museum of Mathematics (MOMATH) Math Outreach and Seminar Training program for early career women in mathematics and engineering, and has been presented to audiences of all ages at MOMATH in New York City.

Diffraction Detectives introduces the concept of diffraction by allowing students to experiment with laser pointers of various wavelengths and diffraction gratings with slits of different widths. By spraying an aerosol onto the laser beam, students are able to visualize the constructive interference that leads to the appearance of the diffraction pattern. We discuss how the diffraction grating performs a mathematical operation on the light to reveal the repeating pattern of the grating in a way that is visible to the naked eye. Depending on the grade level of the students, this discussion could be expanded to introduce the Fourier Transform. We emphasize the inverse relationship between the spacing of the slits in the diffraction grating and the spacing between the reflections in the diffraction pattern. Students then put their diffraction skills to the test by using their laser pointers to distinguish between a CD and DVD. For more advanced students, this lesson can culminate in the use of diffraction to calculate the resolution of their phone screens.
We use the diffraction of a laser through multiple slits as an analogy for the diffraction of X-rays through crystals, and discuss some historical examples of molecules whose structure was determined through X-ray diffraction. This module gives students a glimpse into an exciting application of mathematics to materials science – topics they may otherwise not have had exposure to until much later in their academic journeys.

Poster #3

Partial mastery grading in a large, introductory MSE course to improve student experience and outcomes

Lily Turaski
Georgia Institute of Technology

Assessment is an important part of the university education system, yet there are many ways to assess student learning outcomes and many ways to assign student grades on assessments. In a "traditional grading" setup, students are given one attempt per assessment, and there are frequently a few, high-stakes assessments (exams), possibly interspersed with lower-stakes learning opportunities (homework). While commonly used, there are issues with this traditional approach. For example, increased exam anxiety, a poor reflection of overall learning (students who perform poorly on a high-stakes assignment due to external circumstances may not accurately reflect their understanding), and more.

There are many alternatives (including approaches such as mastery grading, specifications grading, contract grading, and un-grading), which attempt to reduce the negative aspects of traditional grading by providing students with flexibility in the grading process in various ways. However, these techniques also have their drawbacks. For example, in mastery grading, an increased grading workload is created for the instructor, as students are allowed ideally infinite re-tries on each assessment such that they have the opportunity to fully master each concept. This can be difficult and daunting to implement, especially in courses with many students.

In this study, a technique for partial mastery grading was piloted in a large introductory materials science course. This talk will 1) demonstrate how this implementation can be effectively used even in a large course (N = 435 students per instructor, per semester), and 2) show how this impacts students' learning outcomes and course experience.

Poster #4

Integrating Additive Manufacturing Simulations into Introductory Materials Science Courses

Alison Polasik
Campbell University

Additive Manufacturing (AM) for metals is typically introduced in upper-level undergraduate courses, limiting its potential to engage students early in their engineering education. This poster presents a series of assignments and activities that leverage AM simulation tools to enhance student engagement in first- and second-year materials science courses. The modules will be implemented in Fall 2025 in both an introductory materials science course and a senior-level manufacturing course. Each activity explores the interrelationships among material properties, processing methods, and component design. The modules utilize open-source datasets and Ansys simulation tools, but they can be readily adapted for use with other platforms or within different curricular frameworks. Attendees are invited to offer questions, feedback, and suggestions for further development.

Poster #5

Fast-Evolving Generative AI Tools for Materials Science Content Development for MSE Awareness and Education

Dilpuneet Aidhy
Clemson University

Materials Science and Engineering (MSE) faces a unique challenge towards student recruitment: its awareness. When polled, most parents and prospective students have often never heard or have little knowledge of MSE as a major. In this presentation, we will share our recent experiences towards student recruitment and engagement at Clemson. Specifically, we will discuss the use of electronic and social media. With the advent of large language models (LLMs) and generative Artificial Intelligence (AI), the bar to entry for creating artistic YouTube-style content has lowered significantly. We will share our experience in developing such content for MSE recruitment and student engagement.

Poster #6

Implementing mini-CURE (course-based undergraduate research experience) in processing lab

Himani Sharma
Georgia Institute of Technology

In many traditional undergraduate laboratory courses, students follow rigid, step-by-step procedures that limit opportunities for critical thinking and authentic engagement. To address this and better prepare students for independent work in capstone projects, a four-week Course-Based Undergraduate Research Experience (CURE) module was integrated into MSE 4022: Materials Processing Laboratory. This initiative aimed to transition students away from the "cookbook" model and toward a more inquiry-driven learning environment. By designing their own experiments, interpreting results, and drawing evidence-based conclusions, students developed key skills aligned with both academic research and industry expectations.

The CURE module, focused on soft-material processing, engaged junior and senior undergraduate students in real-world research problems centered on polymer recycling and sustainability. Students were grouped into small teams and tasked with exploring research questions such as: How do different processing methods (e.g., compounding vs. extrusion) affect polymer blend properties? What role do recycled polymer additives play in modifying mechanical performance? And how does thermal recycling impact Polypropylene (PP)/Polystyrene (PS) blends after multiple cycles? These questions required students to engage in experimental design, data collection, literature review, and critical analysis, fostering both technical competence and scientific reasoning.

To evaluate the effectiveness of this intervention, pre- and post-module surveys were conducted. Students self-reported their confidence across a range of research and learning skills. The data indicated measurable gains- examples of which are provided in the following bullets.

- Understanding of research process improved from 49% to 76%.
- Confidence in designing experiments increased from 38% to 73%.
- Overall confidence in conducting undergraduate research increased from 43% to 75%.

When asked if the CURE module should be a continued part of the course, over 80% of students responded positively. Open-ended responses also highlighted that students found the experience “empowering,” “eye-opening,” and “more engaging than typical labs.”

This initiative was supported by Georgia Tech’s Transformative Teaching and Learning (TTL) Fellowship and demonstrates the potential of embedding research-like experiences in core laboratory courses. This work suggests that embedding CURE modules—even in technical, upper-level lab courses—can significantly impact students’ confidence, autonomy, and research preparedness. Future iterations will explore extending the timeline and incorporating additional community or industry-driven problems to further increase relevance and engagement.

Poster #7

Reaching Rural Neighborhoods with Materials Science Outreach Programs

Rebecca Welch and Alexis O'Conner

Alfred University

Situated in rural upstate New York, Alfred University offers unique majors in Ceramics, Glass, and Materials Science engineering. One such challenge is increasing student exposure to these disciplines as they are often overshadowed with more popular engineering majors. As such, outreach programs for K-12 students which provide hands-on experiences through exciting student- and professor-led demonstrations has been key to our success. Of note, the most popular attraction is our annual Night of Science event which brings approximately 500 children and families to campus to watch over 50 live demos. These demos include making liquid nitrogen ice cream which introduces concepts in crystallization, exploding thermite reactions, glass making, slime-making to introduce polymers, as well as many others focused on general physics and chemistry concepts. Other popular events have been our “Rube Goldberg Competition” in which local high schools visit campus to compete for cash and scholarship prizes, “Introduce a Girl to Engineering Day” which focuses on more personal demonstrations led by our women engineering students, and our Ring of Fire event which showcases metallurgy and forging.

Poster #8

Bringing Craft Time Back to the College Classroom: Exploring Material Choices via Musical Instrument Creation

Kaitlin Tyler and Elisabeth Huelse

Ansys, Part of Synopsys

Many materials educators would agree that students getting hands on experience working with materials increases their understanding of material behavior and performance while keeping them engaged with course content. But in university curriculum, lab time and space are limited. Many materials of interest are not easily (or safely!) explored in a typical classroom. So what can we do to increase engagement and get more materials in the hands of students?

Why not bring craft time back? As part of the Ansys Academic Development Team’s STEM Resource Initiative, we have created an in-class activity to help students explore the material properties of interest in musical instruments. This involves using available materials (cardboard, rubber bands, milk cartons, and more) to create a musical instrument in class.

Wondering if this activity would be a fit for your class or wondering what else we have created? Come by our poster to see what it is all about!

Poster #9

Annealing, Scanning Electron Microscopy, and More: Enhanced Processing and Characterization Data in Ansys Granta EduPack 2025R1

Susannah Cooke and Kaitlin Tyler
Ansys, Part of Synopsys

Materials Science & Engineering students need a fundamental understanding of not only how material properties change through processing, but also the characterization techniques which can be used to assess these properties. Equipment for material characterization is often expensive, and can be in high demand for research activities, meaning that it can be difficult to integrate teaching of these techniques into the undergraduate curriculum.

The 2025R1 release of Ansys Granta EduPack aims to support education in this area by including a new ‘Characterization Techniques’ table in the introductory-level Materials Science & Engineering database. This new table aims to introduce students to core characterization techniques through images, schematics, descriptions and categorization of each technique. We have also increased the number of bulk material processing techniques have also been added to this database to enhance students’ understanding of bulk processes alongside primary or secondary manufacturing processes. We will explore the new characterization and processing data, and ways to use it in undergraduate Materials Science & Engineering curricula in this poster.

Poster #10

Educational Research Activities at the Alabama Materials Institute

Savannah Barnett and Gregory B. Thompson
University of Alabama

The Alabama Materials Institute (AMI), located on the campus of The University of Alabama, is an interdisciplinary organization that supports the university's research, education, and service missions, centered around the thematic area of materials. The institute has more than 86 affiliated faculty members from the disciplines of chemistry, physics, geosciences, and engineering. The institute supports a variety of educational outreach activities. These include a residential ASM Materials Camp for middle and high school teachers, a newly awarded National Science Foundation Graduate Research Fellowship program, and instrument and equipment training for more than 130 students annually in the use of AMI’s state-of-the-art analytical characterization and powder processing facilities. In addition, AMI hosts tutorial workshops, provided by resident experts and vendor application engineers, that offer deep-dive instruction on techniques and analytical methods for materials analysis. This poster will highlight these outcomes as well as the means to engage AMI in these activities.

Constructivism through Academic Makerspaces: Addressing Modern Science and Engineering Education with Student Centered Learning

Jaclyn Grace
University of Connecticut

Westbrook Middle School is a sixth through eighth grade school located in Westbrook, Connecticut. Throughout the past few years, the school has shifted dramatically from its former state. Grades used to range from fifth to eighth and each grade had four core teachers: science, history, math, and language arts. Now, with the decreasing class sizes and a shortage of teachers, many are required to teach more than just their one core class; some even teach music, biology, and algebra classes at the neighboring Westbrook High School. Home economics and tech education have been removed from available electives and have since been replaced by STEM and robotics courses. Both classes are now taught by the core science teachers in addition to their preexisting preparation periods. Since the classes are still being developed, there is no curriculum for these teachers to follow.

The focus of this project is budgeting and remodeling the former tech shop into an academic makerspace for the STEM and robotics classes. Different machinery, such as 3D printers, laser cutters, sewing machines, and vinyl cutters would ideally be housed in this area alongside typical tools like hammers, screwdrivers, and saws. With this classroom remodel, a finalized curriculum for each STEM and robotics class would be created to use the space to its full potential. The goal of this project is to bring structure back into the class periods, provide a usable alternative to dead space within the school, and enrich the students with life skills alongside their core content knowledge through a constructivist teaching method. By implementing individual time into the curriculum to explore new tools and resources, students will hopefully gain practical skills that extend farther than just the class.

A practical course for first-year PhD students conducting characterization of deformation in structural materials using Universal Design for Learning (UDL) principles

Madelyn I. Payne
University of California, Berkeley

Incoming Materials Science and Engineering (MSE) PhD students are not only expected to have a baseline knowledge equivalent to a B.S. in MSE, but are also expected to figure out the niche techniques and background specific to their research subdisciplines and how to interact with the surrounding literature and community. In this project, I design a course for first-year PhD students to prepare them for independent research on the characterization of deformation in crystalline materials. The course focuses on practical tools and background knowledge needed as an experimentalist, including the identification of deformation features, reading and analysis of published journal articles, and effective communication of one's own work. Ultimately, this course is about providing PhD students tools that will help them integrate into a fast-paced collaborative research environment where many skills are expected but not necessarily taught in a formal setting.

The course is built around UDL principles such as structuring the course around learning objectives, creating opportunities for multiple means of representation, engagement, and expression, and a focus on mastery-oriented feedback. The course emphasizes in-class participation with group and paired activities, with most of the content first introduced outside of the classroom. Content will be introduced through multiple representations including prerecorded lectures, YouTube videos, textbooks, and online reading modules. The UDL framework focuses on proactively building in flexibility for students' strengths, background, and learning needs, which can be especially beneficial at higher levels of education where thoughtful flexibility can better support the inherent variability of an advanced degree.

The main barrier to implementing this course effectively is eliciting enthusiastic engagement from students while maintaining a reasonable workload. Graduate students have major time and energy constraints between balancing required courses, research, and other obligations. Learning objectives help motivate the activities for the students so they can see how they are beneficial. I also use scaffolding in the course structure to help incentivize preparedness for active participation in class. Required asynchronous content followed by "nanoquizzes" at the beginning of each lecture provide students with a routine to prepare for class. The required readings and nanoquizzes also serve other pedagogical aims: learning the material before class allows students to think and ask questions, and repeated exposure to material spaced out over time (readings, in-class activities, and assignments) improves learning. Another way I accommodate graduate students' time constraints is by creating flexible deadlines with the use of slack days and dropped participation assignments. This allows me to emphasize participation without it being burdensome to students when classes need to be missed or points are lost on nanoquizzes.

Through these techniques, we explore course design around the unique needs of incoming graduate students, who often need flexibility as well as very specific guidance. The UDL framework used in this course design helps provide structure while respecting student time constraints, providing students with the tools that will benefit them the rest of their PhD.

Section 6: Workshop and Tour Details

Teaching Sustainable Product Design with Ansys Tools Level 1

Instructors: Kaitlin Tyler and Hesam Moghaddam from Ansys

In pursuit of realizing a responsible production (United Nations Sustainable Development Goal No.12) of goods, sustainability considerations are becoming indispensable in an engineer's decision-making process throughout the product development. Holistic product design must consider the functional, geometric, and material needs as well as environmental impact. This can be challenging to teach to students, especially when various degree programs often focus on specific portions of the design process more than others. To support this, we have developed a Sustainable Product Design (SPD) Methodology, which combines materials selection (building on the Ashby Selection Methodology), functional and geometric analysis via simulation, and a simplified LCA and trade-off analysis. In this workshop, attendees will implement the SPD methodology utilizing Ansys Granta EduPack™ (a teaching software for materials education) and Ansys Discovery™ (a 3D product simulation software) and explore how to implement this in their existing courses.

Software Access and Previous Experience:

Access to both softwares will be provided in the workshop- no need to bring a personal computer. Previous experience with the Ansys Granta EduPack software is recommended, but not required. No previous experience with Discovery is required.

Certification:

Free assessment and certification are available after completion of this workshop.

Workshop Learning Objectives:

By the end of this workshop, participants will be able to:

» Understand how materials selection, simulation, and product life cycle considerations can be used in the classroom for teaching sustainable product design

» Explore the connection between the Ansys Granta EduPack and Ansys Discovery softwares for teaching

» Create and present a short class activity utilizing the Sustainable Product Design Methodology

Proposed Agenda: (Full day workshop)

Time	Activity
9:00-9:15am	Arrival, Check-In, Coffee and Tea
9:15-10:15am	Intro to Ansys Granta EduPack software
	Basic Software Functions: Browse, Search, Chart/Select, and Eco Audit
10:15-10:45am	*Coffee Break*
10:45am-12:00pm	Basic Materials Selection
12:00-1:00pm	*Lunch*
1:00-2:00pm	Advanced Materials Selection
2:00-3:00pm	Course Activity Development Part 1
3:00-3:20pm	*Coffee Break*
3:20-4:15pm	Course Activity Development Part 2
4:15-4:45pm	Course Activity Presentation (required for certification)

Reference Materials:

Utilizing Materials Selection and Simulation in Design | Ansys
Case Study: Bike Crank Design Optimization – Towards Sustainable Product Design

Introduction to Materials Informatics

Instructor: James Saal from Citrine Informatics

Machine learning, artificial intelligence, and data science is becoming an increasingly important component of materials science and engineering, requiring students to be prepared for these methods and tools. However, pedagogy around education on these topics typically requires students to have previous knowledge around programming in languages such as python or MATLAB, limiting coursework to advanced students. In this workshop, attendees will use the no-code, web-based Citrine Platform to learn basic informatics concepts such as data management, machine learning model building, and uncertainty-driven selection of experiments, and then work through practical examples of materials design using the Citrine Platform. All members of the audience will have access to the software during the workshop. The goal of the workshop is to provide attendees with potential resources for inclusion of no-code pedagogies for materials informatics education into undergraduate course curricula.

Proposed Agenda: (Four hour workshop)

9:15am: Conversation with audience on workshop goals, importance of materials informatics, and informatics workforce development.

10:15am: Walkthrough of the Introduction to Materials Informatics course module.

11:15am: Walkthrough of the Alloy Design for Corrosion course module.

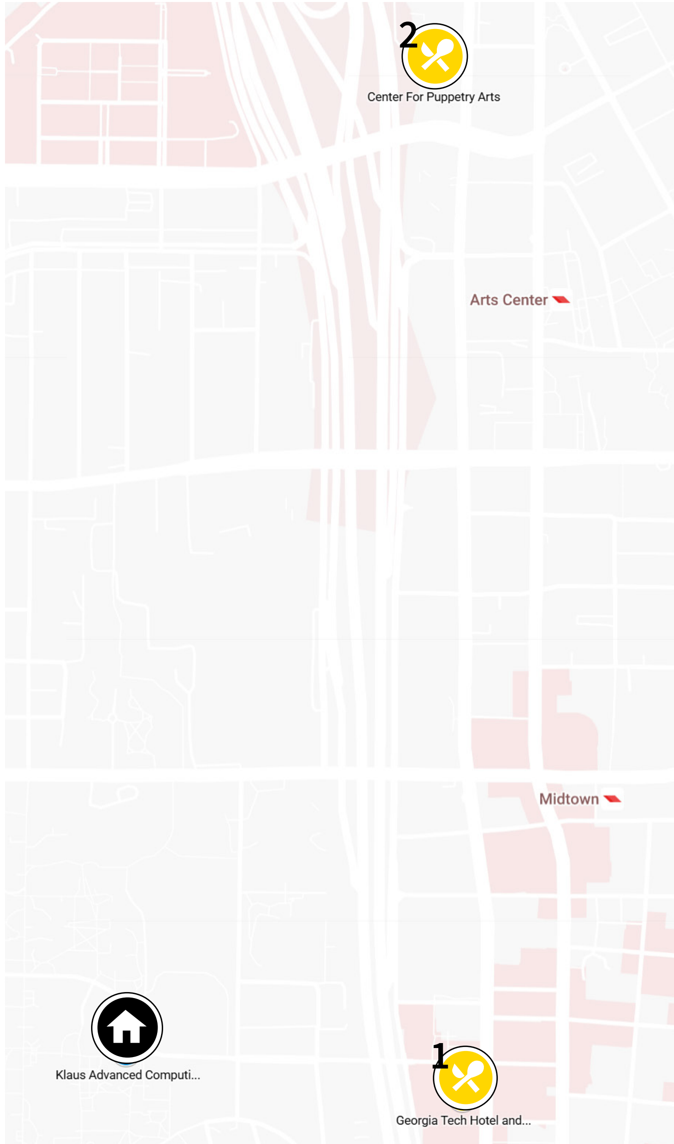
11:45am: Discussion of how materials informatics can be incorporated into undergraduate curriculum (Cal Poly case study).

Georgia Tech UG Labs and the MILL Tour Details

Come tour Georgia Institute of Technology's ***Materials Innovation and Learning Laboratory (MILL)***. Established in 2015, the MILL is the first student-run make-and-measure space exclusively for materials science an education. Now staffed by over 100 undergraduate volunteers, the MILL provides students with free, open-access to a range of processing, characterization, and measurement equipment common to the materials science discipline including electron microscopes, x-ray diffraction, FTIR spectroscopy, mechanical testing and more. The MILL emphasizes ease in equipment usability over cutting-edge performance, with the goal of getting students more hands-on experience. The low barrier to entry, including peer instruction on instrumentation, helps to get over 1000 students from across campus into the space each year.

Section 7: Maps, Contact Details, & Venue Information

Key Event Locations



Location #	Address
	Klaus Advanced Computing Building *Rooms 116 East & West- Conference Location* *Room 1446- Ansys, Part of Synopsys Workshop Location* *Room 1120A- Citrine Informatics Workshop Location* 266 Ferst Dr NW, Atlanta, GA 30332
1	**Georgia Tech Hotel & Convention Center, Conference A** (Presenter's Dinner- By Invitation Only) 800 Spring St. NW, Atlanta, GA 30308
2	**Center for Puppetry Arts** (Symposium dinner) 1404 Spring Street NW, Atlanta, Ga 30309

WiFi Access

To access WiFi while at Georgia Institute of Technology, use either *eduroam* or *GTvisitor*

Conference Transportation Details

Transportation to the Conference and Workshop Locations

The Klaus Advanced Computing Building (Klaus) and Manufacturing Related Discipline Complex (MRDC) are easily accessible by the *free* **Georgia Tech Gold Bus service**.

Transportation to the Symposium Dinner

Transportation via bus will be provided for the Symposium Dinner at the Center for Puppetry Arts. Bus will leave the Georgia Tech Hotel & Conference Center at 6pm sharp.

Transportation to-and-from the Airport

Atlanta's public transportation, MARTA, has a train line that travels directly from the Hartsfield-Jackson Airport to Midtown Station, which is within walking distance of all hotels. A one-way ride is $2.50 using the app, or $3.50 buying a physical Breeze ticket at the MARTA station, and the trip is approximately 30 minutes. You will take the Northbound Red Line or Gold Line from Airport Station to Midtown Station.

Section 8: Community Updates

JOURNAL OF CHEMICAL EDUCATION

pubs.acs.org/jchemeduc Editorial

Journal of Chemical Education Call for Papers: Special Issue on Teaching Innovation in Materials Science and Engineering Design

Cite This: *J. Chem. Educ.* 2024, 101, 5139–5141

ABSTRACT: The *Journal of Chemical Education* announces a call for papers for an upcoming special issue on Teaching Innovation in Materials Science and Engineering Design. This issue aims to highlight innovative approaches in teaching materials science and engineering, with a focus on integrating design principles, sustainability, and artificial intelligence into educational programs.

KEYWORDS: *Materials Education, Design Engineering, Sustainability, Artificial Intelligence in Education, Innovative Teaching Methods, Industry—Academia Collaboration*

■ INTRODUCTION

The field of materials science and engineering is rapidly evolving, driven by technological advancements, environmental concerns, and the need for sustainable practices. As such, education in this field must adapt to prepare the next generation of scientists and engineers to meet these challenges. The Asian Materials and Design Education Symposium (AMDES) has been at the forefront of promoting innovative methods in materials education at the university level, complementing its counterparts:[1] the International Materials Education Symposium (IMES)[2] at the University of Cambridge and the North American Materials Education Symposium (NAMES).[3]

AMDES distinguishes itself by incorporating elements of engineering design alongside materials education, providing a unique platform for educators, researchers, and industry professionals. This approach recognizes the increasing importance of integrating design thinking and problem-solving skills into materials education, preparing students for the complexities of real-world applications.

Despite the significant progress made in materials education, there remains a gap between traditional teaching methods and the rapidly changing needs of industry and society. This special issue aims to bridge this gap by showcasing cutting-edge research and innovative teaching methods that address current and future challenges in materials science and engineering education. For example, many materials science programs struggle to balance foundational science with hands-on, industry-relevant skills, particularly in rapidly advancing fields. Another common challenge is integrating fast-evolving technologies, such as machine learning and sustainable materials, often hindered by resource limitations. Additionally, many programs face difficulties in assessing critical skills such as design thinking and interdisciplinary problem-solving.

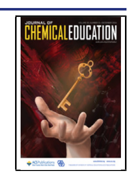
■ SPECIAL ISSUE SCOPE AND CONTENT

This special issue on Teaching Innovation in Materials Science and Engineering Design invites contributions from both the academic and industrial sectors of the materials community. We seek to highlight novel teaching approaches and research in materials education and design education while offering a platform to exchange best practices for incorporating sustainability and artificial intelligence (AI) into educational programs. This would very likely lead to greater employability of students in both the materials and engineering design spaces as these innovations translate to better student career readiness.

We encourage authors to present their innovative teaching strategies and discuss the impact these approaches have had on students' attitudes toward learning materials chemistry, their views on laboratory work, or their understanding of new concepts. Potential topics for manuscripts may include, but are not limited to, one or more of the following key areas that will shape the future of materials and design for education:

1. AI in Teaching and Learning
   - Implementation of AI tools for personalized learning in materials science
   - Machine learning applications in materials discovery and their integration into curriculum
   - AI-assisted laboratory experiments and data analysis
2. Integrating Sustainability into the Curriculum
   - Case studies on incorporating life cycle assessment in materials selection courses
   - Teaching methodologies for sustainable materials design
   - Integration of circular economy principles in materials engineering education
3. Innovative Assessment Design
   - Project-based learning approaches in materials education

Published: December 10, 2024



Ansys
part of Synopsys

Teaching Support with Ansys Education Resources

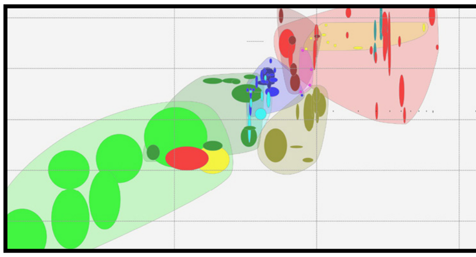
Software integration into curriculum can be challenging and time consuming.

To support our academic users, we have created hundreds of teaching resources, covering a vast range of engineering disciplines and topics to aid in classroom usage.

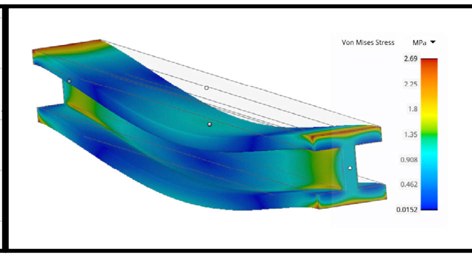
▶ To access the 250+ resources, visit ***ansys.com/education-resources***

/ WHAT LEARNING OBJECTIVES CAN ANSYS SUPPORT?

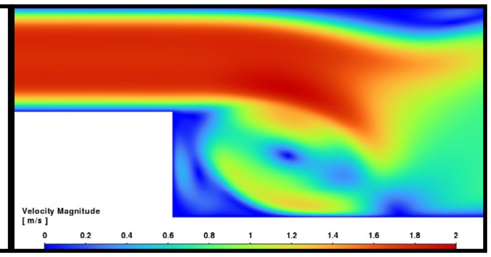
Explore basic concepts through visualizations and equations



Exploring material properties via Ashby Charts

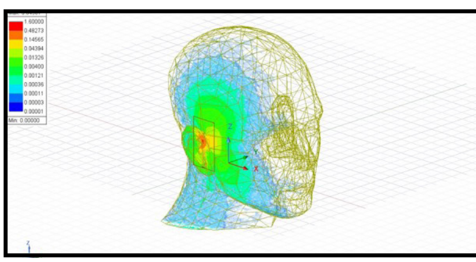


Visualizing stresses in beam theory



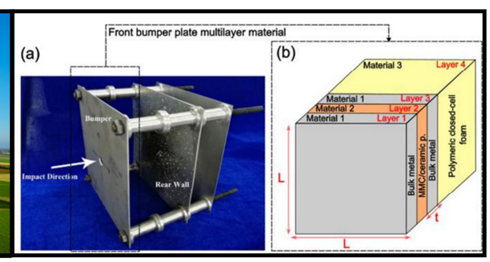
Solve basic problems such as the backwards facing step

Apply fundamental theories and equations to real-world applications



How electromagnetic radiation can be used in imaging

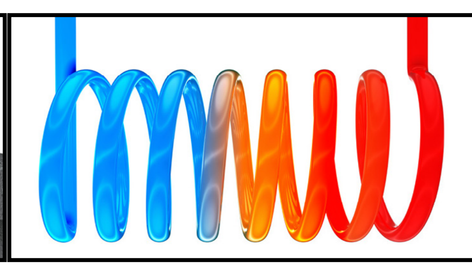
Sustainability considerations in wind turbine design



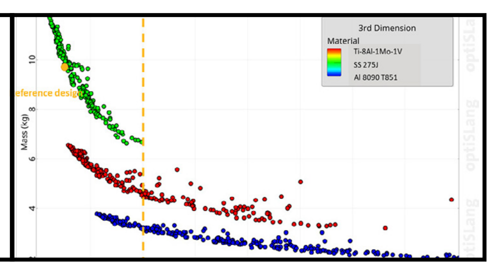
Selecting multilayer materials for aerospace applications

Develop industrially-relevant skills before graduation

Importance of meshing during simulation



How to set up basic simulations (*ex:* heat transfer)



Balancing Optimization and Ecological Impact in Design