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IP1

Shaping the Future of Applied Mathematics Education in the Age of AI

This plenary explores how applied mathematics education can evolve in the age of AI, highlighting opportunities to connect mathematical modeling, computation, and pedagogy to prepare the next generation of innovators.

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IP2

Embeddings, Manifolds, and LLMs in K-12 AI Education

The "new AI" that has emerged in the last 16 years, based on deep neural networks trained on massive datasets, is not easy to explain. Unlike Good Old-Fashioned AI (GOFAI) built from symbolic representations and explicit inference rules, new AI applications are messy, high-dimensional, nonlinear systems. Large language models in chatbots take 'embeddings" as input, and diffusion models that turn text into images operate on "manifolds" in latent image space – concepts not normally covered in K-12 education. In this talk I will describe several approaches to teaching these ideas to middle and high school students, ranging from unplugged activities that introduce multi-dimensional feature spaces, to animations of mapping points onto manifolds, to interactive demos that allow students to personally experiment with these representations.

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IP3

Academia to Industry: A Journey from Applied Math PhD to Construction Autonomy at John Deere

What does training in applied mathematics prepare you for, beyond academia? Nearly anything! This is a personal account of my path from academic applied mathematics through computational lithography, software engineering, stereo camera systems, robotics, and autonomous construction vehicles, and how lessons learned in university and academia provide value in my daily work. I'll focus especially on problems with ties to applied mathematics arising in autonomy projects at Blue River Technology, a wholly owned subsidiary of John Deere.

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IP4

From Early Exposure to Independent Modeling: Developing Applied Mathematical Thinking

Over the past decade or so, many small liberal arts colleges have increasingly recognized the need for faculty with an applied focus, raising questions about how departments evaluate applied scholarship and create meaningful pathways for students interested in applied mathematics. Drawing on my experience working to develop a rigorous applied math curriculum within a historically more heavily proof-based department, I will discuss lessons learned and directions for future curricular development. Using an ecological applicationlarge-scale spatial synchrony of periodical cicadasI will show how emphasizing tractability, scale, and modeling judgment can strengthen students connections between coursework and research. This example highlights how the modeling process naturally starts with simple models and incorporates complexity as needed, encouraging students to learn to formulate questions, justify assumptions, and reason about scale as models and research questions evolve. Within the liberal arts context, an added benefit is that we often have students from other disciplines in our classes and this way of thinking is beneficial to every student. I will describe how we are incorporating this perspective into our courses and identify where I see opportunities to continue to evolve the curriculum to better meet the needs of all students as they progress within mathematics.

Julie Blackwood
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JP3

Joint Plenary Speaker with SIAM Annual Meeting AN26: Ooh, Ooh, Ooh What a Little Course Can Do: Personal and Institutional Transformation Through 1-credit ADAPT Courses

To meet the needs of rapid technological changes and a data-driven world, we need to rethink education. Attention spans are short. People learn best by doing things they care about. Those of us who can be flexible learners and willing to evolve our work practices will be best equipped to help our students do the same. We are tired in so many ways, but we cannot give up. As applied mathematicians, mathematical and statistical modelers and data and AI practitioners, we are well-positioned to lead. My education-related experiences in K-12, industry, higher education, non-profit, and government led me to become the inaugural Executive Director of the NC State University Data Science and AI Academy, which is celebrating its 5th birthday right around the time of the 2026 SIAM Annual Meeting. In this short time, the academy has developed interdisciplinary capacity to engage data and AI across the 12 colleges of the largest public university in North Carolina, reaching students in over 175 programs of study, building data and AI literacy and fluency for students, faculty, staff, and community partners. The key to this success has been a common pedagogical approach: the All-Campus (or perhaps all-learner) Data Science and AI Project-Based Teaching and Learning Model. I look forward to sharing how this approach has infused data science and AI across our campus and beyond.

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CP1

Reimagining Calculus for Biology Students Through Modeling Life

In Fall 2023, we redesigned our Calculus Techniques course for biology and natural resource majors using the Modeling Life curriculum from University of California, Los Angeles. The course replaces a traditional polynomial-focused calculus course with modeling-centered instruction emphasizing dynamical systems, computation, and biological applications. This talk reports on three years of implementation, including course design, assessment methods, and lessons learned. We share evidence of student engagement and conceptual growth, describe the development of a new computational modeling course, and outline the institutional partnerships required to sustain reform. We also discuss challengesplacement, faculty preparation, and curricular alignmentand strategies that helped us build a coherent modeling pathway for life science students.

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CP1

Aligning Calculus with Life Science Needs: Insights From a Modeling First Approach

Calculus is a core requirement for many STEM fields, yet concerns persist about the mismatch between traditional calculus instruction and the quantitative skills students need in their scientific careers. National reports, including those by the Association of American Medical Colleges and the Howard Hughes Medical Institute, call for mathematics curricula that are grounded in authentic, context rich phenomena to strengthen students quantitative reasoning and conceptual understanding. Research in undergraduate mathematics education echoes these concerns, with evidence suggesting that traditional calculus courses may hinder STEM students preparation for advanced disciplinary work, particularly for life science majors. A promising way to make calculus courses more meaningful to life science majors is through a mathematical modeling-first approach to teaching and learning calculus. This talk presents findings from a study investigating a modeling-first, contextually rich calculus course designed for life science students at Utah State University. By combining analyses of student performance with insights from student and instructor perspectives, this project examines how such an instructional approach supports academic outcomes and mathematical preparedness. The results highlight how modeling first curricula can better align calculus instruction with disciplinary needs for course and curriculum reform.

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CP1

Modeling-First Differential Equations - Intrigue, Motivation, and Joy

We offer many examples of lessons we have used with students over the years (50+ of ’em) which always grab their attention and enthusiasm as well as motivate them to want to learn the mathematics of differential equations in order to produce a mathematical model. The subjects cover a wide range of topics in life sciences, engineering, physics, and chemistry - just to name a few. While all these materials reside in the SIMIODE - Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations’ Community of Practice we present narratives of what can actually happen in your classroom should you elect a modeling-first approach with engaging models. We plan to give you a taste of the joy you and your students can have in using modeling to motivate learning mathematics.

Brian Winkel
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CP2

Using Campus Renovations As a Basis for a Class Modeling Project

Our college campus is preparing for a major renovation of the main classroom and office building on campus. There have been extensive discussions among faculty, staff, and administrators on how to best utilize the remaining spaces we have during this process. I decided to give the same problem to my mathematical modeling class in Spring 2026. Students were instructed to develop a model to optimize existing campus spaces and minimize costs and disturbance to normal operations. This presentation discusses the project details and expectations set for students.

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CP2

Game-Based Learning in An Introduction to Mathematics of Computer Science Course: A Case Study

Utilizing active learning, especially game-based learning, within a mathematics classroom can help increase retention, motivation, and overall positive emotions about mathematics. In this talk, we present a case study of using in-class learning activities, based off of popular card games, within an Introduction to Mathematics of Computer Science course. Throughout the talk, games are presented and student feedback is summarized. All games increased students’ understanding of course content. These games can be adapted to any undergraduate mathematics course.

Sara Johnson
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CP2

Inverse Problems in a Linear Algebra Course

In this talk, I will introduce how to incorporate an inverse eigenvalue problem in linear algebra and how it could lead to undergraduate research projects.

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CP2

Teaching Mathematics Through Data Analysis Applied to Precision Agriculture

Precision agriculture is used in a wide variety of agricultural practices that affect our daily lives. Many fields of agriculture are increasingly adopting equipment automation, robotics, and machine learning techniques. These all lead to recognize that data collection and exploitation is a valuable tool assisting in real-time farming and livestock decisions. Thus, the immediate need to empower students and future professionals in Agriculture Sciences with mathematical tools using data analysis is more imperative than ever in the context of Internet of Things (IoT). This talk will present a case study in teaching using data analysis as motivation to concepts in Calculus and Linear Algebra towards applications in the area. Most of the exercises also are framed towards application in this context. This is a result from a thorough research among many areas of applications within the field of Agriculture Sciences, which is in itself a rich interdisciplinary field. It will be presented a few instances of how data obtained from the literature are contextualized to the concepts of functions, derivative and integration, multi variable functions, and linear algebra. In this one-year course, the students were introduced to concepts applied to Soil Physics, Meteorology, Topography, Economics, Biology, Plant Sciences and so on. In addition to sharing this experience, we want stir up the community into this transformative, or innovative, paradigm for teaching mathematics to other fields.

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CP3

Video Games: Your New Math Teacher

Acquiring mathematical proficiency is widely believed to be the greatest hurdle associated with earning a STEM degree, making a lack of foundational math skills one of the foremost causes of STEM attrition. As such, there is demand for supplemental math instruction that is engaging and time-efficient for students. This gives rise to the question: How can math be made more accessible to a general population? Our answer: by teaching mathematics through conceptually rich, culturally relevant video games. The senior personnel behind this NSF-funded project are students and faculty from University of Nevada, Las Vegas (UNLV) and College of Southern Nevada (CSN). The content of the games, an analysis of their effects on student performance, and future directions will be discussed.

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CP3

Taking Advantage of Advanced Placement (ap) Statistics for College Admission: A Study of High School Students in the Houston Area

This project explores the Advanced Placement (AP) Statistics test scores of high school students across various districts in the Houston area. It compares them to local colleges' minimum score requirements for college admission and course equivalency. Through this analysis, the study highlights trends and differences in how colleges accept AP Statistics scores for credit. Based on the findings, the project provides recommendations to the University of Houston-Downtown (UHD) regarding appropriate minimum AP Statistics scores for college credits and course equivalency. These recommendations aim to help UHD establish clearer policies that better align AP credit with the expectations of college-level courses, benefiting both students and the institution.

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CP3

Graph-Based Analysis of How Math Prerequisites Shape Stem Student Progression

Mathematics courses are prerequisites for most STEM programs, yet the structural impact of prerequisite chains on student progression remains understudied. This work uses a graph-based framework combining course prerequisite networks with transcript data from public universities across four STEM majors: Computer Science, Biology, Electrical and Computer Engineering (ECE), and Mechanical Engineering (ME). We model each curriculum as a directed acyclic graph and extract major-specific subgraphs toward capstone courses. For each vertex, we compute reachable downstream courses and historical pass rates. Calculus I emerges as the primary bottleneck across all four majors: highest downstream dependency with among the lowest pass rates. Probabilistic path completion models that incorporate graph structure consistently outperform independence-based models, confirming that curricular topology significantly affects progression predictions. We further analyze how math entry points affect time to degree. Students placing out of developmental math save well over one semester on average, most notably in ME and ECE where prerequisite chains are longest. Grade transition analysis identifies the Precalculus to Calculus I boundary as the sharpest performance drop and a key intervention target. These results offer educators a quantitative tool for identifying structural barriers and guiding strategies such as co-requisite redesign and supplemental instruction at critical nodes.

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CP3

Use of iDGi as a Tool to Assist in Learning of Quadrilateral Geometry for Preservice Teachers

This project examines how an online, individualized, and interactive Dynamic Geometry curriculum (iDGi) supports K8 preservice teachers (PTs) learning of quadrilateral geometry. The curriculum is grounded in learning progressions and embedded within a geometry course for PTs. The proposed research focuses on PTs developing understanding of the prototypical defining properties of quadrilateralsformal attributes that connect closely to the visually salient features students commonly use when classifying and reasoning about quadrilateral types and their relationships. In addition, the study investigates how engagement with iDGi supports PTs movement toward more precise and abstract forms of pre-proof justification. The study draws on data from 541 PTs enrolled across multiple course sections and a control group of 39 PTs. Participants completed identical learning-progressionbased online assessments before and after working with iDGi. Quantitative analyses will examine changes in PTs reasoning about quadrilaterals and make a comparison with students from grades 5, 8, and high school who also worked with iDGi. This work contributes evidence on how learning-progressionbased digital curricula can support PTs and childrens geometric reasoning and offers design insights for integrating online tools with classroom instruction in teacher education.

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MS1
Designing a Cruise Control Using ODEs and the Laplace Transform

Control Theory is ubiquitous in modern technology, and PID ("Proportional-Integral-Derivative") control is one of the most common classes of control algorithms. This type of control is often applied to systems that are governed by differential equations, and the analysis of PID control is made much easier by using Laplace transforms. I'll show a simple application that illustrates the mathematics involved, and how PID control makes a wonderful example of the utility of the Laplace transform that one can use in an undergraduate ODE course.

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MS1
Modeling outside the walls: the pros and cons of community partnership projects

Incorporating the modeling process into a differential equations course can inspire and motivate students because they are answering questions that are meaningful to them. To come up with problems that impact our fellow humans outside of the classroom I have experimented with setting up community partnerships. The goal is to collaborate with community organizations to define modeling projects whose outcomes will help our community partners overcome current and relevant challenges. Getting this to work in the context of a one-semester undergraduate course poses its own problems. In this talk I will describe some of the highs and lows of my experiences using specific modeling examples. My hope is that we can learn together and grow to be more effective partners with our community.

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MS1
Modeling with Differential Equations: A Launchpad for Undergraduate Research

Ordinary differential equations (ODEs) offer students a powerful entry point into modeling real-world systems, enabling them to connect mathematical ideas with practical applications. This presentation shares a series of hands-on projects from undergraduate ODE and mathematical modeling courses that work well as in-class modeling activities while also creating pathways to undergraduate research. Because students come to modeling with different interests and majors, the projects are designed to offer multiple points of entry. Those drawn to physics and engineering explore heat-transfer models for hot-water heaters and attic spaces, as well as data-driven investigations of projectile motion using straw and water rockets. Students with an interest in the life sciences can, for example, engage with data-driven models of glucoseinsulin regulation, diabetes onset, and management. These projects naturally extend into independent research when students refine assumptions, incorporate new datasets, or investigate parameter sensitivity and model validation. The presentation illustrates how analytical and numerical methods, together with data fitting, support this transition from classroom modeling to open-ended inquiry. Collectively, these projects show how ODE-based modeling can serve not only as an instructional tool but also as a launchpad for meaningful undergraduate research and discovery.

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MS1
Mathematical Modeling for Undergraduates from Calculus to More Independent Projects

We share a variety of modeling activities for use in undergraduate courses, including guided worksheets for Calculus and a SIMIODE module for Differential Equations that has multiple entry points, with a SIMIODE scenario that is a great starting point for multiple levels. We share multiple disease models for Differential Equations students, as well as a variety of capstone projects in undergraduate mathematical modeling, some of which involve data analysis. We discuss incorporating these into courses and independent projects.

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MS2
Teaching Matrix Algebra with Python for Computational Applications

This talk presents the design of a matrix algebra course developed for computer science majors. Our goal is to help students learn linear algebra both conceptually and computationally, by weaving Python into a four-part learning cycle that combines lectures, assignments, and in-class collaborative work. Each class includes structured lecture and active-learning assignments, supported by a coordinated instructional team. We will discuss the principles behind this design and illustrate how coding and conceptual work are balanced through specific in-class and assignment-based activities.

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MS2
Exciting Eigenvectors: Seeing Is Believing

There is a simple, inexpensive, easy-to-build, and easy-to-operate device (adapted from [1]) that can be used to demonstrate to students the physical reality of eigenvectors. In this talk you will see how to build that device, observe it in action, learn about its connection to eigenvectors, and how many mathematical concepts are concretely realized in its behavior. This device is suitable for use at many levels, from sophomore-level differential equations and linear algebra courses, to second courses in linear algebra, mathematical modeling courses, and even for undergraduate/graduate math club talks. Although I have used it primarily in lecture/demonstration mode, there is considerable scope for adapting this to a more hands-on, direct-engagement-by-students mode. I hope that you can develop such adaptations. [1] H. V. McIntosh, *Matrix Analysis II: Further Introduction and some Applications to Physical Problems*, 1952.

Steve Mackey
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MS2

Incorporating Programming in Linear Algebra and Differential Equations

I will describe some of my experiences incorporating programming tools and assignments in linear algebra and differential equations courses. I will describe mostly my experience using the Python language in my courses, but the focus will be the student experience in these courses, as well as the different challenges on the instructor side.

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MS2

Balancing Abstract and Applied Linear Algebra: Pedagogical Challenges and Opportunities

Modern curriculum design increasingly calls for integrating abstract mathematical concepts with technology-enhanced learning to promote deep conceptual understanding and strong problem-solving skills. Yet effectively balancing rigorous theoretical development with meaningful computational application in linear algebra remains a persistent pedagogical challenge. This presentation examines a case study of an undergraduate numerical linear algebra course taught with MATLAB and AI. Preliminary observations suggest that thoughtfully designed technology integration can enhance conceptual engagement while maintaining mathematical rigor.

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MS3

The Role of Research, Policy, and Practice in Efforts to Improve Undergraduate Mathematics

Over the past several decades, substantial research has generated insights into how students learn mathematics, providing us with knowledge about student learning, instructional design, and institutional transformation. At the same time numerous policy changesat federal, state, system, and institutional levelshave sought to increase access, improve completion rates, and align mathematics pathways with student goals. This presentation discusses the need to consider holistically how lessons from research and changes to policy influence the practice of teaching mathematical sciences and the learning experiences of the students. It provides selected examples of initiatives aimed at the work of educators, academic units, student success offices, and institutional leaders. These examples highlight the need to consider the classroom experience and the policy levers as components of an interconnected system that also includes many other factors (e.g. professional learning communities, data-informed decision making, departmental and institutional culture) influencing efforts to improve undergraduate mathematics learning.

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MS3

Accessible Entry Points to Discussing Systemic Change in Undergraduate STEM Education

Higher education institutions today need to prepare learners with diverse backgrounds and varied aspirations for success in a changing world. Helping students prepare to be knowledgeable citizens, productive workforce contributors, and individuals capable of leading meaningful and fulfilling lives requires student-centered institutions that recognize and build on each students unique assets. This session will share actionable resources and strategies for creating such a learning environment, developed through collaborative work by members of the Roundtable on Systemic Change in Undergraduate STEM Education. The goal of the module collection is to equip leaders at all levels of academia with concrete tools they can use to drive organizational change towards a student-ready model of undergraduate STEM education. This session will introduce participants to ways they can use the modules to advance understanding of key concepts including the STEM education ecosystem, STEM culture and its impact on students, and student-ready institutions. The practical strategy modules tailored to institutional leaders and to academic unit leaders will also be introduced. These modules are intended to provide accessible, evidence-based guidance for leaders and instructors who want to engage colleagues in productive discussions about policies and practices that could enhance undergraduate STEM programs and foster institution-specific planning and implementation for student-centered environments.

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MS3

The Mathematical Sciences Education Boards Current and Future Efforts to Improve Teaching and Learning

The Mathematical Sciences Education Board (MSEB) aims to guide the future of mathematics education in the United States and has recently launched a consensus study on Modernizing Mathematics Education for Grades 9-14. The work of MSEB is to explore student learning experiences across preK-12, undergraduate, and graduate education, considering what these experiences should look like in practice and how they can be tailored to meet students interests and needs. It will explore pedagogy, pathways, and policy issues that are crucial to our nations future to provide evidence-based guidance to policymakers and practitioners at schools, colleges, and universities; and at federal, state, and local education agencies. The consensus study addresses the evolving role of mathematical sciences, the knowledge and practices that students need to advance their future goals, the most effective pedagogical approaches to support that learning, and the role of technology in Grades 9-14. The report and future work from MSEB will provide anchor points for advancing national conversations about the teaching and learning of mathematics education, this session is designed to offer opportunities for participants to provide input into both activities.

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MS3

Implementation of National Academies Report on Effective Teaching in Undergraduate STEM Education: A Framework for Institutions, Educators and Disciplines

Transforming Undergraduate STEM Education; Supporting Equitable and Effective Teaching is a recent consensus report of the National Academy of Sciences, Engineering and Medicine. The report presents seven principles for effective teaching and identifies policies and practices at the classroom, academic unit, and institutional levels that can facilitate implementation of the principles. Participants will learn about the seven principles through examples in mathematical sciences. The reports recommendations for changes to systems for professional learning, thinking about instruction at the level of academic units, and valuing instruction at the institutional level will also be shared.

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MS4

Designing An Applied Math Curriculum at a Liberal Arts College

As student interest in applied mathematics continues to grow, many mathematics departments at liberal arts colleges are reexamining their curricula. In this talk, we will share our departments ongoing efforts to explore and design a potential applied mathematics track at our institution. We will discuss the initial faculty conversations that motivated this work, share enrollment data from applied mathematics electives, and outline our current course offerings. We will also reflect on key challenges and where we currently stand in the process. The goal is to invite discussion about designing and sustaining applied mathematics programs in small-college settings.

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MS4

Building Data Literacy in Introductory Statistics

Undergraduate statistics courses for general-education students offer key opportunities to build data literacy, critical thinking, and computational reasoning. This presentation outlines a redesign of an introductory statistics course built around three innovations: adopting an open educational resource (OER) textbook, integrating accessible data-science tools, and aligning activities with national computational-thinking standards. The course employs the OpenStax Introductory Statistics (2e) text to reduce financial barriers while providing high-quality instructional materials. Data-analysis activities are carried out using CODAP, a browser-based platform that supports intuitive exploration of multivariate data and enables students without programming experience to engage in meaningful investigations. Course modules also align with the ISTE Computational Thinker standards, emphasizing skills such as data collection, analysis, abstraction, and automation. The presentation offers sample activities, implementation strategies, and reflections on student learning, providing a practical framework for integrating OER, data-exploration tools, and computational-thinking competencies in introductory statistics.

Ariel Cintron
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MS4

Exploring An Applied Mathematics Track at a Liberal Art College: Data, Design, and Discussion

This talk presents a case study of developing an applied mathematics track at a liberal arts college. I will share enrollment trends that motivated the initiative, outline the proposed structure of the track, and discuss trade-offs specific to small departments, including staffing constraints and balancing rigor with accessibility. The goal is to invite broader conversation about designing coherent and flexible applied mathematics pathways in liberal arts settings.

Xiaoqian Gong
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MS4

Designing An Interdisciplinary Applied Math Curriculum under Non-Standard Institutional Constraints

Most math departments follow a fairly consistent structure for course content and sequencing. What might be possible if we didn't have those constraints? Bennington College is a tiny progressive liberal arts college where all students have individualized plans of study. We have complete autonomy in how we structure our curriculum and our classes. Our main constraint is that with only 2.5 faculty in math/stats we need to design a structure that meets the needs of students studying math as well as those across other disciplines. Since each upper-level course can only be offered every 2-3 years, we have developed a flattened course structure such that all courses have a limited number of prerequisites. This is enabled in part by a focus on teaching mathematical thinking, problem solving, and mathematical independence in lower-level classes. An unintended side-effect is that the flattened course structure creates doable pathways for non-math students to take higher-level courses relevant to their area of focus. This leads to upper-level mathematics classes with an interdisciplinary mixture of students all bringing their expertise and interests to the course and an ideal community for applied mathematics education.

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MS5

Ripcord-Powered Toys Don't Just Spin Their Wheels

This talk will examine the ingenious design of the Tomy Pop Cycle, a ripcord-powered toy motorcycle from the 1980s that relies on rolling with slipping for the stable acceleration of the toy. A related SIMIODE modeling scenario will also be discussed, in which real data is used to model the velocity and distance traveled for the toy. The implementation of this hands-on project in calculus or differential equations courses will also be discussed.

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MS5

A Computer Laboratory Component to Enhance the Theoretical Understanding of Differential Equations

Differential Equations are very difficult to solve in general, albeit some simpler examples are applicable in Engineering and Science. This leads to the practice in introductory courses of exclusively emphasizing equations that can be solved by hand. With this concern in mind, I designed a computer component for the Differential Equations course required for most Engineering (and some Science) students at Penn State, although only conducted at the Berks College. The students use Wolfram Mathematica to explore the behavior of more complicated equations, including nonlinear equations, as well as exercises to expand their general understanding of the theory of differential equations, like existence of solutions.

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MS5

Predators and Policies: Teaching ODEs by Modeling Florida's Alligator Ecosystem

In anticipation of the impact covid would have, in early 2020 several mathematicians created the online Polymath Jr Summer Research Program; it's been so successful it runs annually, providing hundreds of students with opportunities to learn, apply and extend mathematics. We report on one of the projects we mentored: modeling predatorprey dynamics on Florida alligators and their role in wetland ecosystems. Our students had minimal backgrounds in the subject; this was a great way to excite them about learning the material and guide them to original research. We report on our successes and opportunities for others to join us in reaching similar students in future summers.

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MS5

Engaging Students in Data-Informed Bio-Economic Modeling with Differential Equations

In this talk, we present a student-accessible project that applies optimal control theory to guide sustainable management of biological resources. Motivated by fisheries management, we examine a predatorprey system in which harvesting decisions must balance ecological stability with economic profitability. The model is formulated as an optimal control problem that seeks to maximize the total discounted net revenue from harvesting while ensuring the long-term coexistence of both species at viable population levels. Appropriate for undergraduate students with a background in differential equations, this project focuses on data-driven analysis, interpretation of results, and bioeconomic relevance. The analysis highlights how economic parameters, particularly the discount rate, influence optimal harvesting strategies and resulting population dynamics, revealing trade-offs between short-term gains and long-term sustainability. This work demonstrates how bioeconomic modeling can be integrated into upper-level undergraduate courses and research experiences, providing students with hands-on opportunities to connect mathematical theory, data, and real-world decision-making.

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MS6

Specifications Grading in First-Semester Calculus: Implementation and Outcomes

Calculus 1 serves as a foundational course in STEM degree programs, yet it is also seen as a gatekeeper course. In this talk, we present the assessment model of Specifications Grading applied to a subset of Calculus 1 classes. Over the course of two years from Fall 2022-Fall 2024, data was collected from the control and treatment groups. Given this model, we show data on the likelihood of students passing Calculus 1 and passing Calculus 2.

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MS6

Challenges and Opportunities in Bringing Pedagogical Innovations to the Applied Math Classroom

Inclusive teaching and assessment strategies, such as standards- or mastery-based grading, inquiry-based learning, flipped classrooms, and more, are seeing widespread adoption in the mathematical community. However, many of these strategies are implemented largely in introductory or theoretical math classes, and do not always translate directly to an applied math setting. At the same time, applied math classes provide opportunities to increase engagement by having students leverage physical intuition and solve authentic real-world problems. In this talk, we will explore some examples of how inclusive teaching strategies are developed and deployed in applied math classes, and the resulting unique benefits and challenges that arise.

Marissa Gee
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MS6

Using Interactive Pre-Class Activities to Facilitate Student Engagement and Early Intervention in Applied Mathematics Courses

In this talk, well discuss the use of interactive pre-class activitiesdesigned by the speaker using Desmosin applied mathematics courses. The use of such activities has presented numerous benefits, including (1) freeing up class time for active learning by transferring portions of lecture material to a flipped setting, (2) helping the instructor to identify students who are struggling immediately, allowing for early intervention, (3) promoting student engagement by giving students daily opportunities for hands-on practice with the material, and (4) supporting students through regular formative feedback, among others. Advice for those interested in crafting such activities will be provided.

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MS6

Toward a Replicable Operating Model for Community-Engaged Applied Mathematics Courses

Community-engaged learning courses in undergraduate mathematics are increasingly discussed, but remain uncommon in practice. A central barrier is operational: the logistical and pedagogical details required to run such a course are rarely documented with sufficient precision to support replication. This presentation draws on a semester-long implementation at a regional liberal arts university to present a transferable operating model for a community-partnered applied mathematics course. The model addresses partner acquisition and onboarding, structuring open-ended projects within a fixed semester timeline, aligning authentic external deliverables with academic assessment, and sustaining student engagement across the semester. The goal is a practical blueprint that applied mathematics faculty can adapt across institutional contexts.

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MS7

Undergraduate Data Science Competencies: Acm Task Force Needs Your Input

A group of representatives of data-science-related professional organizations have been working to define the data science skills and competencies for an undergraduate degree in data science. The group includes mathematicians, statisticians, computer scientists and data science leaders. SIAM needs your help to vet the ideas we have developed so far and to consider how they align with the choices and approaches to data science curriculum in your institution.

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MS7

Mathematics for Life: Transforming Mathematics Education to Focus on Preparing Learners for a Data-Rich World

In a world increasingly shaped by automation, artificial intelligence, and real-time data streams, mathematics education stands at a crossroads. For generations, school mathematics has emphasized procedural fluency and symbolic manipulation separated from authentic contexts. While these skills remain important, they are no longer sufficient. Today's learners must be equipped to interpret data, evaluate evidence, model uncertainty, recognize bias, and make informed decisions in a complex, technological society. This session will provide a perspective to transform mathematics education to center relevance, elevate data literacy, and prepare learners to thrive as informed citizens, adaptable professionals, and ethical decision-makers in a data-rich world. The exponential growth of data has advanced every sector of society. From healthcare diagnostics and climate modeling to financial forecasting and social media algorithms, data drives innovation and influences daily life. In a data-rich world, mathematical literacy is an economic imperative. When mathematics instruction is relevant and forward-looking, it becomes a powerful catalyst for empowerment and success in modern life. This session invites participants to imagine and enact a future where mathematics truly serves life. By centering data literacy, authentic applications of mathematics, and critical reasoning, mathematics education can transform from a gatekeeper of opportunity into a gateway to possibility.

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MS7

Preparing Future Mathematics Teachers to Teach Data Science

First, we highlight recent developments in data science education in the state of Iowa within grades 9-12, 2-year, and 4-year institutions. Then, we discuss efforts to prepare future mathematics teachers to teach data science in grades 9-12. Our project responds to national calls for increased K-12 data science education by developing and evaluating a four-week module for preservice secondary mathematics teachers. The module focuses on visualization and classification of data points and optimization algorithms. Implemented over three years, iterative revisions to the module lessons on utilizing optimization algorithms to classify points were made to develop PSMT understanding. This included lessons that scaffolded preservice teachers from more familiar mathematics towards the unfamiliar data science content and writing pseudocode for optimization algorithms. Results suggest that these lessons significantly improved preservice teacher understanding of optimization concepts across the three iterations. This is a joint project with Heather Gallivan, University of Northern Iowa.

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MS7

A Major at the Intersection of Mathematics, Statistics, and Computing

The Computational Modeling and Data Analytics (CMDA) major at Virginia Tech was created at the intersection of mathematics, statistics, and computing to prepare students for mathematically grounded, data-driven problem solving. From its inception, the program has emphasized modeling, abstraction, computation, and statistical reasoning as integrated tools for understanding complex systems. In this talk, I will briefly trace the origins of CMDA and the motivations that shaped its design. I will reflect on the past decade of growth, curricular refinement, and lessons learned as data science has become increasingly embedded across research and industry. I will also discuss current challenges facing programs like CMDA, particularly in light of rapid advances in artificial intelligence. What should remain foundational, and what must adapt? I will outline key questions we are confronting as we consider the next phase of the program.

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MS8

Using Oral Exams and Poster Sessions As Part of Inclusive Assessment in Applied Mathematics

Over the past 25 years, I have experimented with including poster sessions, oral exams, writing assignments, projects, and textbook-reading assignments as part of alternative assessments in mathematics courses of all levels at three very different kinds of academic institutions. Sometimes I have used these assessments as part of no-points student-focused grading schemes that were focused on assessing students progress on the learning assessments. At Gonzaga, until recently I have mostly used these assessments in upper-level applied mathematics courses. Post-pandemic, I have been teaching mostly multivariable calculus, where I have found that exam-focused assessment schemes are now markedly less effective in encouraging student learning and development. I have observed that two reasons for this are student gaps in prior mathematics knowledge and increased student anxiety regarding taking exams. Over the past two years, I have pivoted and utilized various combinations of oral exams, poster sessions, writing assignments, and textbook-reading assignments in my multivariable calculus courses. One surprise for me has been how well my students with disabilities have responded to these alternative assessments. In this talk, I discuss my observations as I look to carry forward what I have learned to two upper-level applied mathematics courses this fall.

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MS8

Virtual Laboratory Activities As a Tool for Teaching Computational and Applied Mathematics

One of the great challenges of teaching applied mathematics to undergraduate students, particularly at large-enrollment institutions, is being able to provide an environment for students to become proficient with applied/computational mathematics tools while simultaneously avoiding widening student outcome inequality. This talk will detail my own experience attempting to do so by implementing synchronous and asynchronous ”virtual laboratory” activities across multiple applied and computational mathematics courses in the University at Buffalo; focusing on its successes, its challenges, and the context in which these take place.

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MS8

Teaching Small Groups As a Supplement to Large-Scale Calculus Courses

Undergraduate students in engineering and applied sciences at large-enrollment universities commonly take their required first-year math courses with hundreds of students in big, amphitheater-style classrooms. By itself, the large-lecture-hallstyle teaching does not provide students with many opportunities to improve their sense of belonging in engineering and applied sciences or receive just-in-time feedback as they learn math. This talk will explore the benefits (to students) and challenges (to instructors) of offering supplementary, voluntary, 50-min/week small-group math sessions that review key concepts, provide additional guided problem-solving practice, and offer students personalized attention.

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MT1

Enhancing Student Learning Experiences in the Presence of AI

See tutorial details

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