How KSU plans to help undergraduate STEM students better understand mathematics

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CSMConnect is the College of Science and Mathematics (CSM) biannual newsletter designed to keep you informed of the latest activities and developments going on in the college. CSM values the networks developed with partners on and off campus. You are important in our network of partners.

The College of Science and Mathematics (CSM) provides students a high quality and innovative academic experience through our seven minor programs, seven undergraduate degrees, and three masters programs. Students can create their own learning experience through provided tracks, research, and specialized courses. CSM is soaring into the next level of national prominence through cutting-edge research.
The 2017-2018 academic year was a year of great accomplishment for the College of Science and Mathematics. Back in August, we welcomed 585 new freshman students to the College of Science and Mathematics. Of these, 130 participated in a new cohort enrollment program we call the Advanced Majors Program (AMP). In this program, students enroll as a cohort in common courses. The courses in the common schedule are coordinated to give the students exposure to the integrated nature of mathematics and the sciences. We also dedicate time in these courses to helping students develop their metacognitive skills.

The AMP program is one example of how the College is addressing the needs of each of our students. Lecturers Ludmilla Orlova-Shokry and Linda Galloway from the Department of Mathematics are also meeting the educational needs of students by leading our Mathematics Emporium project. In the Mathematics Emporium, students enroll in facilitated, self-paced instruction in College Algebra. This approach allows students the time and attention to develop a deep understanding of the material before moving on to the next topic. It also allows students to focus their studies on topics that they have less familiarity or comfort with, and less time on topics already mastered. This approach is truly a student centric way of providing instruction. The College is currently renovating space in one of our buildings on the Kennesaw campus to better accommodate the Emporium classes, and we have plans to do the same on the Marietta campus in the near future.

Professor Kadian Callahan, Assistant Dean for Faculty and Student Success, is leading an effort in collaboration with Professors Lake Ritter, Jennifer Vandenbussche, and Erik Westlund, to transform the instruction of the Precalculus, Calculus, and Calculus II sequence. Professors Kim Cortes and Michelle Head have been teaching General Chemistry in the AMP program, and they are leading efforts to transform the General Chemistry course to follow the CLUE format. CLUE stands for Chemistry, Life, the Universe, and Everything, and is an integrated approach to teaching chemistry that scaffolds the student experience along core principles. This approach helps students build deep understanding around fundamental chemical principles that are central to learning advanced topics in chemistry and other scientific disciplines.

These activities demonstrate the fundamental emphasis the faculty and staff of the College of Science and Mathematics have placed on the success of students in our programs. Part of that success is to give students a research experience so they can apply and integrate their understanding in an application. Over the last several years, the college has nearly doubled the number of students engaged in undergraduate research. One such activity is the Birla Carbon Scholars program. This program, in partnership with Birla Carbon, provides an opportunity for 10 undergraduate students to conduct research full-time during the summer months. The increased participation in research has led to a growing number of publications and conference presentations authored by faculty and students each year. During 2017, faculty in the College had 32 active awards supporting these research efforts. Of these, 18 awards were from either the National Institute of Health or the National Science Foundation. This is the largest number of active NIH/NSF awards in KSU History.

Over three years ago, the College developed our Student Success Initiative. This strategic plan was focused on helping each student achieve success in all of our courses and in all of our degree programs. Thanks to the faculty of the College, those efforts are resulting in great outcomes for our students. Our goal is for each of those 585 students who started their studies in August 2017 with an interest in College of Science and Mathematics disciplines, that we will be congratulating them on receiving their degree in May of 2021. As evidenced by the good work that I’ve outlined above, faculty of the College of Science and Mathematics are dedicated to our mission of educating our students and preparing them for careers in the sciences.
Dr. Kadian Callahan speaks with WABE’s “Closer Look”

KSU undergraduate students pursuing STEM degrees will see a new approach to teaching introductory mathematics courses.

Over 240 people attended with students, faculty, staff, and external guests from over 45 companies and four other universities. There were 45 students that presented, from the Applied Statistics and Data Analysis minor, Master of Science in Applied Statistics degree program, and Ph.D. in Data and Analytics Science.

Listen to her interview (starts at 37:01) >>

Statistics students participate in 2017 KSU R Day

Graduate and undergraduate students from both the Department of Ecology, Evolution, and Organismal Biology and the Department of Molecular and Cellular Biology participated in oral and poster presentations at the Biology Research Symposium on November 30.

See poster presentation winners >>

Biology students participate in 2017 Biology Research Symposium

Local students ‘high tech mapping’ help firefighters race to emergencies faster

WSB-TV’s Linda Stoffer interviewed Department of Statistics and Analytical Science professors and Ph.D. in Data and Analytics Science students about their recent study to help Cobb County firefighters reduce emergency response times.

See poster presentation winners >>

Watch the interview on WSB-TV >>
Kennesaw State University undergraduate students pursuing STEM degrees will benefit from a new approach to teaching introductory mathematics courses. The University is one of only a handful invited to join the Association of Public and Land-grant Universities (APLU) in working to scale the adoption of active learning for undergraduate pre-calculus and calculus instruction.

The National Science Foundation (NSF) is supporting the project, known as SEMINAL: Student Engagement in Mathematics through an Institutional Network for Active Learning, with a $3 million, five-year grant. The initiative will focus in part on helping underrepresented minority students succeed in introductory math courses that are foundational in STEM fields.

KSU is one of only nine other universities across the country selected by the APLU for inclusion in the program. The process will help to identify which methods for implementing active learning for mathematics work best at different types of schools, with the ultimate goal of developing models that can work at virtually any institution.

“Students who enroll in pre-calculus or calculus 1 will be directly helped, but we anticipate residual benefit for students who enroll in calculus 2 and other courses that require these courses as prerequisites,” said Kadian M. Callahan, assistant dean for faculty and student success, and associate professor of mathematics education. “Our students represent a broad range of majors and programs across KSU.”

On average, nearly 3,400 students are enrolled in pre-calculus, calculus 1, and calculus 2 sections at the University each semester, and that number is increasing.

“On behalf of my entire team, we are so pleased that the APLU has chosen Kennesaw State to be part of this exciting initiative,” said Callahan. “One of the keys to success in STEM is acquiring a strong foundation in
introductory math courses. Active learning has proven highly effective in helping more students succeed in such courses."

Callahan’s team includes associate professors of mathematics Lake Ritter, Jennifer Vandenbussche and Erik Westlund.

“This project supports faculty as they work to use active learning instructional practices to increase the number, percentage and diversity of students succeeding in pre-calculus, calculus 1 and calculus 2, and who experience continued success in subsequent courses,” Callahan said.

The largest study of undergraduate STEM education literature to date – a meta-analysis of 225 studies published by the National Academies in 2014 – found that undergraduate students in classes using active learning methods had higher course grades by half a letter grade, and students in classes with traditional lectures were 1.5 times more likely to fail.

The eight other institutions joining the effort are: California State University, East Bay; California State University, Fullerton; Loyola University, Morgan State University, The Ohio State University, University of Maryland, University of Oklahoma, and the University of Texas Rio Grande Valley.

The nine universities will join the three core institutions to form a diverse cohort of institutions aiming to study how to enact and support institutional change fostering the use of active learning in mathematics. The universities joining the effort were selected from a pool of 47 institutions that submitted proposals and will serve as models for a national push to reform introductory math instruction. The goal is to create a broader network of universities in the SEMINAL project.

“Far too many students hoping to pursue careers in STEM fields get tripped up by introductory math courses right off the starting block,” said Howard Gobstein, APLU’s executive vice president and one of the principal investigators on the NSF-backed initiative. “With a persistent shortage of skilled workers in STEM fields and unequal access to all students, we have a tremendous opportunity to broaden participation and address the biggest hurdle for STEM students’ success.”

The institutions were selected through a rigorous peer review process examining the merit of proposals as well as institutional characteristics including type, size, location and attributes of the student body. SEMINAL was initiated through, and continues to align with, the APLU Mathematics Teacher Education Partnership (MTEP) – building on earlier funding from the Helmsley Charitable Trust. APLU is also working to increase underrepresented minority participation in the STEM fields through its APLU INCLUDES effort, which aims to diversify STEM faculty.
As we usher in a new spring season, we welcome new faculty and celebrate recent research successes. Here are recent highlights:

The Department of Ecology, Evolution, and Organismal Biology is excited to welcome new Professor and Chair, Dr. Christopher Sanford. Dr. Sanford joins us from Hofstra University and after a successful stint as a National Science Foundation Program Director. We are excited about the energy and insights that he brings to CSM’s students, faculty, and staff! Dr. Sanford’s research focuses on the evolution and functional morphology of vertebrates. His laboratory uses the swimming and feeding behavior of fishes to address important questions in how anatomical changes affect performance.

We are excited to have Dr. Altug Poyraz join the Department of Chemistry and Biochemistry. Dr. Poyraz received his Ph.D. at the University of Connecticut and was most recently a Research Associate at Brookhaven National Laboratory before joining the faculty at KSU. His lab studies inorganic materials design, synthesis, and characterization. Possible applications of his research include improved energy storage strategies, such as more efficient designs for batteries. Although Dr. Poyraz has only been at KSU a short while, he has already assembled an undergraduate student research team. Recently, Dr. Poyraz and his students Liana Gerhard, Josh Lauhlin, and Zeljka Zec were awarded one of KSU’s highly competitive CARET support awards for their project entitled “Synthesis and Characterization of Manganese Oxide Cathode Materials for Aqueous Rechargeable Zinc-ion Batteries.”

We love hearing about the ongoing research successes of CSM alumni, and Dr. Paula Jackson, a professor in the Department of Ecology, Evolution, and Organismal Biology, brought to our attention that one
of her previous students is attracting some hot attention for cold research. Josh Hashemi (Biology ’16) is currently pursuing a Ph.D. at San Diego State University, where he is part of the institute’s Global Change Research Group. Josh is part of a research team that braves the frigid temperatures of the High Arctic to research how a changing global climate may affect the carbon cycle in soils. Learn more about this research program.

Dr. Mohammed Chowdhury, an assistant professor in the Department of Statistics and Analytical Sciences, recently published two separate works, one in the Journal of Statistical Computation and Simulation and another in Metrika. Each of these applications of statistical methods that have been demonstrated through a large epidemiological study of childhood growth and blood pressure.

Dr. Martina Kaledin, an associate professor in the Department of Chemistry and Biochemistry, has made exciting recent advances in her research program. Dr. Kaledin studies the mechanisms of proton mobility in aqueous solutions. Understanding proton migration in water, for example, is essential for understanding fundamental properties about how our body’s cells work at a molecular level. Working with colleagues at Emory University, the Max Planck Institute in Berlin, and the Wilhelm-Ostwald Institute in Leipzig, Dr. Kaledin leveraged the power of KSU’s High-Performance Computer Cluster to run all the simulations necessary for her analyses. This work resulted in a manuscript in the prestigious journal Physical Chemistry Letters.
Kennesaw State statistics students crunch emergency response data

In a unique collaboration with local firefighters, Kennesaw State University graduate statistics students – using advanced statistical software and Google Maps – analyzed five years of emergency response data to potentially reduce trip times.

The Cobb County Fire Department asked KSU’s Department of Statistics and Analytical Sciences for help in making sense of a huge amount of data. The information covered several years of emergency responses. The pro bono project, which launched in January 2017, covered 29 fire stations and their corresponding 272 fire zones, which averaged 168 incidents a day.

When the study began, the department’s 8-minute emergency response time was double the National Fire Protection Association’s 4-minute standard. At issue was whether a careful analysis of the data could lead to ways to improve emergency vehicles’ travel times.

An influx of people during the past five decades had turned the mostly rural county into a thriving suburban community. In 1970, the county had fewer than 200,000 residents versus almost three-quarters of a million residents today. Along with explosive population growth, the area has experienced traffic congestion.

“Getting emergency vehicles to an incident is critical in saving lives and property,” said Joe DeMaio, professor of mathematics and data science, who headed up the project with assistance from Gene Ray, director for the Center of Statistics and Analytical Research, and Kurt Schulzke, associate professor of accounting.

“The aim of the study was to look for ways to reduce the fire department’s response time by focusing on the travel times of their various emergency vehicles,” DeMaio said.

Students in the Ph.D. in Analytics and Data Science program – Bogdan Gadidov, Yan Wang, Lili Zhang and Yiyun Zhou – conducted the yearlong
research as part of their degree program.

The team investigated how certain fire zones and stations could be realigned to reduce travel times by analyzing historical response time data from September 2011 to August 2016. The city of Marietta, which maintains its own fire department, was not part of the project.

"Google Maps data was used to analyze the geography, roadways and traffic congestion of the county," said Gadidov. "We studied four different times of the day: morning, afternoon, evening and overnight."

The students said working with actual data, rather than a textbook problem, gave them a real connection with the community.

"The main reason I chose this project is that it benefits all of the people in Cobb County," said Zhang. "That was very rewarding."

By using Google Maps to check the response times from neighboring fire stations, the group tried to determine if a different fire station could have responded more quickly to the same incident. It was determined some fire zones could be reassigned to different fire stations to reduce future traveling times.

Another possible solution would be to subdivide fire zones and assign the resulting areas to different stations. In the event that a fire station is busy and has no vehicles to send to an incident in one of its zones – or if an incident is so large that additional fire stations are needed – a list of backup fire stations for each fire zone could be created using the Google Maps simulation.

Results varied for each fire station, but the research showed room for improvement. The group plans to review the results with fire officials next month before embarking on the second phase of the study, which could pinpoint specific operational areas.
Eight Kennesaw State students were honored recently for their scholarship and research at the 2017 STEM Innovators Conference in Atlanta, hosted by the University. The 12th annual symposium and research conference recognized outstanding Peach State Louis Stokes Alliance Minority Participation (LSAMP) Scholars.

There are currently more than 50 LSAMP Scholars at Kennesaw State’s Marietta and Kennesaw campuses. The LSAMP initiative is designed to improve minority participation and success in undergraduate and graduate science, technology, engineering and mathematics (STEM) degree programs.

“Congratulations to all the students who presented and represented KSU so well,” said Donald J. McGarey, interim vice president for research, Office of Research, and chief operating officer, KSU Research and Service Foundation, Inc. “Special thanks to the faculty who gave their time, energy and resources to support and mentor these students. Finally, thank you to the STEM deans and department chairs who continue to place a high priority on undergraduate research. This is an area of excellence and notoriety for KSU.”

**Winners from the Marietta Campus:**

1st place oral presentation in engineering
Christopher Roper;  
Research mentor: Adeel Khalid

1st place poster presentation in technology, electrical engineering or electrical and computing engineering
Mizzani Walker-Holme  
Research mentor: Carl Disalvo, Georgia Tech

2nd place oral presentation in engineering
Andrew Jones  
Research mentors: Tien Yee and Eduardo Farfan

3rd place poster presentation in mechanical engineering/aerospace
Alain Santos  
Research mentors: Adeel Khalid and Ayse Tekes

**Winners from the Kennesaw Campus:**

1st place poster presentation in chemistry
Christianne Hoggs  
Research mentor: Huggins Msimanga

1st place poster presentation in cell and molecular biology
Beryl Khakina  
Research mentor: Susan Smith

1st place oral presentation in chemistry
Julian Mory  
Research mentor: Mark Mitchell

2nd place oral presentation in cell and molecular biology
Michael Aaron Baker, II*  
Research mentor: Daniella Tapu

*Baker competed in the chemistry classification, however he was classed under cell and molecular biology
Ida Lee Spence, a first-generation Kennesaw State University senior, has been named a recipient of the Georgia Board of Regents 2018 Academic Recognition Award.

The Board bestowed the honor on one student from each of its colleges and universities for classroom academic achievements. Spence of Dallas, Ga., is a math major with a 3.97 grade point average.

Spence’s honors and accomplishments include: the Zell Miller scholarship, Hubert W. Tino Endowed scholarship in Science and Mathematics, and the School of Music scholarship.

An active member of the Kennesaw Women in Mathematics student organization, Spence has served as a supplemental instruction (SI) leader since 2015. In both 2015 and 2016, she won the Outstanding SI Leader Award, and in 2017 she won the Service Award for mentoring new SI leaders.

Spence served as undergraduate research assistant to Dhruba Adhikari, an associate professor of mathematics. She is currently taking advanced partial differential equations as a directed study (first-year graduate level) course with him.

“Lee is truly a brilliant person whom many faculty in the Mathematics Department believe is one of the top students that any of us have ever taught,” Adhikari said. “She has been performing so well that I have been making available her solutions to problems in exercises to all students in the class. Her solutions are clear and complete.”

Spence has participated in summer Research Experiences for Undergraduates (REU) programs at North Carolina State University, Sam Houston State University and the Institute for Advanced Study at Princeton University. Admission into these REU programs is highly competitive.

During Spence’s REU experience at North Carolina State University, she worked on the project “Physiologically Based Pharmacokinetic (PBPK) Modeling for a Persistent Chlorinated Water Contaminant: 1,2,3-Trichloropropane” under the supervision of Marina Evans of the U.S. Environmental Protection Agency. Spence was one of three co-authors on the paper that was written as a result of this project.

Spence also participates in various ensembles in the School of Music, including Flute Ensemble, Wind Symphony, Symphony Orchestra and Wind Ensemble.
The Raccoon Creek Science Symposium was held on Friday, January 26 in the Carmichael Student Center, followed by field excursions to the Raccoon Creek watershed on Saturday, January 27. There were 82 registrants from 30 organizations including eight colleges and universities, two state agencies, one federal agency, five Paulding County Government units, and four environmental non-governmental organizations.

The Friday morning sessions highlighted research and outreach projects by Kennesaw State University (KSU) faculty and graduate students; management and restoration projects from The Nature Conservancy and the Georgia Department of Natural Resources; and educational activities by Paulding County secondary science teachers. Afternoon break-out sessions produced a series of concrete steps that will ultimately lead to the establishment of the Raccoon Creek Environmental Education and Research Center.

The weather cooperated on Saturday and participants spent time on the ground in the watershed, visiting locations and project sites highlighted in the Friday morning sessions. Conference organizers and participants left with a high level of optimism about the opportunities for research and educational activities associated with the Raccoon Creek watershed. A project website will be coming soon, so keep your eyes open for further updates!

(ABOVE) Brent Womack, a wildlife biologist with the Georgia Department of Natural Resources, explaining the approach he uses to manage longleaf pine in the Raccoon Creek watershed. Photo courtesy of Chris Brown, a biology faculty member at Georgia Gwinnett College.

(ABOVE) Miranda Gulsby, a graduate student in the MSIB program who works with Dr. Thomas McElroy, explaining the approach she is using to monitor reptiles and amphibians in the watershed. Photo courtesy of Chris Brown, a biology faculty member at Georgia Gwinnett College.
Master of Science in Applied Statistics (MSAS)

Master of Science in Applied Statistics is a professional degree program which utilizes cutting-edge statistical methods. These methods are used in industry, business, and government for predictive modeling and process improvement with emphasis on the unique challenges associated with BIG Data. Graduates will analyze and interpret real-world data effectively.

Master of Science in Chemical Sciences (MSCB)

Discover the next level of research in this thesis-based program with tracks in chemistry and biochemistry. MSCB prepares students to think in interdisciplinary ways in various related areas of study. Current research areas include traditional sub-discipline areas although not limited to chemical biology, astrochemistry, nanochemistry, synthetic organic chemistry and enzymology.

Master of Science in Integrative Biology (MSIB)

Integrative Biology is based on the emerging paradigm linking concepts across disciplines to produce a more complete understanding of biological systems. The thesis-based graduate program is designed to integrate expertise in specialized fields within biology with collaborative research to solve current and complex biological problems.

Growing Education

Student learning experiences are enhanced by contributions provided to the college to support our student scholarships; improve the margin of excellence; and support research endeavors and professorships to help Kennesaw State University provide a strong environment for recruitment and retention of promising faculty.

For philanthropic opportunities, visit giving.kennesaw.edu.
To donate to the college, visit bit.ly/GivetoCSM.