Building Academic Pathways and Supports: An Integrated Precalculus/Calculus Course and Concurrent Emerging Scholars Program, **Robin Gottlieb**, *Professor of the Practice in Teaching Mathematics*, and **Dr. Brendan Kelly**, *Senior Preceptor*, **Harvard University**

For many students mathematics courses can be a barrier to STEM degrees. What are programmatic elements we can implement to improve students' perseverance and support our students' passion for STEM? By looking at pathways designed to increase students' persistence through STEM, we will reflect on the perennial question of how to move math from a sieve to a pump.

The Emerging Scholars Program is a STEM enrichment program that fosters community, bolsters students' problem solving skills, and offers holistic advising and support for students. ESP is a supplementary, for-credit, rigorous academic program designed to support students who are passionate about an area in STEM but arrive at the college without a very solid mathematics foundation. The program supports its scholars by fostering a diverse and engaged community, involving the scholars in mathematically rich and cooperative learning experiences, and providing personally tailored advising, with the goal of helping our scholars flourish and reach their potential.

ESP students are a subset of students in Math M our integrated precalculus/calculus course investigating functions and their rates of change. Math M is a year long course that blends important precalculus topics into the calculus storyline that showcases mathematics as a sense making activity that helps explain the world in which we live. The course supports students develop a growth mindset and metacognitive skills with assignments and reflections sprinkled throughout the year.

Learning Gains in Math Courses Revised to Utilize Adaptive Learning, **Dr. Sara Milillo**, *Senior Academic Director of Core Curriculum and Science*, and **Dr. Maura Devlin**, *Deputy Chief Learning Officer*, **The American Women's College**

A retrospective study was conducted to analyze the revised math classes offered via The American Women's College at Bay Path University. The three courses involved were MAT104, MAT112, and MAT120 which cover pre-algebra, introductory/intermediate algebra, and basic statistics. Each course had been revised to utilize the Knowledge Path (KP) system starting fall 2018. This system features an adaptive learning software that guides students through hand-selected learning materials pertinent to the goals of each course. Each student may take a different "path" as the system considers their current knowledge and tracks their knowledge gains before presenting them with the next learning material in the course. The retrospective study took advantage of existing data sourceable from Canvas, our course management system which delivers KP to the students, from before and after course revision. Data collected included final grades, grades for various assignments, and other learning analytics where available. Student satisfaction as measured by anonymous course evaluations was also reviewed. Statistical methods were used where appropriate to confirm the existence of significant relationships or trends. Student feedback highlighted some technical issues with system settings that need to be addressed but was otherwise positive. In general, the effect on cumulative course grades was positive for all courses, though the change in means was not always significant.

Using Hollywood Movies to Teach Principles of Physics to Non-Science Majors, **Dr. Frank Robinson**, *Assistant Professor of Physics and the Director of the Engineering 3+2 Program*, **Sacred Heart University**

This talk will describe a class I have taught for many years at Yale University and more recently at Sacred Heart University. In the class students learn how to critically evaluate Hollywood action or science fiction movies using the laws of physics and guesstimation. Is the movie a good or bad representation of what actually happens in the real world? Emphasis is on problem solving on the fly, in class and/or while watching a movie. To claim a scene violates the laws of physics, one needs to be able to back up that claim with a solid quantitative argument.

Data analysis across the curriculum: elements of a program, **Dr. Manolis Kaparakis**, *Director of Quantitative Analysis Center*, **Wesleyan University**

While data analysis has always been an integral part of the scientific process, its integration into our curricula significantly varies across disciplines and institutions of higher learning. Some of these differences become even more apparent as academic institutions respond to the recent explosion in data availability and the society's changing expectations of the capabilities of a college graduate. Over time many institutions have developed data reasoning programs designed to advance quantitative literacy across the curriculum. Typically, however, these programs address the most fundamental needs in quantitative and data analysis, but not the more expanded needs that the era of so-called "big data" brings. On the other side of the spectrum, "big data" issues were initially addressed primarily by graduate programs that emerged in the STEM fields representing variations in computational mathematics or applications of data intensive science that had given rise to a range of informatics programs. These programs generally developed as interdisciplinary programs from the outset and the term "Data Science" emerged as the name of this new interdisciplinary field[1], but - with few exceptions[2] - these interdisciplinary collaborations have remained limited to the STEM fields. This history may explain in part the apparent gap between scientific advances in the area of data science and actual practice in applied non-NSM fields in particular that increasingly make use of large and complex data sets.[3]

The presentation describes an attempt to facilitate further integration of data analysis across the curriculum and presents the basic elements of our program. We will address issues relating to the background, circumstances and motivation that led to the development of the particular approach and program, and present some evidence of student response from our early implementation experience.

[1] For some discussion of this process, see Kirk Borne, John Wallin, and Robert Weigel, "The New Computational and Data Sciences Undergraduate Program at George Mason University," ICCS 2009, Part II, LNCS 5545, pp. 74-83.

[2] See for example the "Discovery Informatics program", which claims to be the first program in this area, at the College of Charleston; it has now evolved into a Data Science BS with fourteen different cognate areas (`http://blogs.cofc.edu/datascience/program-information/`).

[3] For example, Computer Science Professor Juliana Freire recently stated at a workshop organized by the Committee on Applied and Theoretical Statistics (CATS) that "domain scientists do not know what is possible to do with their data, and technologists do not know the domain, so there is an expertise gap" (CATS. 2014. *Training Students to Extract Value from Big Data: Summary of a Workshop (2014)*, pre-publication. Washington, D.C.: The National Academies Press).

Incorporating Quantitative Reasoning into Biomedical, Data Science-Intensive Courses, **Susan Liao**, *Predoctoral Fellow*, **Johns Hopkins University School of Medicine**

Having designed and taught courses at the undergraduate-, graduate-, and medical-level on focused on how high-throughput data, specifically next-generation DNA and RNA sequencing, is transforming both basic research and translational medical care, I plan to present several examples of how instructors can supplement lectures with introductory problem-based inquiry exercises which align with course learning objectives, reinforce quantitative reasoning skills, and motivate non-majors to enroll in advanced courses in mathematics and computer science to apply to their own academic and research interests.

How Our Center of Excellence for Women in STEM Enhanced Quantitative Literacy and Boosted STEM Success for Underrepresented, Low-income, and First-generation Women at Bay Path University, **Dr. Gina Semprebon**, *Director, Center for Excellence for Women in STEM* and **Dr. Yadilette Rivera-Colón**, *Assistant Professor of Biology and Undergraduate Research Program Coordinator*, **Bay Path University**

Our students at Bay Path University, a women-serving institution at the undergraduate level, have showed an increased attraction for pursuing STEM majors over the past several years. However, our gateway, foundational STEM courses within the first two years of study have proven to be a more challenging roadblock to student success in recent years – particularly for our underrepresented, low income and first-generation students. This has been particularly due to poor quantitative literacy skills confounding student success in our chemistry foundational courses. Our response was to develop a long-term and inclusive excellence plan for our STEM majors and to develop a Center of Excellence for Women in STEM (CEWS) to institute, coordinate and assess all high-impact learning activities, grant procurement, peer-mentoring and inclusion efforts. We have been rewarded with excellent retention rates of low-income (77%), minority (84%), and first-generation (81%) women in STEM. This success is the direct result of a major overhaul of our entire STEM curriculum for student-centered, active learning, incorporating national biological literacy recommendations, and major quantitative literacy efforts spearheaded by an integrated math/science faculty learning community. We also totally revamped our peer-mentoring system and included an intentional effort at increasing the number of minority peer mentors, and the institution of pervasive CURE and other high impact learning experiences. We have also developed a refined delivery system for independently-mentored research infused with quantitative literacy components and our initiatives and methods are being modeled by other non-STEM departments and have contributed greatly to catalyzing a highly developed all-university diversity and inclusion initiative.

Teaching QR: A Journey in an Urban College, **Dr. Nadia Benakli**, *Associate Professor of Mathematics*, **New York City College of Technology**

We will describe the quantitative reasoning program at an urban college. We will discuss initiatives taken to better support our students such as selecting course material with an approach based on context, and designing faculty development workshops to better equip instructors to engage students successfully in the learning process.

Using STEM to increase engagement and efficacy in entry level mathematics courses, **Dr. Vanessa Hill**, *Professor of Mathematics*, **Springfield Technical Community College**

A look at interventions that can be incorporated into both the developmental as well as entry level mathematic courses with the introduction of STEM applications and careers. By explicitly exposing students to these areas we can cultivate interest and build equity with students from underrepresented groups.

Why is tutoring effective? Three hypotheses, **Dr. Melissa Mills**, *Teaching Assistant Professor and Director of Mathematics Learning Success Center*, **Oklahoma State University**

Research has shown that tutoring attendance correlates to higher student grades, increased student confidence, and improved retention rates. What is missing from the conversation is what happens during a tutoring session. What is it about a tutoring interaction that contributes to student success? I present three hypotheses that appear in the literature and we will discuss real observation data of mathematics tutoring sessions in light of these three perspectives.

Being Human in STEM: students, staff and faculty partnering to enhance inclusion in STEM on campus, **Dr. Sheila Jaswal**, *Associate Professor of Chemistry*, **Sai Chauhan**, *junior math and physics major*, and **Linh Le**, *senior math and french major*. **Amherst College**

When student protesters occupied the Amherst College library for four days in November of 2015, the campus community was transfixed by the painful testimonials shared by marginalized students about their experiences at Amherst as individuals identifying as Black, brown, female, queer, trans, disabled, international, among others. In response to letters from a Black neuroscience major and a non-binary biochemistry and biophysics major, every STEM department wrote a letter of support, pledging to work with students to address their concerns. The following semester, Chemistry professor Sheila Jaswal collaborated with students to develop a project-based course, titled "Being Human in STEM" (HSTEM), to actively engage STEM students and departments in learning about and enhancing inclusion in STEM settings. Now in its sixth iteration, students drive the academic inquiry, investigating both the local experience and the literature on diversity in STEM. They then use that research to design tools and interventions to share with and enhance their own STEM community. In this panel, HSTEM students Sai Chauan '20 (Mathematics & Physics) and Mylinh Le '19 (Mathematics & French), and Prof. Jaswal will describe how HSTEM course projects and activities have continued the conversation started by students during the Uprising, connected STEM inclusion efforts across the Amherst campus, and produced resources such as www.beinghumaninstem.com and the "Inclusive Curricular Practices" handbook, that have been used by STEM educators from high schools, colleges, universities, and the Howard Hughes Medical Institute Inclusive Excellence institutions. They will present evidence on the impact of the HSTEM course and practices on students, faculty and staff at Amherst, and provide examples of how a growing network of institutions, including Yale, Brown, Skidmore, Depauw, and University of Utah, are adapting the HSTEM model to their own STEM community needs. Finally, they will lead participants in an activity to envision how to bring features of the HSTEM model and practices to their own campuses.

Math anxiety of female college students, **Victoria Gruneiro**, *Assistant Professor of Mathematics*, **Bay Path University**

Math anxiety can start interfering with a student's abilities in the subject as early as their elementary grade levels, and increase during middle and high school years. Subsequently, math anxiety for female students in college is a struggle that many deal with on a daily basis. This presentation will take a look at some of the issues that young women face as they learn mathematics. The contributing factors and the stages of math anxiety will be discussed as well as strategies math instructors can develop in their math courses.

Collecting visitor data at UConn's Q Center, **Dr. Alvaro Lozano-Robledo**, *Director*, and **Diane Briody**, *Program Coordinator*, **Quantitative Learning Center, University of Connecticut**

In this talk we will give a quick overview of how the Quantitative Learning Center at UConn works, and then we will describe the system we use to collect visitor data, and student feedback. But more importantly, we will discuss how we use the data to start conversations with the academic departments we serve and, in turn, improve our services based on their feedback.

Overview of a One-Credit Tutor Training Course, **Dr. Justine Chasmar**, *Director of Quantitative Reasoning Center*, **Goucher College**

During the second year of the Quantitative Reasoning (QR) Center at Goucher College, the director created a one-credit course designed to train new tutors. The course combines cross-sectional pedagogy from mathematics, data analytics, quantitative reasoning, and education. Students who complete the course review essential quantitative content, examine self-regulated study strategies, and learn basic teaching and tutoring pedagogy. This presentation will review the entire creation and implementation of the first semester of this course and allow for time for questions and discussion.