

# STEM-ester in Review

## Kaput Center Newsletter

### Welcome

Welcome to the new Kaput Center newsletter. We aim to send out a newsletter twice each year to keep everyone updated on the work of the Kaput Center. If there are features you'd like to see, please let us know! You can always email us at [kaputcenter@umassd.edu](mailto:kaputcenter@umassd.edu)

### New People

The Kaput Center is delighted to welcome Kym Welty as a Grant Support Specialist and project manager. Kym brings much appreciated experience with UMass Dartmouth systems and processes as well as a service-oriented attitude.

### New Website

The Kaput Center is getting a new website! Set to launch at the end of July, the new website will be located at <http://kaputcenter.org>



## STEM<sub>4</sub>Girls

**By: Kimberly Welty, Grants Support Specialist**

On March 3, 2018, the Kaput Center for Research and Innovation in STEM Education held its 7th annual STEM outreach event called "STEM<sub>4</sub>Girls Day" at the University of Massachusetts Dartmouth. This free event was open to all girls grades 3-8 who wanted to learn more about and engage in Science, Technology, Engineering and Mathematics (STEM). Over 190 girls from the Greater New Bedford area registered and over 130 attended despite the SouthCoast being hit by a strong Nor'easter the day before the event. Our keynote speaker, Dr. Angela Dorsey from NASA's Jet Propulsion Lab, kicked off the program. Her message to the young women in the audience stressed the importance of perseverance. She also wanted to dispel the notion that girls who enter STEM fields of study can't have families. Instead, she said "you can have a career in STEM and still be a mom."

(STEM4Girls Continued)

We hosted 16 STEM workshops, led by experts who volunteered their time, for the girls to participate in. Presenters included UMass Dartmouth faculty and graduate students; local middle and high school teachers from Fairhaven, Fall River and New Bedford; and personnel from other STEM-related organizations. The day's activities were supported by over 40 volunteers from help of our volunteers who included UMass Dartmouth students from TANGENT, Phi Sigma Sigma, Society of Women Engineers, Women in Computer Science, and the Biology Association as well as other people who wanted to help out.

UMass Dartmouth Kaput Center Director Chandra Orrill noted the program's purpose is to make STEM more enticing for girls. "The goal is to engage them in seeing that STEM is fun as well learning some of the content of STEM," Orrill said. "What the research shows us is between fourth and eighth grade, girls tend to lose interest in pursuing science and math courses, which locks them out of pursuing STEM careers later." Women held 47 percent of all jobs in America in 2015, but only 24 percent were in a STEM fields, according to the United States Department of Commerce. Orrill said getting girls into STEM fields is also important for equalizing the workforce and perspective. "If we want to see a more equal workforce this is the age we have to grab their attention," Orrill said. "Both men and women live in the world and if we want to improve everybody's lives then we need to have people from all different perspectives contributing to improving everyone's lives."



## Dr. Jen Lacy Symposium

**By: Paul Fredette, Executive Board Member**

I attended the afternoon workshop led by Dr. Lacy and presentation of her research on the implementation of and experience observing the use of a well-funded high school Maker facility.

The workshop was a group experience for each participant to become a maker using simple craft materials to illustrate the concept of *balance* and how it might be used to express concepts in mathematics. Participants were educators and some children of the Kaput staff. The lack of directions provided a challenge that allowed various independent expressions of creativity.

For my part, I picked up some glue, popsicle sticks, cups, clay and straws. This started as a primitive tool for measuring weights relative to each other. Others started in this direction and spent more time creating a more elaborate implementation. The plan I formulated was to create a unit mass of clay that could be duplicated by using the balance by matching the weight. Not spending more time on the

balance itself led to limitations that other implementations did not have. This was a result that the group was able to achieve that individual efforts may not have explored.

Other participants took very different approaches. One construction was natural scene with trees and plants that were in balance with each other in the environment. One thing that surprised me was a teacher that created an arrow out of Chenille stems. The arrow was used as a pointer to describe the elements of her creation. Quite clever.

The workshop was followed by Dr. Lacy's research talk about one school's recently created Maker Space. Her

observations showed a lack of conceptual learning as students engaged with the latest tools in contrast to the more traditional experiences of "shop" and art. Specifically, the use of computer-based tools became procedural in a somewhat sterile environment of white space and quiet. This was the criteria for the design of the space with the stated goal allowing creativity by removing distractions.

The 3D printing capability was typically used to print objects found on the internet versus students designing them from scratch. The Maker Space faculty believed machine created items were more accurate than shop made items, even when this was clearly not the case as sometimes rough surfaces needed to be processed in a shop to make them precisely match the desired dimensions and aesthetics. Student comments illustrated the deeper learning that occurred when both modes of "making" were employed. The net result was that what seemed obvious about how the latest and best "tech" stuff would enhance learning was not the magic recipe for creativity or Maker Space implementation.



## Dr. Maria Blanton Symposium

**By: James Burke, Postdoctoral Fellow**

In February, we welcomed Dr. Maria Blanton to talk about her research on the capabilities of young students to engage in algebraic thinking. Dr. Blanton is a Senior Scientist at TERC in Cambridge, MA. Her visit was especially significant considering this year's theme revisiting the research interests and contributions of Dr. Kaput and seeing how his legacy has continued. Dr. Blanton worked with Jim Kaput on early algebra research when she was a Professor of Mathematics Education at UMass Dartmouth.

During her visit to the Kaput Center, students and faculty met with Dr. Blanton to discuss the question of whether students in the early grades can think algebraically, and if so what impact might a curriculum in algebraic thinking have on students' mathematical understanding and readiness for algebra in the middle grades.

Dr. Blanton's colloquium presentation on her research, including the work of Project LEAP (Learning through an Early Algebra Progression). Algebra, as Jim Kaput saw it, was not merely the manipulation of symbols ("factoring  $x^2 - 4$  until it comes out your ears.") Rather, the algebraic thinking that involves spotting, expressing, and comparing patterns. Project LEAP views algebra through Kaput's framework of four practices across three content domains. Students think algebraically when engaging in generalizing, representing, justifying, and reasoning with mathematical structure and relationships. This occurs in domains of generalizing arithmetic, functional thinking and working with equations, equalities, and expressions.

Dr. Blanton shared promising results of LEAP 3's interventions using a curriculum of algebraic thinking in the early grades. Students who tested similarly before the intervention showed increased gains in performance at every later point in time,

through 3rd and 4th grade (with 5th-grade results yet to come). This study led by a randomized pool of teachers showed that early algebra could have a significant impact. However, that impact was less than the result measured when researchers led the intervention, leading to questions about how we support teachers better in implementing innovative curriculum with fidelity.

Dr. Blanton reminded us of Jim Kaput's tenacious nature when investigating a problem, which she saw as a particular virtue that applies to the pursuit of knowledge and building a career in mathematics education research. Maria recommended that researchers consider sticking with a problem of interest rather than sampling many questions. Despite expected setbacks and rejections, slowly, methodically, developing an agenda would yield eventual payoffs in work. This message and the foundations that Jim provided encourage us to build, using what we know about what students can achieve to push against the boundaries of what we commonly expect students to know in mathematics.



## Faculty Spotlight: Dr. Stephen Witzig

**By: Jinsook Park, Graduate Research Assistant**

Stephen Witzig, a Science Educator at UMass Dartmouth, currently serves as the principal investigator on the \$2.86 million project funded by the National Science Foundation's Robert Noyce Teacher Scholarship Program to implement the Teaching Fellowship/Master Teaching Fellowship Program, known as "TEACH! SouthCoast STEM". UMass Dartmouth and its partners are preparing 20 STEM Teaching Fellows (TFs) and Master Teaching Fellows (MTFs) as STEM educators for the middle and secondary schools of Fall River, New Bedford, and Wareham, MA. The project prepares STEM teacher leaders by focusing on three major strands: (1) educators deepen STEM content knowledge and instructional practices through myriad content-intensive learning experiences; (2) educators develop critical 21st Century skills through the active exploration of emerging technologies in STEM education; and (3) educators develop teacher leadership skills via a collaborative approach, based on a proven model that utilizes peer-coaching, mentoring, and professional learning communities.



Dr. Witzig's research interests are science teacher knowledge and how teachers' experience shapes their knowledge development. The science teacher knowledge construct that is the focus of his research combines science content knowledge and pedagogical knowledge together into what is known as pedagogical content knowledge, or PCK, – craft knowledge that is unique to science teachers. The PCK construct also includes science teacher orientations – teachers' beliefs, goals, and purposes towards teaching science. These are not static and develop over time with experience both in and out of the classroom. Dr. Witzig's research has included participants from his TEACH! SouthCoast STEM grant as well as teachers from his graduate level science education courses.

This summer, he is teaching two courses for science teachers. These courses are titled "Socioscientific Issues for Secondary Science Educators" and "Science Teaching & Learning in Informal Contexts for Secondary Science Educators." Both of these courses include classroom and field-based experiences for middle and high school science teachers that will link scientific learning standards from Massachusetts State Curriculum Frameworks to the local environment. The Socioscientific Issues based course focuses on a new approach to teaching science that involves teaching science through social and political issues where the issue is introduced up front and has a substantive connection to science (i.e. green energy, genetically modified organisms, etc.). The informal science learning course will leverage experiences that teachers can draw from in visiting local museums, zoos, aquariums, nature centers, etc., as places for teachers to engage their students in STEM learning. "So we will go to the sites for informal learning and have teachers become inspired with how to interface with those segments of informal learning to enhance what they are already doing in their classroom."

## Grant Spotlight: Girl Power in Making

**By: Kym Welty, Grants Support Specialist**

This project, funded by the University of Massachusetts Dartmouth, was led by Prof. Shakhnoza Kayumova. The goal of this project was to conduct research to support a proof of concept by designing and implementing socially and culturally mediated Makerspaces approach to coding and robotics in the context of science curriculum which aims at understanding how to support and empower girls' participation and identity development in STEM disciplines. Prof Kayumova's team consisted of other faculty, graduate and undergraduate students from STEM Education & Teacher Development, Computer Science and Engineering. Prof. Kayumova met with central administration and middle school principals from the Fall River Public School District and selected two middle school grade science classrooms in Talbot Middle and Lord Community Schools to participate initially in this project. With the assistance from UMass Dartmouth professors and students, as well as Makerspace, science and technology consultants from local public schools, Prof. Kayumova developed classroom lesson plans using Bristlebots, aligned these lessons plans to the Fall River Public School curriculum standards and then facilitated these activities with middle school students over a six-day period in the two chosen classrooms. She was able to assess students' attitudes about science identity, attitude and motivation both pre- and post-intervention using surveys. Students participated in interviews and classroom activities were videotaped. Going forward, Prof. Kayumova plans to review the data from the surveys, videotapes and interviews to put together professional development that will be delivered during the Fall 2018 semester to Fall River Public Schools.



## Breaking News: STEM Education Ph.D. Approved!

On June 19, 2018, the Board of Higher Education approved the new STEM Education Ph.D. program for UMass Dartmouth. This program builds on our successful Mathematics Education Ph.D. program to include Science Education and, eventually, Engineering Education. Stay tuned for upcoming programming in support of the new STEM Education Ph.D. program. If you are interested in learning more about the program, please contact the Graduate Program Coordinator, Dr. Karen Terrell, at [kterrell@umassd.edu](mailto:kterrell@umassd.edu).

## Upcoming Events

Visit Kaput Center personnel at Educating for the Future: Practices - Programs - Partnerships on August 15 at Bridgewater State University! More info available here: <http://www.connectsemass.org/stem/>