

MATH MATTERS

CENTER FOR MATHEMATICS EDUCATION + COLLEGE OF EDUCATION



LOOKING BACK ON A GREAT ACADEMIC YEAR,

let's start off with the people who have left and those who are coming on board. **Whitney Johnson** successfully moved on to a tenure track position at Morgan State University. **Rick Hollenbeck** went back to full time teaching at River Hill HS in Howard County (though he still teaches a course a semester for us), and **Susan DePlatchett** moved on to work for the department and the dean's office. To take on some of the responsibilities that were left vacant, **John Seelke** was hired on as a PDS coordinator for secondary mathematics, and **Rodrigo Gutierrez**, a graduate of the University of Arizona, and **Janet Walkoe**, a graduate of Northwestern University, will be joining us as clinical faculty.

I was promoted to full professor. **Grace Benigno**, **Darcy Conant**, **Jill DePiper**, and **Wanda McCoy** all completed their PhDs. **Sherwin Collette** completed his MA, won an award from the college, and has joined our doctoral program. In addition, **Elizabeth Fleming** is our newest Fey-Graeber fellow.

The college reorganized and we are now a part of the **Department of Teaching and Learning, Policy and Leadership (TLPL)** within the **Division of Science, Technology, and Mathematics Education (DSTME)**. The CfME fits into a larger ecology of STEM education efforts on campus, including efforts on undergraduate education, teacher education, outreach, research, and more. The CfME will increasingly move to center its activities around its research agenda.

We continue to explore **opportunities with STEM education** and to work more closely with colleagues in science and technology. **Beatriz Quintos** and I have grants from MSDE to investigate the creation of coursework for elementary STEM certification. With support from the Center for Teaching Excellence, we've brought together a group of faculty fellows from Engineering, the College of Computers, Mathematics, and the Natural Sciences (CMNS), and Education to consider what STEM means, what elementary teachers are like as learners, and how we might create coursework and programs. The new MSDE STEM standards seem to open up possibilities for innovative instruction in schools, including in mathematics. It is exciting to consider the role that mathematics might play in such endeavors.

Our MAC-MTL grant will be ending in the fall of 2013 and the research projects are reaching their publication phase. The Case Studies project has a special issue coming out in 2013 in the Teachers College Record. It will be on the web shortly. The Quant project has articles in review in several leading math ed journals.

Outreach to school districts continues to be a priority. Our second PGCPs cohort of elementary certified teachers interested in middle grades math and our third MCPS cohort will graduate next year. We have a new MCPS cohort launching this coming year, and Beatriz Quintos and I were successful on an ITQ grant with support for 40 PGCPs teachers to take 6 credits to prepare for the Common Core Standards with a focus on numbers.

We have continued to explore new pathways for **initial teacher certification**. This past year we were active in recruitment and this year a cohort of Middle Grades MCERT Math and Science will be launched, as well as a cohort of undergraduates seeking the same certification. We continue to explore support for teacher candidates: **Lawrence Clark's** Noyce grant application was successful and the first cohort of Noyce scholars has been chosen. We continue to work toward the institutionalization of the MSMaRT program.

So, as you can see, it was a busy and productive year with lots of change. We're looking forward to another such year in 2012-2013.

Daniel Chazan

For nearly 50 years, the
**CENTER FOR
 MATHEMATICS
 EDUCATION**
 in the College of Education
 has served as a scholarly
 voice for excellence and
 innovation in mathematics
 education, while nurturing
 the next generation of
 mathematics educators
 and researchers.

The Quantitative Study Project by Matt Griffin

Hello again from the Quant Project! We are in our sixth year of the MAC-MTL grant, which investigates the potential relationships between teacher knowledge, teacher beliefs and awareness, and student achievement. To date, the project team has designed and piloted instruments (surveys and knowledge assessments), and utilized these instruments to collect data from over 450 upper-elementary and middle-school teachers in 23 participating districts across Maryland, Delaware and Pennsylvania. In recent years, we have performed different analyses involving three statistical models and through them we have discovered several interesting findings, including:

- Teachers' mathematical content knowledge (for all teachers) and middle-school teachers' pedagogical content knowledge were significantly and positively related to student achievement.
- Significant interactions emerged between teachers' beliefs and knowledge, as predictors of student achievement, suggesting that teacher beliefs about the teaching and learning of mathematics and teachers' perceived awareness of their students may serve as conditional influences on the effect of teacher knowledge on student achievement.
- For upper-elementary teachers, teacher knowledge was significantly and positively related to teachers' beliefs that students should struggle with mathematical problems and, for all teachers, teacher knowledge was significantly and negatively related to teachers' belief that teachers should model mathematics for incremental mastery.
- Special education certification was significantly and negatively related to middle-school teachers' pedagogical content knowledge and to upper-elementary teachers' beliefs that students should struggle with mathematical problems.

We believe our findings have important implications for teacher preparation, teacher evaluation and professional development. We feel that the results provide evidence of the relevance of teacher knowledge as well as teachers' beliefs and awareness, considered both separately and when interacting together, in the conceptualization of teacher quality. In February, we led a work session on professional development materials produced from selected items at the Association of Mathematics Teacher Educators Annual Conference and in April, we presented poster sessions of our papers at the American Educational Research

Association Annual Meeting in Vancouver. Our next steps include finalizing separate analyses and producing reports for the states of Maryland and Pennsylvania.

The following UMD faculty, staff and current and former CfME fellows are engaged on the Quant project: **Patricia Campbell, Lawrence Clark, Masako Nishio, Toni Smith, Darcy Conant, Amber Rust, Jill Neumayer de Piper, and Matt Griffin.**

Elementary Math Specialists by Pat Campbell



Pat Campbell and Matt Griffin are conducting the research component of the NSF-funded project investigating the impact of elementary mathematics specialists on student achievement in rural elementary schools distributed over 13 districts in Virginia. After completing five mathematics content courses and two leadership/coaching courses delivered through either a blended, distance-learning or a summer-institute format by universities in Virginia, 21 teachers from rural communities were prepared for their placement as math specialists at the beginning of the 2011-12 school year. Last July, after completing their last final exam in mathematics, Pat met with these prospective specialists in Richmond as she distributed their new iPads. While all of the participants knew that they would be expected to record daily activity logs after being placed in a school as a math specialist, they did not know that they would receive iPads in order to do so. Understandably, they were quite pleased. Their data has been streaming in all year, and when the student achievement data from Virginia's state tests arrive in the fall 2012, Pat and Matt will have a lot to keep them busy.

The Center has received National Science Foundation (NSF) funding for the last 10 years to collaborate with other universities to rebuild the nation's research basis and personnel infrastructure for leadership in mathematics education. The mathematics education faculty at the University of Maryland, University of Delaware, and Pennsylvania State University are partners in the Mid-Atlantic Center for Mathematics Teaching and Learning (MAC-MTL). The NSF grant supports an innovative doctoral and postdoctoral program in mathematics education that addresses teacher education, teacher professional development, educational policy and leadership, as well as reform.



Recent graduate Jill N. de Piper with graduate students Hollie Young, Nancy Tseng, Dana Grosser-Clarkson, and Senfeng Liang.

Faculty Focus by Tom Coleman



Lawrence Clark

As an assistant professor, Dr. Lawrence Clark has been very busy this past year! His commitment to examining and exploring issues in mathematics education has been evident in his instructional, advisory, and research participation.

Specifically, he continues to tirelessly investigate the influences on teachers' mathematics instructional practices, particularly in schools with a history of low achievement in mathematics. As Dr. Clark's advisee, student, and research assistant it has been easy to see his passion for the work that he does.

Dr. Clark's commitment to quality mathematics education in urban settings is evident in his acquisition of an NSF grant, which brings the Noyce Scholars program to the University of Maryland. This program prepares and recruits cohorts of talented and diverse UM students to teach middle and high school mathematics in high needs areas through paid tutoring and scholarship opportunities.

As part of his involvement on the QUANT team, Dr. Clark has served as lead author on an article recently submitted to the *Journal for Research in Mathematics Education* regarding teacher beliefs and perceptions and how to model them. He has also provided feedback and advised on other articles pertaining to the QUANT project's preliminary findings pertaining to teacher beliefs and perceptions. Additionally, Dr. Clark published an article in *Urban Education* that examines instructional dilemmas of urban middle school teachers while they integrate technology into their mathematics classroom.

Somehow, he also finds time to provide high-quality instruction in the graduate and undergraduate courses he teaches! As a participant in both I have found myself continually challenged to push my learning forward by Dr. Clark's insights and questions.

The mathematics education community at the University of Maryland, and the mathematics education community at large, is extremely fortunate to have a member who is so passionately and personally dedicated to furthering the field. Personally, I am grateful for the time, effort, and insight Dr. Clark has provided me throughout the year. Thank you!

FACULTY +



Andrew Brantlinger

LISA BOTÉ I spent the past year redesigning our elementary math methods courses around core practices that particularly embrace mathematics as a necessary tool for global competency. As I work to implement this new design, I am also exploring web-based personal learning networks and the use of social media for helping pre-service teachers make professional global connections. The redesign effort has afforded me the opportunity to collaborate with many of our amazing faculty members.

addresses the elusive connections between teachers' mathematical content and pedagogical knowledge and their students' achievement on state mathematics assessments (Grades 4-8).

DANIEL CHAZAN This past year empirical papers from the two large projects I've been working on since coming to Maryland began to come out. With colleagues, I recently published "Is the Doing of Word Problems in School Mathematics Changing? Initial Indications from Teacher Study Groups" in *Cognition and Instruction*, 30(1), 1-38. A special issue "Studying Black Mathematics Teachers in Today's Urban Schools: Integrating Social and Historical Considerations into Examinations of the Teaching of Content" is due out in 2013 as *Teachers College Record*, 115(2). This special issue is grounded in data from two of the six teachers in the MAC-MTL Case Studies project. And, LessonSketch.org continues to develop as a site to support the use of representations of classroom interaction in practice-based teacher education. Finally, the spring involved two honors. I appreciate greatly that my colleagues in CfME proposed me for the College of Education's inaugural Excellence in Mentoring of Faculty award. I am honored to be the first recipient of this award. Finally, in spring 2012, I was promoted to full professor.



Pat Campbell

ANDREW BRANTLINGER I am a principal investigator on the Maryland Science Mathematics Teacher Residency (MSMaRT) Program, a resident teacher program for middle grades teachers in Prince George's County Public Schools. My research interests are in the areas of secondary mathematics education, urban schooling, and the sociology of education.

PAT CAMPBELL My mathematics education research informs efforts to improve the reality of public schooling, particularly within high poverty and high minority schools. I'm currently leading two differing funded projects. One project is investigating the impact of elementary mathematics specialists/coaches on student achievement, and the other



Lawrence Clark

RESEARCH

LAWRENCE CLARK My recent research interests and projects have consisted of developing a framework of mathematics teacher knowledge that incorporates teachers' knowledge of students' experiences inside and outside of the mathematics classroom and the ways these experiences position students to see themselves as competent mathematics learners. I am using data from various research projects (including the Center for Mathematics Education's Quant project and Case Studies project) to build the teacher knowledge framework and develop artifacts of practice that can be used in teacher education and professional development. I am also the PI for the UM Noyce Scholars Program.

ANN EDWARDS My research centers on mathematics teacher practice and professional development in high-needs schools and districts serving diverse student populations. This year, I continue my work with the Case Studies of Urban Algebra Teaching project where I'm completing an analysis, together with several of our students, that uses multiple perspectives on "caring" to examine how three of the teachers in the project support their students to become learners of mathematics. In addition, I have nearly completed two research projects focused on professional practices that impact mathematics instruction and achievement in high-needs middle schools. The first of

these projects examines how data-based decision-making processes impact middle school mathematics teaching and learning with particular focus on how the press for using student achievement data to make instructional decisions impacts teachers' thinking and learning about their students and about mathematics teaching. The second project, conducted in collaboration with Dr. Mega Subramaniam of the iSchool, examines the nature of, conditions for, and constraints upon professional collaborations between middle school math teachers and school media specialists supporting the use of technology in math teaching in diverse classrooms.

BEATRIZ QUINTOS Joining the Center for Mathematics Education has allowed me to learn about the teaching and learning at local schools and imagine new possibilities for the mathematics education of those children who have been historically underserved. One imagined reality was to have a math methods course that focuses on mathematics literacy; a course in which pre-service teachers develop the skills to create environments that involve children as agents of change and critical math world-citizens. Another imagined reality is supporting a cohort of PGCPs teachers to take a professional development course in mathematics education with a focus on equity. I am a co-principal investigator working on elementary STEM education.



Ann Edwards



Beatriz Quintos



Dan Chazan

University of Maryland's Elementary STEM Certification by Amy Green

Speed cameras, satellite imagery, solar panels, wireless internet connections, portable digital music players, artificial hearts, hybrid cars...



We live in an age in which technology has seamlessly saturated virtually all aspects of our daily lives and it has thus become increasingly crucial that our schools prepare all of our children with the technological savvy necessary to function productively in modern society. This means preparing them with the knowledge, skills, and habits of mind essential to not only become democratic citizens able to participate in the technologically-driven decisions that affect their individual lives, but to be able to take part in the innovative workforce necessary for our nation's domestic economic prosperity and competitiveness in the global market.

It is being increasingly recognized that such preparations must be explicitly addressed within the classroom particularly in what has become known as an integrated approach to STEM

(science, technology, engineering, and mathematics) education. As a former elementary school teacher, I strongly feel that progress in the enhancement of STEM education requires not only curricular restructuring but also teacher professional development and this is why I am so excited to be a part of the University of Maryland's Elementary STEM Certification program.

With support from MSDE, faculty across the colleges of Education, Mathematics, Natural Sciences, and the i-School are coming together in an effort to redesign content courses to meet the needs of certified elementary teachers seeking specialization in STEM, as well as to create a new concentration in STEM for pre-service teachers. The program will integrate technology and design principles to create a coherent set of courses that will bridge the content knowledge and pedagogical expertise to create an atmosphere of excellence and equity in the local schools. Furthermore, in order to bridge the world of the University with that of elementary schools, the project's advisory group includes researchers from UM, district leadership, and exceptional STEM teachers from both Prince George's County Public Schools and Montgomery County Public Schools.

The impact technology and innovation is having on modern society means it is becoming increasingly crucial for members of the education community to prioritize STEM education. The University of Maryland is taking up the charge in this effort by expanding and enhancing the pedagogical STEM content knowledge and skills of pre-service and in-service teachers to the benefit of all our students.

Become Prepared for Middle-Grades Teaching by Dan Levin

The State of Maryland now requires certification for middle-grades level teaching (Grades 4-9), and UMD offers unique middle school mathematics and science programs to prepare candidates for this certification. The demand for highly qualified middle school science and mathematics teachers is great, and I'm thrilled to return to Maryland, after a two-year absence, to coordinate these new programs.

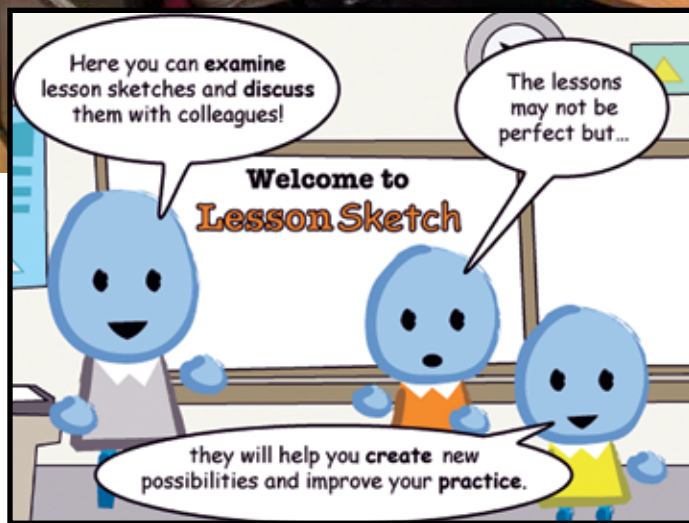
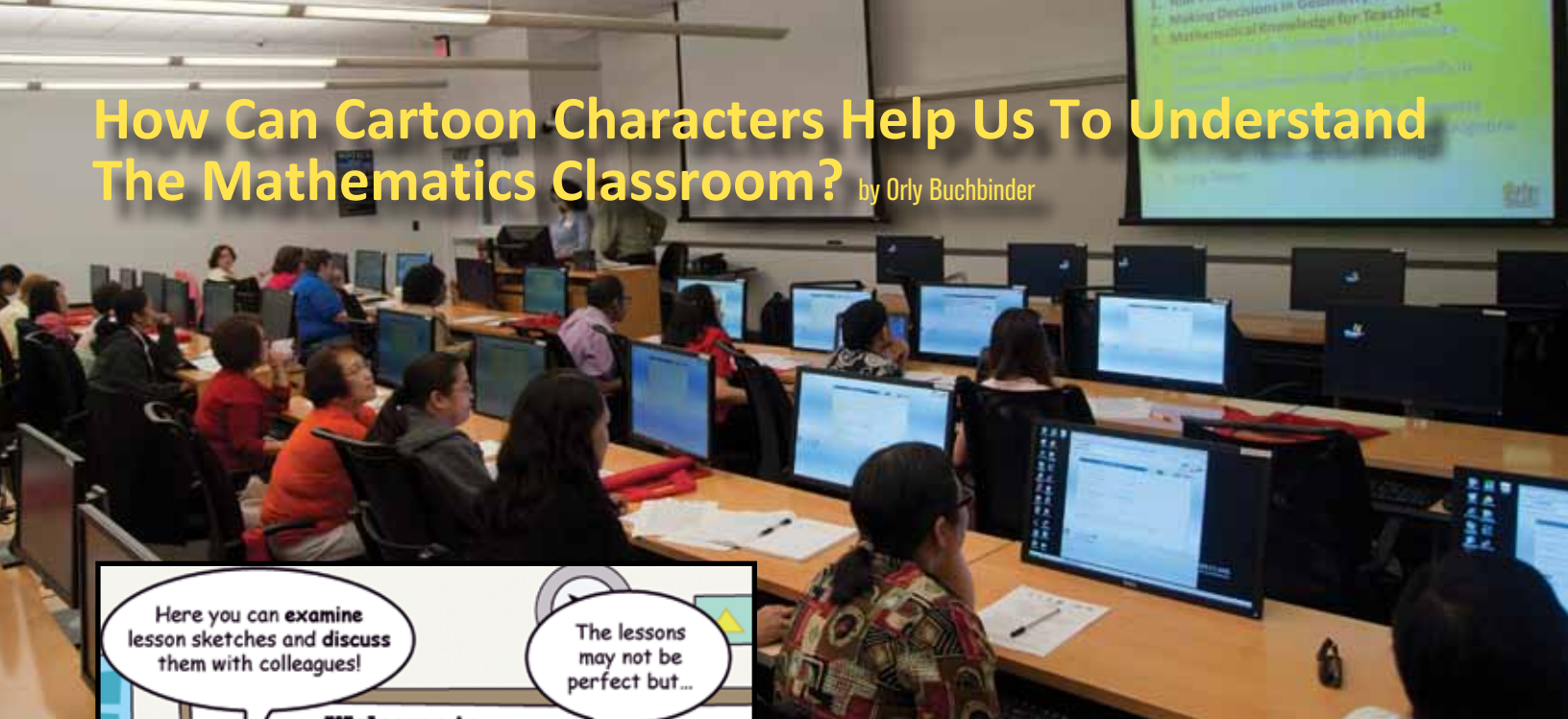
Several years ago, Rick Hollenbeck and I, in collaboration with other faculty and staff in the department, designed an undergraduate major in middle school mathematics and science. This program was approved by the University and by the State, and this year we have our first students (freshman and sophomores) to select this as their major. One novel feature of the middle school major is an early field experience in middle schools during the sophomore year. This field

experience is paired with a new course (EDCI 297), is designed to help pre-service teachers gain insight into the structures of schools, develop awareness of the backgrounds, needs, and expectations of students, and consider ways to make connections with local communities.

In the Master's Certification program (MCERT), candidates with an undergraduate degree can earn a Master's degree and certification in middle school math or science (or both). In both the Master's and undergraduate programs, in addition to courses in mathematics and science teaching methods, candidates take a new year-long methods course, Interdisciplinary Middle School Teaching Methods, designed to help prospective middle school teachers plan for and help their students to engage in learning across traditional disciplinary boundaries.

How Can Cartoon Characters Help Us To Understand The Mathematics Classroom?

by Orly Buchbinder



IT MIGHT APPEAR SURPRISING, but researchers involved in the ThEMaT (Thought Experiments in Mathematics Education) project believe that cartoon characters can be useful in understanding mathematical practices in real classrooms.

The LessonSketch.org website, which was created by the University of Michigan in cooperation with the University of Maryland, is a free on-line environment that uses cartoon representations of interaction between teachers and students in mathematics classrooms. This environment presents unique opportunities for teacher education and for research as well. LessonSketch has a collection of classroom stories, in the form of animations, representing both customary and non-standard teaching. Some animations include several alternative scenarios for the same story, showing how classroom events might unfold depending on different instructional moves by the teacher.

We In addition, LessonSketch has a variety of tools which allow the users to create cartoon slideshow, tailored for specific needs, as well as to pose questions about the slideshows, ask for comments or invite others to compare several possible actions and rank-order them. These features allow for creating a whole experience involving rich media representations of teaching.

This spring, the ThEMaT project team invited over 60 middle and high school teachers from several counties in Maryland to participate in a multi-day event focused on LessonSketch experiences. By interacting with animations and slideshows depicting classroom interactions on LessonSketch, the participants piloted a set of on-line surveys. The project team asked questions like: What do you think of the teacher's actions in these scenarios? What might you have done if you found yourself in his/her shoes?

We were very excited and encouraged by the positive feedback we received from the teachers who took part in the event. We are working now on analyzing the data and hope that the findings will help us better understand how mathematics classrooms operate from the perspective of teachers.





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The MSMaRT Program Continues to Expand and Make a Difference by Brie Walsh



"I was looking for a program that would allow me to make the transition into the classroom easier and sooner than going to traditional school, because I already have two master's degrees. I wanted to teach...because teaching has shaped who we are, and I wouldn't be who I am without teachers."

The Maryland Science and Mathematics Resident Teacher (MSMaRT) Program continues to grow with each passing year. Last year, we worked with Prince George's County Public Schools to prepare 10 teachers for middle school mathematics and science classrooms. This year, we are working to prepare 12 math and science teachers that will make an impact on students in middle school classrooms. The MSMaRT Program recruits individuals with a mathematics or science background who are looking to change careers and make a difference in public school classrooms. Our resident teachers have backgrounds in pharmacy, engineering, finance, and more. Don't listen to me! Just read what one of our candidates said, "I was looking for a program that would allow me to make the transition into the classroom easier and sooner than going to traditional school, because I already have two master's degrees. I wanted to teach...because teaching has shaped who we are, and I wouldn't be who I am without teachers." Currently, the MSMaRT Program is recruiting individuals to be a part of our third cohort, and so far, we are thrilled with the quality and quantity of people who want to become middle school math and science teachers.