

MATH MATTERS

CENTER FOR MATHEMATICS EDUCATION \subseteq COLLEGE OF EDUCATION

A Year of Achievement and Change

The 2011-2012 academic year will bring new opportunities and challenges. The College is undergoing a reorganization of its academic departments. The proposal to reorganize was approved by the University Senate in April and its changes will begin to take effect for the fall. The Center for Mathematics Education will now be housed in the new Department of Teaching, Learning, Policy and Leadership (TLPL), rather than Curriculum and Instruction (EDCI). The new structure will bring faculty in closer contact with colleagues in science education, as well as faculty with expertise in educational policy and the preparation of educational leaders and principals. One of the major goals of this reorganization is to increase opportunities for collaboration and we are looking forward to another productive year!

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.

IT HAS BEEN AN EVENTFUL YEAR FOR THE FACULTY of the Center for Math Education. Associate Professor **Pat Campbell** was awarded the 21st Annual Louise Hay Award by the Association for Women in Mathematics. Congratulations are also due to Assistant Professor **Ann Edwards** and Assistant Professor **Andrew Brantlinger**, who have both been reappointed to their current positions. In addition, Ann received the College's Support Program for Advancing Research and Collaboration (SPARC) grant and was appointed both as a Gates Fellow and Faculty Technology Fellow.



This cohort of Prince George's County teachers graduated in December 2010 with an M.Ed. in Middle School Mathematics Teaching and Learning. This cohort was partially supported by an Improving Teacher Quality grant from the Maryland Higher Education Commission.

In March, Assistant Professor **Lawrence Clark**, with colleagues in the Mathematics Department, submitted an NSF grant for Noyce fellowships for pre-service secondary teacher candidates. We learned this summer that the grant has been awarded! Dr. Clark and colleagues will use the grant funding to support recruitment activities and scholarships for student interested in becoming math teachers in high needs schools. **Lisa Boté** and **Ann Edwards** launched hybrid teacher preparation courses. **Rick Hollenbeck** led the development of the new middle grades science and mathematics UNDERGRADUATE TEACHER education program. **Whitney Johnson** had a key role in MAINTAINING the collaboration between the CfME and the Mathematics Department. We are also excited to welcome three new Fey-Graeber fellows to our program: **Thomas Coleman**, **Dana Grosser-Clarkson**, and **Hollie Young**.

It was also a year of achievement for our students. In 2010, **Steven R. Jones** and **Farhaana Nyamekye** were awarded Ph.Ds. In December, with support from the Maryland Higher Education Commission, and in collaboration with our colleagues in the Mathematics Department, the first Prince George's County Public Schools (PGPGS) cohort of our middle grades mathematics endorsement program graduated. This summer, the first cohort of our U. S. Department of Education-supported Maryland Science Mathematics Resident Teacher Program (MSMaRT) also graduated.

It was also a year of big changes in the world of education! The Common Core State Standards were unveiled. This U.S. education initiative seeks to bring diverse state curricula into alignment with each other by following the principles of standards-based education reform. States and districts are now planning for implementation and the College is preparing to support this effort.

The State of Maryland's Race to the Top (RTTP) application was successful; the College is part of the Partnership for Assessment of Readiness for College and Careers (PARCC) assessment consortium. One unique aspect of Maryland's application was an initiative to create Science, Technology, Engineering, and Mathematics (STEM) endorsements for elementary school teachers. In April, Program Coordinator **Beatriz Quintos** and Associate Professor **Daniel Chazan**, along with colleagues in science education, were awarded a grant from the RTTP competition for creating STEM specializations for elementary school teachers. This initiative will be implemented over the next three years. The first stage will include a seminar on-campus for instructors about visions for STEM education for elementary preservice teachers.

Rebuilding the Nation's Research Basis and Capacity in Mathematics Education

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. At the University of Maryland Center for Mathematics Education, doctoral students and faculty are currently engaged in two MAC-MTL funded research projects detailed below.

The Quantitative Study Project by Toya Jones

After more than a year of data collection, our research team has finally settled into the writing, revising, and disseminating phase of the project. We are working on three drafts for publication. From our preliminary analysis, we have found that upper-elementary (grades 4 and 5) and middle-school (grades 6-8) teachers' pedagogical content knowledge was significantly related to their students' academic achievement. For upper-elementary teachers, content knowledge and their awareness of their students' dispositions towards mathematics were significantly related to student achievement as well. Based on the results of our secondary analyses of teacher knowledge and teacher beliefs, we will re-run our models to include new variables that may help to better explain the relationship between teacher- and school-level characteristics and teachers' mathematical beliefs and knowledge.

These initial findings were presented at annual meetings of the American Educational Research Association and the Research Pre-session of the National Council of Teachers of Mathematics. The discussants and audiences received our findings with interest and found the results intriguing, particularly that teachers' awareness of their students' mathematical dispositions influenced student achievement. We also learned from the work of other research teams exploring similar issues. We have proposed a work session for the upcoming Association of Mathematics Teacher Educators Annual Meeting in January 2012, to further expand our professional development based on our findings. We are looking forward to engaging in some R&R this summer and fall: revising and resubmitting.

The following faculty and fellows are engaged in this work: **Pat Campbell, Lawrence Clark, Masako Nishio, Amber Rust, Darcy Conant, Jill DePiper, Toya Jones** and **Mathew Griffin**. They are joined by **Toni Smith**, an alum of the Center who worked on the project as a graduate fellow and who is now an assistant professor at George Mason University.

For more information, please visit:

www.education.umd.edu/MathEd/qstudy.html

THE CASE STUDIES PROJECT

The main purpose of the project is to analyze and learn from the practices and perspectives of "well respected" teachers of Algebra 1 in urban schools populated predominantly by African American and Latino students. Over a three-year period, the project team conducted nine interviews and approximately 30 classroom observations for each of the six mathematics teachers in the study, all of whom are African American. Based on the results, the team of researchers is currently exploring the use of animated cases as a tool for professional development.

Animated Cases Produced by Case Studies of Urban Algebra I Teachers Project Research Team by Lawrence Clark

The research team of Case Studies of Urban Algebra I Teachers has begun the development and production of a set of animated cases based, in part, on findings from the Case Studies project data. The animated cases are structured to include two key features: **1)** teacher characters are 'interviewed' and discuss their experiences as mathematics learners and their motivations to teach mathematics, **2)** an interaction between teachers and students is presented for the purposes of exploring mathematics



teachers' role in developing their students' dispositions towards mathematics. A narrative case focusing on pedagogical approaches to specific mathematics content is developed to accompany the animated case. The overarching purpose of the four animated cases is to use them as research and professional development resources. It is expected that four animated cases (and four

'linked' narrative cases) will be produced by the summer of 2012. For example, the first animated case, "The Case of Scott Johnston and Vanessa Campbell," depicts two African American high school mathematics teachers telling their personal stories and interacting around the ways 'mathematical ability' messages are sent to their students. Scott is concerned that achievement gap discourse creates perceptions that African American students are less able than White and Asian students. He is determined to address this issue with his students, and to teach that mathematics ability is not 'fixed' from birth or determined by race. Vanessa appreciates his concern, but approaches building confidence in her students' mathematics ability differently.

CfME faculty members Lawrence Clark and Ann Edwards presented "The Case of Scott Johnston and Vanessa Campbell" at the

2011 Annual Meeting of the Association of Mathematics Teacher Educators and the 2011 Research Pre-session of the National Council of Teachers of Mathematics. It is projected that the Case Studies research team will facilitate the first case with small groups of teachers during the summer of 2011, for the purposes of collecting data related to teachers' biography, perceptions, and practice. Stay tuned for the results of their work!

The following faculty and fellows are engaged in the Case Studies Project: **Lawrence Clark, Ann Edwards, Whitney Johnson, Dan Chazan, and Nancy Tseng.**

For more information, please visit:

www.education.umd.edu/MathEd/case.html

Faculty Focus

Patricia Campbell by Jill Neumayer DePiper

And the award winner is... Dr. Patricia Campbell! The Association for Women in Mathematics (AWM) presented the Twenty-First Annual Louise Hay Award to Dr. Patricia Campbell to honor her outstanding achievements in the area of mathematics education. In her letter of support for Dr. Campbell's nomination, Dr. Andrea Bowden, Supervisor of Science, Mathematics, and Health Education for the Baltimore City School System wrote, "It is difficult to capture the magnitude and to do justice to Dr. Campbell's incredible devotion of time, energy, expertise, and commitment." As a student of Dr. Campbell, I could not agree more.

Dr. Campbell is known as a leader in the mathematics community for her commitment to urban schools and her reform efforts in underserved schools. Specifically, she has been engaged in large-scale systematic efforts of school-wide mathematics reform to increase student academic achievement in these schools. She has received grants from the National Science Foundation, supporting these goals as well as her current research studying the relationship between teacher knowledge, beliefs, and characteristics and student achievement.

As her student, I have had the pleasure of taking Dr. Campbell's course on policy, professional development, and teacher preparation where she shared these experiences and her knowledge about system-wide reform and teacher knowledge. As a member of the QUANT project, I have gained valuable insights into the design, implementation, analysis, and writing aspects of large-scale research. Dr. Campbell goes above and beyond in supporting her students' work and their own research; she keeps an open door (until late at night) and is always available to her students. Her help during my comprehensive exams and the writing stages of my dissertation has been invaluable. Dr. Campbell, your students and colleagues, the teachers and

researchers, are grateful for your commitment to mathematics education, both through your own work and the many personal ways in which you support us. Congratulations!

Richard Hollenbeck by Beatriz Quintos

Could a Center for Math Education dream of having an outstanding middle school teacher of the year, who is also a reflective teacher educator, a supportive colleague, and a joyful person? Well, the CfME does in fact have such a person! For the past two years, Richard Hollenbeck has been part of the CfME faculty. His fascinating dissertation was a self-study exploring some of the practical challenges that teachers face when promoting multiple solutions in the mathematics classroom, and considering how teachers might address these challenges.

As part of the faculty, he has been a key participant in the preparation and professional development of secondary mathematics teachers, as well as in the development of the new middle grades science and mathematics education program. His goal to bridge the world between the university and public schools permeates his work and efforts. When asked about his work, Dr. Hollenbeck said, "I am grateful for the opportunity I've had to reflect on the craft and complexity of teaching mathematics and to seriously think about the specific practices of skillful teachers. I hope I will be a much better math teacher when I return to the classroom." Dr. Hollenbeck connected his experience as a teacher with pre-service teachers' preparation. He believes teaching middle and high school students to become problem solvers and "doers" of mathematics is similar to his work with pre-service teachers. He supports their engagement in the practice of teaching, instead of just reading and reflecting. He hopes practitioners will embrace the vision for mathematics learning and teaching that mathematics educators write about and show how the constraints of the classroom and school curriculum can be managed.

Dr. Hollenbeck, your gifted work and vision shapes our Center. Thanks for sharing your skills and talents with us!

FACULTY +



Andrew Brantlinger



Pat Campbell



Lawrence Clark



Ann Edwards

LISA BOTÉ I continue to focus on math education courses in the capacity of mathematics in assuring the healthy and whole development of all children so they have the intellect and resilience to (a) understand a rapidly changing world and (b) to sustain or change their place in the world. I am currently experimenting with digital storytelling in teacher education as a method of professional discovery. In addition, I am exploring user-generated content through social media and its impact on public perception of issues in education.

ANDREW BRANTLINGER I joined the faculty in Fall of 2008. 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 I undertake mathematics education research that informs efforts to improve the reality of public schooling, particularly within high poverty and high minority schools. I am currently leading two different funded projects. One project is investigating the impact of elementary mathematics specialists/coaches on student achievement, and the other addresses the elusive connections between teachers' mathematical content and pedagogical knowledge and their students' achievement on state mathematics assessments (Grades 4-8).

DANIEL CHAZAN I've been exploring how we represent teaching so that we can study it and teach people to do it. The Thought Experiments in Mathematics Teaching (ThEMaT) project has made animations of classroom interaction. In March, the project launched LessonSketch.org. This site allows teacher educators to prepare experiences involving rich media artifacts (like the ThEMaT animations) with pre-service candidates. This software will be developed over the next two years. To explore the use of this on-line environment, with Rick Hollenbeck and Hagit Sela, we have also started Animated Representations of Teaching in Mathematics Education group. This group of mathematics teacher educators and professional developers in the mid-Atlantic region will work together to explore new technologies for preparing mathematics teachers.

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 Quantitative Study 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.

ANN EDWARDS This year I began two new research projects focused on middle school mathematics teaching. The first, funded by the College of Education, Support Program for Advancing Research and Collaboration (SPARC), is a study of how math teachers, school leadership, and district personnel

RESEARCH

use student data to make decisions that shape mathematics instruction in several high needs middle schools. Together with Sam Reheard, a doctoral student in Mathematics Education, and mentored by Dr. Betty Malen in Education Policy and Leadership, we examine what I call “stakeholders’ data utilization processes” and what they may be learning about math learning and teaching that can improve outcomes for students in high needs schools. My other new project, funded by the NSF-supported ADVANCE initiative at UMD, is a collaboration with Dr. Mega Subramanian, an assistant professor in the iSchool. We are looking at whether and how math teachers and school media specialists/librarians in high needs middle schools collaborate to support the effective use of technology in mathematics instruction. I also continue to work with Dr. Lawrence Clark and others on the Case Studies Project on the development and use of artifacts of practice in teacher education and professional development focused on issues surrounding teaching mathematics in urban contexts.

RICK HOLLENBECK Since joining the CFME in 2008, I have become interested in identifying key practices central to teaching secondary mathematics and studying the challenges of implementing standards-based mathematics instruction in middle school classes with a history of low academic performance. Prior to joining the CFME, I taught high school and middle school mathematics. I am interested in returning to secondary mathematics teaching, while maintaining my responsibilities of training pre-service mathematics teachers.

WHITNEY JOHNSON I joined the faculty in Fall of 2008. My research interests are in the areas of secondary mathematics education, urban schooling, and the role that race plays in the teaching and learning of mathematics for Black teachers and students. Prior to joining the faculty at the University of Maryland I was a post-doctoral research associate and directed the “Case Studies of Well-respected Urban Algebra I Teachers” project for the Mid-Atlantic Center for Mathematics Teaching and Learning and worked on another research project entitled, “Thought Experiments in Mathematics Teaching” (ThEMaT). I also directed the “Teaching Data Analysis in a High Stakes Context” project during this time. Prior to coming to Maryland, I was an assistant professor at Albion College in Albion, MI for three years.

BEATRIZ QUINTOS This year has been full of rewarding professional experiences. I was able to witness the first PGCPs cohort graduate from our M.Ed. in Teaching and Learning Middle School Mathematics, as well as the launch of a new cohort with the funds from the Improving Teacher Quality grant from MSDE. As the coordinator of this program, I meet committed and critical teachers from some of our local school districts and work with amazing instructors like Whitney Johnson, Rick Hollenbeck, and Karen McLaren. This year, I also had the great opportunity of co-teaching the Elementary Mathematics Methods course with Dr. Paula Maccini, and then co-teaching a parallel course in the Department of Special Education with Dr. Maccini and Tricia Strickland. Not only did we have a wonderful time co-teaching, but we challenged each other and questioned our own beliefs. This experience added to my vision of creating school environments in which teachers and children become caring world-minded citizens.



Rick Hollenbeck



Beatriz Quintos



Dan Chazan



Whitney Johnson

ALUMNI | PLAYING A KEY ROLE AT THE NATIONAL LEVEL

Changing the Equation to Improve Math and Science Learning by Dr. Linda R. Rosen

In 2010, President Obama launched his “*Educate to Innovate*” campaign that aims to improve the participation and performance of America’s students in science, technology, engineering, and mathematics (STEM). Last summer, Change the Equation (CTEq) was launched to answer the president’s call to action. CTEq strives to be the conscience of a national movement to improve STEM learning for every child. In July 2010, I became its first Chief Executive Officer.

Leading a startup national coalition is akin to flying a 747, as you’re building the jet. But a very rewarding aspect of this job is arming policymakers with the data they need to maintain high standards for all students in STEM.

Last month, CTEq released the first set of “Vital Signs” reports that assess the condition of STEM learning in each state and Washington, D.C.

I joined a panel of business, government, and education experts in Washington to discuss the need for states to set a higher bar when measuring student proficiency in STEM subjects. I also advocated for the need for more data on where each state and the District has made gains, where it has work to do, and what it can do to prepare more of its students for life and work in the coming decades. CTEq has already begun work in this area.

Our innovation economy depends upon our ability to produce students with deep content knowledge in and a love for STEM. I’m proud to be leading a national coalition that is committed to transforming STEM learning.

Using Animated Representations of Teaching in Mathematics Education (ART-iME) by Hagit Sela



Have you ever thought of using animations in your teaching? I mean serious and academic animations, not Tom and Jerry. We have. The **ThEMaT (Thoughts Experiments in Mathemat5cs Teaching) project** has created animations that represent classroom interactions in Algebra 1 and Geometry.

A major affordance of animations is their capability to represent alternative teaching moves stemming from a given situation. For example, students come up with four different answers to a mathematics problem; how should the teacher react? Should all the solution methods be addressed in class? Should class time be devoted to learning the correct answer only? And how does this decision affect student learning and motivation?

The animations can help teachers and pre-service teachers to reason about the complexities of teaching. By representing each alternative as an animated scenario, participants discuss merits and limitations of different teaching moves and provide justifications for tactical and strategic decisions teachers make.

We are now interested in what teacher educators think about the opportunities that animations open for them. We convened a working group of 12 local teacher educators to talk about mathematics education, representations of teaching and use of animations. Our first meeting was in February 2011; we are enthusiastic and look forward to our next meetings.





No, we haven't bought ourselves a fleet of new Priuses (though that's not a bad idea), but we are exploring new technological territory in other important ways. This year, Dr. Ann Edwards and Dr. Lisa Boté began to 'hybridize' some of their teacher education courses. Hybrid or blended learning—educational experiences that blend face-to-face learning interactions with online activities employing various web-based technologies—has become a popular way for students, both local and global, to pursue undergraduate and graduate level education. And, for the educator, the ever-expanding and diversifying world of web-based educational technologies makes developing innovative and effective learning experiences for students an exciting, if sometimes daunting, adventure. Drs. Edwards and Boté have focused on two courses—**EDCI 653: Problem-Solving and Innovative Thinking in the Mathematics Classroom** and **EDCI 652: Teaching and Learning Mathematics in the Elementary School**—to explore the redesign of their courses to take advantage of new technologies.

EDCI 653 and EDCI 652 were conducted about 60% time face-to-face and 40% time online. In each of the independently developed courses, the online component involved asynchronous activities involving small groups or individual students. For example in one strand of activities for EDCI 653, Lisa had students engaging in NCTM e-seminars, watching TED conference videos, and listening to podcasts about issues in STEM education. She

had students utilize forums like blogs and online discussion boards to share their reactions and discuss the connections they were making to their own schools and classroom practice. In EDCI 652, the online component was often used to bridge students' field placements and topics in the course. For example, Ann's students conducted extensive field-based assignments involving interviews and observations with students, teachers and other school personnel to investigate a variety of different issues impacting elementary mathematics teaching, such as different ways of assessment of students' mathematical thinking and participation, immigration and English Language Learners, testing and accountability, and notions of mathematics ability and effort. They shared what they learned in small group blogs and discussion board forums, including videos and other artifacts from the field.

While sometimes challenging, these experiences showed us what was possible in a blended learning experience. In the future, we hope to further develop our ideas for meaningful and effective blended courses. For example, Lisa is thinking about ways to build on her experiences using digital storytelling as a reflection and motivational tool for professional goal setting and marked growth. Ann is working with the Expanding the Toolkit Faculty Technology Program in the College to develop ways for pre-service teachers to share and collaboratively inquire their own teaching using video and online technologies.



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MsMaRT Maryland Science Mathematics Resident Teacher Program by Brie Walsh



Have you thought about becoming a teacher but are currently working in another career? Do you like working with adolescents? Do you enjoy mathematics and/or science? If you answered

yes to any of these questions, then there is a program for you! The Maryland Science and Mathematics Resident Teacher (MSMaRT) Program is an alternative teacher preparation program that certifies recent college graduates and career changers to teach middle school math and science in Prince George's County Public Schools (PGCPS).

We are proud to be the first alternative preparation program for middle school math and science teachers in the state of Maryland.

The MSMaRT Program is 14-months long and is a combination of rigorous academic study and teaching internship. The program allows you to teach part time in PGCPS and earn a halftime teacher's salary with benefits, while you also take courses with knowledgeable university professors, such as Dr. Andrew Brantlinger (MSMaRT PI), Dr. Lawrence Clark (co-PI), and Dr. Maria Hyler.

The MSMaRT Program is preparing to graduate its first cohort of 10 students. Our second cohort began their summer coursework in June. We have doubled our size and are expecting about 20 candidates this year!

The MSMaRT program is pleased to welcome Brie Walsh, a doctoral student in Department of Curriculum and Instruction, as the new Program Director. We thank the entire MSMaRT staff for the continued growth of our program.