

MATH MATTERS

CENTER FOR MATHEMATICS EDUCATION + COLLEGE OF EDUCATION



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 UNITED STATES has urgent needs for more well-qualified mathematics teachers for elementary, middle, and high schools; math teacher educators for universities and residency programs; and math education researchers. Faculty at the Center for Mathematics Education work tirelessly with colleagues at the University of Maryland and other institutions across the nation to meet these needs. We've collaborated with colleagues at the University of Delaware and The Pennsylvania State University on doctoral education. And we are members of 100Kin10, a network of top academic institutions, nonprofits, foundations, companies, and government agencies which aims to train and retain 100,000 STEM teachers by the year 2021.

In 2014-15, 53 students enrolled in Terrapin Teachers, our replication of the UTeach program developed at the University of Texas under the leadership of Dr. Mary Ann Rankin, now our provost here at Maryland. A collaborative effort of the College of Computer, Mathematical, and Natural Sciences and the College of Education to recruit undergraduates into teaching in STEM fields, Terrapin Teachers is supported with funding from the National Mathematics and Science Initiative and the Howard Hughes Medical Institute. Central to Terrapin Teachers' efforts are TLPL 101 and 102, courses which offer undergrads academic credits for developing and teaching inquiry-based math and science lessons in elementary and middle school classrooms in Prince George's County Public Schools.

The program's initial results are promising. Almost sixty students are enrolled for fall 2015. While not every undergrad enrolled in TLPL 101 will become a secondary teacher in the long term, we nonetheless hope to grow the program's capacity in order to certify 40 undergraduates in mathematics and science every year. Meeting this goal will mean that, in combination with our programs for middle grades education, the University of Maryland will recommend 100 secondary STEM teachers for certification every year. These graduates will play an important role in meeting the need for highly qualified STEM teachers in Maryland's schools.

Daniel Chazan, Ed.D.
Director, Center for Mathematics Education

Every Child Deserves a Champion! by Tina Ramirez



IN AN INSPIRATIONAL TED TALK, educator Rita Pierson extols the power of teacher-student relationships: **“Every child deserves a champion – an adult who will never give up on them, who understands the power of connection and insists that they become the best they can possibly be.”**

During my student teaching internship, I had the privilege to work with a student who greatly impacted my life. I will call him Adam. Adam was on the verge of failing out of the talented and gifted program. On paper Adam seemed unintelligent, but he was really a very bright student. He always made great contributions to class discussions, but it was easy for him to fail because he lacked motivation. I don’t think Adam understood why he was attending school.

I was drawn to Adam because I saw myself in him. I saw a student who both feared school and saw it as an academic penitentiary – a place where I wasn’t comfortable, where I didn’t thrive. As a middle school student, I constantly felt like I was fighting an uphill battle. Even setting goals for myself was an extremely difficult task because I was afraid of failure.

After this realization, I said to Adam, “I know you are smart, and I know you can do better than this. So what can I do to make you feel more a part of this class?” I saw Adam’s potential and did not want him to give up. But what was more important was that he needed to see it himself. My colleagues and I did many things to help Adam, but above all else, I tried to acknowledge his potential and the importance of his role in my classroom.

I am not sure whether I made an impact on Adam’s life. But I still believe that building trust and making connections is integral to ensure the success of students in and out of the classroom. The College of Education imparted this belief to me, the same one Rita Pierson espouses. Every child deserves a champion.

In my time at Maryland, I met future educators with an ardent love for teaching. Their passion will inspire students to fulfill their potential and change the world. As teachers, we strive to transform our students into independent thinkers, to show them how to challenge ideas, and most importantly to build their self-confidence. That’s how we become champions for our students.

Christina Ramirez de Arellano (B.S. Middle School Mathematics and Science '14) teaches science at Forest Oak Middle School in the Montgomery County Public Schools.

Lenses for Examining Students’ Mathematical Thinking



“Making sense of student thinking” is a notion frequently touted in both teacher education and professional development, but often without much guidance about how to do it. Turning this abstraction into manageable, concrete pedagogy is the challenge taken up in “Lenses for Examining Students’ Mathematical Thinking,” co-authored by Dr. Janet Walkoe for the Connecting Research to Teaching section

of the September 2014 *Mathematics Teacher*, published by the National Council of Teachers of Mathematics.

Working from a qualitative analysis of discussions in a video club, in which math teachers watch videos of their own classes, Dr. Walkoe and her colleagues identify three lenses for unpacking students’ mathematical thinking: taking an initial look at students’ responses, going deeper into the sources of student thinking, and looking across the many ideas expressed by students in order to find connections.

According to the article, “taking an initial look” involves exploring the specifics of what a student may or may not understand. Teachers can do this by asking a few questions. What is the student’s idea? What misunderstanding does the

student exhibit? What is reasonable about this idea? Crucial to this stage is the recognition that correct thinking can crop up in the middle of a response that is incorrect at face value – and the teacher can potentially use it to steer a lesson.

Once teachers know what a student seems to be saying and seems to understand, they might pursue the potential origins of the student’s idea – “going deeper.” *Where did the idea come from?* Figuring out what prompted a student to think in a particular way is often an important step in reformulating the student’s thinking. And teachers can also find it useful to question their own assumptions about what a student says and consider alternative interpretations. *Is there more than one way to understand what the student is saying?*

“Looking across” describes the practice of drawing connections between an idea and other ideas, whether expressed by other students or the same student. How does this idea compare with others? How might this student respond to another problem? Such analysis can give teachers additional insights into how their students think and help them ask effective, probing questions during instruction.

Dr. Walkoe and her co-authors recommend these lenses for various professional development settings and note the success teachers often have as they adopt them in the classroom.

TERRAPIN TEACHERS: An Innovation in STEM Teacher Preparation



SUPPORTED BY THE National Mathematics and Science Initiative, Terrapin Teachers is an innovative undergraduate academic program at UMD for secondary STEM teacher preparation, undertaken through collaboration between the College of Education and the College of Computer, Mathematical, and Natural Sciences. Intended to increase the number of highly skilled secondary STEM teachers, the program provides STEM majors with the opportunity to add teaching to their career options, while preparing them to teach math and science effectively with inquiry- and project-based instruction. Through Terrapin Teachers, these students receive both a degree in their STEM discipline and eligibility for teacher certification.

One of the finest benefits of the program is that undergrads get to experience the excitement of teaching in a classroom during their very first course, TLPL 101, Inquiry Approaches to Teaching, which emphasizes inquiry-based instruction. During the 2014-2015 academic year, TLPL 101 students prepared and taught a total of four science and math lessons at Hyattsville Elementary School, Cool Spring

Elementary School in Adelphi, and Paint Branch Elementary School in College Park. Developed with guidance from UMD master teachers Dr. Catherine VanNetta (Ph.D. Mathematics Curriculum and Instruction '00) and Dr. Anita Sanyal (Ph.D. International Education Policy '09) as well as mentor teachers from the elementary schools, some of the lessons included "The Golden Ratio," "Sounds and Vibrations," "Seasons," and "The Wind Turbine Engineering Challenge." "Fieldwork distinguishes this class from other education courses by allowing hands-on experience with students in a real classroom," says biology major Maddie Kutzera said of her Terrapin Teachers course.

"We spent many classes analyzing student responses and teacher effectiveness," says sophomore Neha Gupta, who took TLPL 101 in spring 2015. "It's easy to hear a student's response and, through a discussion, conclude what he may have meant; it's just as easy to watch someone else teach and criticize them, saying you would respond differently in their position. However, standing in front of thirty students staring at you and waiting for your response is much harder. You lose the safety of time; everything you do is on your feet. Through this course, I learned to always be prepared, be comfortable speaking, and, most importantly, be okay with not finishing a lesson."

The second course in the Terrapin Teachers sequence, TLPL 102, began in spring 2015. Undergrads interviewed a middle school student about a science or math concept, then used what they learned to plan and conduct inquiry-based lessons for students at Hyattsville Middle School and College Park Academy.

To learn more about Terrapin Teachers, visit the program's website, tt.umd.edu, or contact the program's associate director, Dr. Anisha Campbell, either by phone at 301-405-0094 or by email at tt@umd.edu.

BY THE NUMBERS

Since 2001, the University of Maryland has recommended **232** mathematics teachers for grades 7-12 certification.

Since 2008, the University of Maryland has recommended **212** STEM teachers for grades 4-9 certification.

In 2001-03, we recommended an average of **25** STEM teachers; in 2013-15, we recommended an average of **63**.

Since 2003, CfME faculty members have directed the dissertations of **31** doctoral graduates. We've graduated an average of just over **2.5** doctoral students per year!

Since 2003, **2** of our doctoral students were Fey-Graeber Fellows and **19** were MACMTL Fellows. **11** more Fey-Graeber Fellows are now in-progress.



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Engaging English Language Learners in Mathematical Discourse



Rodrigo Gutiérrez and Halla Jmourko

DURING THE 2014-15 SCHOOL YEAR, Prince George's County Public Schools math and ESOL teachers met for a focus group led by a dynamic pair of experts, PGCPs ESOL coach Halla Jmourko and UMD Clinical Assistant Professor Rodrigo Gutiérrez. Addressing one of the county's greatest needs – math education for English language learners – this professional development workshop provided twenty-five teachers with seven full-day sessions to expand their capacity for promoting both mathematical and linguistic development.

Mornings filled with hands-on activities, relevant resources, classroom videos, and student work samples engaged teachers in lively discussions about the challenges and great opportunities of teaching mathematics to English learners. Teachers examined

Maryland's WIDA Standards for Language Development, integrating them with the Common Core State Standards for Mathematics, and they analyzed their own lessons for linguistic demands and mathematical complexity.

Between sessions, teachers experimented with classroom structures, scaffolds, and supports aimed at engaging English learners of all language proficiency levels in productive mathematics conversations and advancing their language and mathematics skills. Teachers then reported back to the focus group on shifts in their professional thinking and instruction. Rodrigo and Halla supported these teachers through planning sessions, in-class support, videotaping, debriefing lessons, and identifying next steps. Rodrigo and Halla also visited teachers in their classrooms to help them bring the focus group's ideas to life.

At the end of the school year, teams of teachers shared video of their classes' mathematical investigation, "How to Plan a Party." Exemplifying some of the prime skills that make a difference in the practice of teaching – professional collaboration, thorough preparation, risk-taking, and thoughtful reflection – these teachers shared both their challenges and what they learned from implementing some of the strategies discussed by the focus group.

During the 2015-16 school year, the Center for Mathematics Education will build on the success of this focus group. Supported by ELLMath, a new Improving Teacher Quality grant from the Maryland Higher Education Commission, we will offer three graduate courses for 25 elementary teachers in Prince George's County.

