

# WMU Math Education Matters

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## Mathematics Education at WMU

WMU's mission is to be "learner-centered, discovery-driven and globally engaged." For the mathematics education group that isn't just an empty slogan—it reflects how we go about our work.

A core value of our group is involvement with schools. We recognize the need to adapt our instruction to the changing population of students both coming into the university and into our graduates' future classrooms. Although many of us experience schools directly through our own children and volunteer activities, we have also developed research foci that bring us into schools on a regular basis. As a mathematics education community our work is grounded in improving the teaching and learning of mathematics. Since we are continually refining our courses to reflect new understandings, students at all levels are engaged in making sense of significant mathematics. Those in pedagogy courses are also engaged in thinking deliberately about effective ways to teach so that their mathematics students can have that same experience. In this way, being discovery-driven and learner-centered are mutually supportive enterprises in our mathematics education community.

We are also engaged at the global level through participation in outreach and research activities internationally, hosting visiting students from other countries, and networking with the wider international mathematics education community when conducting and disseminating our work.

In this issue you will find several articles related to our commitment to being learner-centered, discovery-driven and globally engaged.



## Dr. Jon Davis Granted Fulbright Scholarship

## Okan Arslan Visits WMU

Have you ever wanted to travel to South Africa? Well, you can follow Dr. Jon Davis "in spirit" as he teaches at Nelson Mandela Metropolitan University in Port Elizabeth, South Africa from January through June 2017 as a Fulbright Scholar. His duties will include teaching mathematics content courses as well as mathematics education courses to prospective secondary teachers.

Although not required to complete research as part of his grant, he will be investigating codeswitching in South African secondary mathematics classrooms. Codeswitching, which pertains to the use of two or more languages during the same conversation, can provide additional complexity to the already challenging task of facilitating productive discussions. He is also interested in the promotion of equity via reform-oriented mathematics teaching practices.

With regard to the global outreach goals of Western Michigan University (WMU), Dr. Davis will also be laying the foundation for a program whereby interested WMU preservice teachers could complete their student internships in public schools in South Africa.

Dr. Davis' wife and daughter will be accompanying him for the duration of the grant. His daughter, Sonata, is interested in attending a school in Port Elizabeth where she can continue her study of French.

Dr. Davis' wife, Lori, is an occupational

therapist who works in pediatrics. She looks forward to volunteering in the public schools in and around Port Elizabeth working with children who have disabilities.



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Okan Arslan is a Ph.D. candidate at Middle East Technical University (METU) in Turkey, working under the supervision of Assoc. Dr. Çiğdem Haser. He received a fellowship from TÜBİTAK, the major funding agency in Turkey, to spend the 2016-17 academic year at WMU working with Dr. Laura Van Zoest on his dissertation research.

Okan's dissertation focuses on case studies of two teachers to explore how early career mathematics teachers develop mathematics teacher identity in communities of practices with different characteristics (aligned with vs. opposed

to the teachers' preparation). While at WMU Okan will also be involved in the MOST project (LeveragingMOSTs.org).

When asked why he chose to come to WMU, Okan replied: "The chief reason behind my choice is being able to work with Dr. Laura Van Zoest, whose article, 'Mathematics Teacher Identity Framework' was beneficial to conceptualizing my dissertation. I also contacted some Turkish graduate students from WMU. They all shared their positive experiences at WMU, supporting my decision."

During his time at WMU, Okan hopes to "... improve myself both academically and socially. I believe that the time that I am going to spend at WMU will contribute to me as an emerging researcher. My work with Dr. Laura Van Zoest on my dissertation and being a part of the MOST project research is a great opportunity for me. Although I have spent a limited time with the group, I am already impressed by their knowledge and expertise. Apart from academic experience, I hope to gain insights about different cultures. Being in the United States will not only help me to experience American culture, but also help me to experience different countries' culture thanks to the multicultural dynamic of the United States."



Calling all former WMU math education students . . .

*Math Education Matters* is interested in featuring your news and recent professional accomplishments in future issues. Brief news items can be sent to Dr. Laura Van Zoest at [laura.vanzoest@wmich.edu](mailto:laura.vanzoest@wmich.edu).

# Internship in Curriculum Design for Future Teacher Educators



We are fortunate to have an undergraduate program for prospective elementary/middle school teachers that includes three mathematics content courses specifically designed for this population. Some of our faculty have been intensively involved in designing the curriculum for these courses and researching their effectiveness. This work requires a long-term circular process of curriculum design, instructor reflection, student assessment, and curriculum alterations.

The first course in our sequence is focused on Number and Operations and the curriculum design has been headed by Dr. Terry Grant for over a decade. This work began as part of the NSF-funded *Understanding Mathematics Deeply for Teaching (UMDT)* project directed by Flowers and Rubenstein (2003 – 2007) at the

University of Michigan-Dearborn. Since that project ended, Dr. Grant has continued to lead a collaborative effort to better understand the struggles of prospective teachers in this area, and to use this knowledge to develop, enact, and revise curriculum materials for this course.

Several of our graduate students in mathematics education are currently enrolled in an internship experience on curriculum research and design. Graduate students attend one section of the class taught by Dr. Grant and participate in weekly instructor meetings to debrief observations, analyze student work, and discuss possible alterations.

This course has proven to be an effective site for encouraging our graduate students to consider the

difficulties faced by prospective teachers (re-)learning this content with meaning. While our graduate students use their knowledge of number and operation in the context of doing other mathematics, they have not typically thought about the meanings that underlie that mathematics nor the justifications for those procedures. As one graduate student explained: *I experienced some dissonance during the first few weeks of observing this class and had to rewire my thinking to come to terms with thinking about the meanings of things I thought I already knew.*

Dr. Grant is presenting on the curriculum research and design of this course at the upcoming annual meeting of the Association of Mathematics Teacher Educators (AMTE) in Orlando, FL. You can contact her at [terry.grant@wmich.edu](mailto:terry.grant@wmich.edu).

## About WMU and Our Programs

Western Michigan University (WMU), located in Southwest Michigan, is a vibrant, nationally recognized student-centered research institution with an enrollment of nearly 25,000. The Carnegie Foundation for the Advancement of Teaching has placed WMU among the 76 public institutions in the nation designated as research universities with high research activities. For more information, see [wmich.edu/about](http://wmich.edu/about).

The Department of Mathematics offers programs in mathematics and mathematics education at the bachelor's, master's, and doctoral levels. Research strengths in math education include curriculum development and implementation, assessment and evaluation, technology, mathematical thinking (children, teachers), and teacher education (preservice, inservice).

Current mathematics education faculty are: Dr. Christine Browning, Dr. Jon Davis, Dr. Theresa Grant, Dr. Ok-Kyeong Kim, Dr. Kate Kline, Dr. Mariana Levin,

Dr. Jane-Jane Lo, Dr. Tabitha Mingus, Dr. Laura Van Zoest, and Dr. Steve Ziebarth. For more information, see [wmich.edu/math](http://wmich.edu/math).

Several teaching assistantships are available for our graduate programs for the upcoming year; the deadline for applications is February 15, 2017. For application procedures, see [wmich.edu/apply/graduate](http://wmich.edu/apply/graduate). Also, feel free to contact Dr. Laura Van Zoest ([laura.vanzoest@wmich.edu](mailto:laura.vanzoest@wmich.edu)) with any questions you might have about our programs.



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# Calculus Initiative

For students pursuing a STEM degree, calculus is a crucial gateway. Unfortunately, over the last decade the national failure rate in calculus has steadily climbed to over 50%. Sadly, these numbers are also the case at WMU and students of color, females and first-generation students bear the brunt of this failure rate. Our team of two mathematicians (Dr. Melinda Koelling and Ms. Daniela Hernandez), a mathematics educator (Dr. Tabitha Young Mingus) and two mathematics graduate students (Matthew Stodola and Jennifer O'Brien) are committed to teaching all sections of first semester calculus for the next three academic years and are participating in two initiatives to improve student success in calculus.

We are participating with The John N. Gardner Institute (JNGI) Gateways to

Completion initiative, which works with undergraduate institutions to improve student success in gateway courses. This has helped our team identify causes for student failure (institutional, programmatic, and classroom) and create a plan to ameliorate those causes.

The team is also participating in the Active Learning in Mathematics Research Area Cluster (ALM RAC) of the Mathematics Teacher Education Partnership (MTEP), an off shoot of the Science and Mathematics Teacher Initiative (SMTI). The ALM RAC focuses on the use of active learning and student-centered pedagogy in the pre-calculus to calculus 2 sequence. WMU is one of 15 universities engaged in the development of curricula and supplemental resources that are



textbook agnostic. The ALM RAC is also developing research instruments for measuring the impact of active learning on student attitudes and beliefs and observation tools and protocols for documenting active learning in the classroom. The WMU team is incorporating student-centered learning activities to increase student engagement and help them learn key concepts.

We are optimistic about these efforts and the increased conversations that have resulted among faculty in the Department. Direct inquiries about this initiative to [tabitha.mingus@wmich.edu](mailto:tabitha.mingus@wmich.edu).



# Research on Children's Thinking

There is no question that it is quite challenging for teachers to engage with children's thinking when they facilitate discussions. It is common practice, for example, to have children share and describe their strategies with their classmates as a way to generate conversation. However, what is challenging during these sharing sessions is to focus on the mathematical structures underlying the strategies and to make connections among them. This may partly be due to the fact that it takes a wealth of knowledge about children's thinking and common misconceptions to facilitate such discussions. It may also be the case that it would be helpful for teachers to have another impetus to push conversations to a deeper level. Perhaps it may be thinking more broadly about how children craft appropriate arguments to express their thinking that would support teachers to facilitate more meaningful conversations.

Based on this premise, Dr. Kate Kline worked on a sabbatical project during this past academic year to study issues related to children's arguments. Many researchers have used Toulmin's (1958/2003) model of argumentation for their analyses. Toulmin suggests that an argument includes a claim, data or facts from which the claim was based, and warrants or justifications for why the data leads to the claim. Researchers have found that if encouraged (and sometimes even if not encouraged) children often make claims in the midst of doing mathematics. These claims may or may not be true, but regardless, can lead to qualitatively different discussions that align with what it means to do mathematics.

Unfortunately, we do not have much information on the types of claims children make in the midst of their work nor how they attempt to justify those claims. Therefore, the first phase of Dr. Kline's research in this area (which took place during her sabbatical) was to collect data on children's claims and justifications. To study this, she worked with several different small groups of children throughout the year in kindergarten, second grade, and fourth grade. Small groups were given tasks related to place value to work on independently or in pairs and then were asked to share their thinking about their solutions. These sessions were videorecorded, transcribed, and analyzed by study group members that included WMU alum Dr. Lisa Kasmer from Grand Valley State University, and WMU undergraduate students Heather Crull, Rachael Carr, Lindsay Genter, and Anika Shane.

Preliminary findings have shown that claims children make, while based on underlying knowledge, have a unique quality separate from the strategies children might use to solve problems. The claims also do seem to provide a different lens into children's thinking. Phase 2 of this study will consider to what extent these claims might allow teachers to not only listen differently during discussions but also facilitate them more productively.

Preliminary findings on children's claims are being disseminated at an upcoming presentation at the annual meeting of the Association of Mathematics Teacher Educators (AMTE) in Orlando, FL. Contact Dr. Kline at [kate.kline@wmich.edu](mailto:kate.kline@wmich.edu) if you have any questions about this study.

# News from Graduates

## Shari Stockero (1997, 2006)



I am an Associate Professor and Director of Teacher Education at Michigan Technological University. My daily work varies widely, from teaching, to research, to overseeing our undergraduate and graduate programs, advising students, and leading our accreditation process. I am also serving as the inaugural president of the Michigan Association of Mathematics Teacher Educators (MI-AMTE). I am currently teaching an online graduate research course for students in our Master's program. I also regularly teach our mathematics methods course, which is my favorite course because it allows me to incorporate my research into my teaching.

My research focuses on supporting teachers to productively use student thinking. I am currently working on two National Science Foundation-funded research projects. The first is a CAREER grant that focuses on understanding how to support preservice mathematics teachers to notice and respond to important student ideas that surface during a lesson. The second is a collaborative project with colleagues at Western Michigan University and Brigham Young University that has focused on characterizing the instances of student thinking that are important for teachers to attend to because they provide high-potential opportunities to support student learning, as well as productive teacher responses to such instances—what we call the teaching practice of building on student thinking. Our recent work with classroom teachers has allowed us to consider how we might support them in developing this practice.

My graduate study at Western Michigan University has shaped both my teaching and my research. I first attended WMU in an National Science Foundation-funded master's program for high school mathematics teachers. This program provided me an opportunity to interact with outstanding mathematics teachers from around the state and was pivotal in helping me rethink and develop my teaching practice. I returned to Western to work on my Ph.D. six years later; this experience allowed me to consider how the practices that I learned as a high school teacher transferred to teacher education, and also set me on the course for my current research. In short, my experiences at WMU laid the foundation for me to become a successful teacher, researcher, and now administrator in teacher education.

## Lisa Kasmer (1987, 2008)



I am an associate professor in the Mathematics Department at Grand Valley State University in Michigan. My primary teaching responsibilities include teaching mathematics courses for our pre-service teachers (Mathematics for Middle School Teachers, Algebra for Elementary Teachers, Senior Capstone). My research at Grand Valley has included textbook and curriculum standards analysis and instructional decisions of pre-service teachers. I am also currently collaborating with Dr. Kate Kline at WMU on her sabbatical research project on children's thinking. Most recently, I along with 3 graduates from the Center for the Study of Mathematics Curriculum (CSMC) (Drs. Shannon Dingman, Travis Olson, and Dawn Teuscher) have received funding from the National Science Foundation to examine the curricular reasoning of middle school mathematics teachers. This is a three-year study where we hope to develop a taxonomy to characterize teachers' curricular reasoning.

In addition to my teaching and research responsibilities, I am the director of Study Abroad: Tanzania, where our pre-service teachers spend one month in Tanzania teaching mathematics in local schools. I also serve as faculty director of WISE (Women in Science and Engineering). This is an academic living-learning community on campus that provides the residents opportunities to interact with STEM faculty, attend seminars and group study sessions, and receive advising pertaining to graduate school and careers in their fields.

Being a part of the CSMC has provided me with a rich foundation and numerous opportunities to network with those in the field, all of which has developed and built my professional work at Grand Valley State University. In addition, the ongoing relationships with mathematics education faculty at WMU have been a wonderful added benefit of being part of such a vibrant mathematics education community.

# New Elementary School Mathematics Major

Anika Shane is a student in the first cohort of our new Elementary School Mathematics major. The major requires additional mathematics content and methods coursework beyond the 4 semesters of content and methods required of all WMU students receiving elementary school teaching certification. The additional coursework includes number systems and proportional reasoning, functions and modeling, and concepts of calculus, as well as teaching middle school mathematics and computing technology. Some courses are taken along with our secondary mathematics teaching minors and majors, providing an opportunity to discuss diverse perspectives on learning and teaching mathematics. Anika relished the chance to choose the elementary mathematics teaching major as soon as it became available even though there was a time when she would have considered math her least favorite subject. She can remember pages



upon pages of homework where she would look through her notes to try to remember rules or equations that her teacher had taught her. She also remembers those “extend your thinking” questions where she felt extremely frustrated and would just give up.

She chose to major in the new elementary mathematics teaching major because she knew that her story was not unique. And now that she has experienced learning mathematics with understanding in the courses she has enrolled in thus far, she recalled these experiences that had frustrated her so much before.

Anika wants to show her future students that math is not about memorizing rules and that mathematics concepts are not out of reach. She is honored to be a part of the first cohort of the Elementary School Mathematics major and is excited about the many contributions she will be able to make as a result of the knowledge she gains from the program. Those teaching Anika in the program are excited to have her in the first cohort and look forward to continued work with her as she grows professionally.

## Upcoming Presentations

### TeMaCC, Ann Arbor, MI, October 2016

**Grant, T.** *Building versus estimating strategies: A framework for approaching computation.*

**Lo, J. & Cox, D.** *What’s so hard about 3-D composite shapes?*

### PME-NA, Tucson, AZ, November 2016

Campbell, M.P., Selling, S.K., and others, including **Van Zoest, L.R.** *Designing and researching pedagogies of rehearsal and enactment for secondary mathematics teacher development.*

**Ochieng, M.** *Elementary preservice teachers’ perceptions of experiencing a reform-based number concepts course.*

**Van Zoest, L.R.,** Peterson, B.E., Leatham, K.R., & Stockero, S.L., *Conceptualizing the teaching practice of building on student mathematical thinking.*

### Interregional Conference on Science and Mathematics Education, Beirut, Lebanon, November 2016

**Levin, M. & Levrini, O.** *Reconstructing the content and teaching materials in secondary courses to problematize the image of STEM fields as exclusive clubs.*

### AMTE, Orlando, FL, February 2017

**Browning, C.,** Crespo, S., & Bieda, K. *Writing a successful MTE manuscript: Connecting practice, innovation and systemic inquiry.*

**Grant, T. & Levin, M.** *Expanding and extending debate without getting personal: Exploring a framework for engaging with incorrect thinking.*

**Kline, K. & Kasmer, L.** *Using children’s authentic claims to consider the role of argument in the classroom.*

**Ochieng, M.** *Bellringers in methods course: A tool for developing instructional practice.*

Stockero, S.L., **Van Zoest, L.R.,** Leatham, K.R., & Peterson, B.E. *Barriers to building on student mathematical thinking.*

van Es, B., Stockero, S.L., Dyer, E., & **Van Zoest, L.R.** *Intentional use of video for teacher education.*