

# Math Education Matters

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## Our Reach

With all our programs, we strive to provide opportunities for our students to experience various aspects of the profession of mathematics education. For example, last fall we took a group of nine graduate students (pictured above) to the PME-NA conference. We also consider ourselves to be learners no matter how long we have been in the profession. In this issue of Math Education Matters, we learn of the ways current and former members of our mathematics education community continue to do the work of our profession.

In this issue, you will read about two current graduate students and their decisions to return to their homes in Kenya and Saudi Arabia during summer breaks to share with teachers and colleagues what they have learned in their graduate program at WMU. You will also learn about two WMU alums who have taken on important leadership roles to support other mathematics teachers in their efforts to improve mathematics teaching in our schools.

We are honored by the work that they and others do as they reach to other communities around the world. This is another confirmation that math education matters at WMU.

# Graduate Student Research Apprenticeships

## Sand Box of Learning by Christine Browning

Exploring how the use of digital tools can help engage and empower prospective teachers in the teaching and learning of mathematics and statistics has always fascinated me. I have been fortunate to find many graduate students who have similar interests and have been willing to “play in my sand box” of exploring ways to use digital tools to their best advantage. By digital tools, I mean any computerized device or application that I can use in the teaching and learning of mathematics. We still continue to use other non-computerized tools as well, but I focus my research on digital tools, such as Tinkerplots (a dynamic statistics software package); the google suite apps of apps, including google drive, documents, hangouts, sheets, forms; interactive white boards; Livescribe pen; Voicethread; and wikispaces.

Currently I am working with two mathematics education graduate students in our department, Omar Ghalyoun and Yaomingxin Lu, as I teach a probability and statistics course designed for prospective elementary/middle school teachers of mathematics. Omar has been studying the informal inferential reasoning of prospective teachers and how their understanding of both experimental and theoretical probability can be further developed in this reasoning. Yao is examining prospective teachers’ understanding of variability by unpacking this understanding with a structure of observed learning outcomes (SOLO) taxonomy.

We have received funding from the Mathematics Department to support this work, which has included travel support for students to share their findings at conferences such as AERA, AMTE, NCTM and PME-NA, as well as to begin networking with those who share common research interests. My hope is that these initial small explorations “in the sand box” will lay the groundwork for their future academic careers.

Please contact us if you are interested in discussing this work:

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## Mock Symposia by Laura Van Zoest



A long-standing tradition in our department is to conclude the graduate mathematics education research course with public research symposia. Students who have completed a pilot study for their dissertation present their own work; others take on the identify of a researcher who shares their interests and present that researcher’s work. Following the AERA model, small groups of students prepare a symposium proposal, write individual papers, and work together to coalesce their individual presentations into a symposium. This year our mini-conference had three symposia:

*Supporting Preservice Teachers’ Pedagogical Learning,*

*Improving Preservice and Inservice Teachers’ Mathematical Content Knowledge, and*

*The What and How of Powerful Mathematics Classrooms.*

We were very pleased to have Dr. Chris Hirsch return from retirement to join current faculty Dr. Terry Grant and Dr. Mari Levin as discussants. Not only does the mock research symposia provide students with the opportunity to engage in important professional practices, it is a fun community event!

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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 [math-ed@wmich.edu](mailto:math-ed@wmich.edu)

# Faculty Sabbaticals

## A Year of Reflection on Teaching with Technology by Jane-Jane Lo



When I go on sabbatical, I like to start by reflecting on work I have been doing and by finding ways to push beyond my own thinking by traveling to other places and visiting with other mathematics educators. Last year I spent my sabbatical doing exactly this.

For the past few years I have been exploring the use of technology to support prospective elementary teachers in their geometry and measurement course. I began my sabbatical by reflecting on these experiences and compiling the results of this reflection in a book chapter that will soon be available in *Research advances in the mathematical education of pre-service elementary teachers – An international perspective* edited by G. J. Stylianides and K. Hino. I also shared my thoughts with colleagues at colloquium talks at Portland State University and Washington State University in Vancouver.

To move beyond my own thinking, I enrolled in a professional development course, “Teaching Mathematics with Technology,” offered by the Friday Institute for Educational Innovation at North Carolina State University (<https://place.fi.ncsu.edu>). I learned more about the affordances of technology for learning mathematics and various ways to capitalize upon these affordances in selecting rich mathematical tasks to support students’ learning through technology. More specifically, it gave me valuable first-hand experience on how one can learn from an online environment; information that I now use in designing my own courses.

After expanding my thinking about the use of technology in this way, I conducted a research study examining the effects of GeoGebra apps on students’ understanding of several measurement concepts, including the formula for finding area of the circle. The participants of this study included pre-service teachers as well as middle grade students from both the U.S. and Taiwan. I was able to

do a preliminary analyses of the data, which highlighted the importance of “slowing down” and “highlighting” when interacting with the technology.

Finally, I also travelled to my home country of Taiwan, where I visited elementary classrooms that used technology as an integral part of mathematics instruction. The most impressive observation I made was with a 6<sup>th</sup> grade classroom where they used a learning platform called Junyi Academy (<https://www.junyiacademy.org>), the Chinese counterpart of the Khan Academy. Students all had Ipads that they could use to access a personalized study plan set up by their teacher. The teacher commented that one big advantage of using Junyi was the ability to keep track of student progress both by observing her students directly and by logging into the teacher account to see what students were working on at that particular moment and to determine their performance on various tasks up to that point. This information allowed the teacher to provide more timely assistance to those students who needed additional support. However, she also admitted that there was a constant tension to balance individual learning needs with time for whole class discussion to encourage collaborative learning.

As you can tell, my sabbatical was full of learning opportunities that resulted in both new knowledge and new questions for the future. If you would like more information on this work, please contact me at [jane-jane.lo@wmich.edu](mailto:jane-jane.lo@wmich.edu).



## Six Years of Curriculum Analysis by Ok-Kyeong Kim

Curriculum analysis has been an important area of research from both practical and theoretical perspectives. I have been conducting research on teachers’ curriculum use and as part of my research have analyzed a range of elementary mathematics curriculum programs. Understanding the nature of various components of curriculum resources is a necessary step in examining how teachers use them. Over the past six years in the *Improving Curriculum Use for*

*Better Teaching* (ICUBiT) project, I have collaborated with a team of researchers—including WMU doctoral students—to develop an extensive coding protocol for analyzing elementary curriculum programs, which has been used thus far on the following: *Everyday Mathematics*, *Investigations in Number, Data, and Space*, *Math Trailblazers*, *Math in Focus*, and *Scott Foresman-Addison Wesley Mathematics*. We have begun work on a book, titled “*Comparing Elementary Mathematics Curriculum Materials: Implications for Teachers and Teaching*,” as part of the *Research in Mathematics Education* monograph series, to disseminate the findings from this analysis. I look forward to completing this book during my Spring 2018 sabbatical. The book will present the analysis of the five programs in regards to the mathematics content, the pedagogical approaches used, and the ways in which the authors communicate with teachers. What is exciting about this work is the implications it has for teaching, based on the complexity and role of curriculum materials examined, and how curriculum authors can better support teachers in effectively enacting curriculum programs.

If you are interested in discussing this work further, please contact: [ok-kyeong.kim@wmich.edu](mailto:ok-kyeong.kim@wmich.edu)

# International Outreach: Doctoral Students Give Back

## Paying it Forward in Saudi Arabia by Mona Aladil

When I was a teacher in Saudi Arabia, I began to realize that studying teaching would be a productive and useful way to improve programs for preparing preservice teachers in my country. This led me to consider graduate school in the U.S. and I eventually chose to come to WMU to pursue a doctorate in mathematics education. One of the main questions I had upon entering the program was: *What do teachers need to know to enact teaching productively, and how do they learn to teach effectively?*

In one of my first experiences here at WMU, I observed a Number and Operations course for preservice elementary teachers for an entire semester. This experience allowed me to see first-hand how to encourage preservice teachers to develop meaningful understanding of numbers and the operations, and to use that meaning to reason through computation. The course also helped me consider different methods of teaching, including building on students' thinking, asking questions, orienting students to each other's ideas, and making decisions based on knowledge of students' thinking. Since then, I have continued to develop my understanding in these areas, through coursework and additional time spent working with faculty in their classrooms.

I quickly began to think about how I might replicate this with teachers in Saudi Arabia. Many students in Saudi Arabia have similar issues as students in the U.S., in that while they may be able to do computations, they are not always able to reason about the operations they are using. Furthermore, teachers in Saudi Arabia often focus on student answers, and ignore how students got those answers. Although there are curriculum materials that attempt to focus on conceptual understanding, many teachers lack the knowledge to implement them well. So next summer when I visit Saudi Arabia, I plan to conduct a workshop for a small group of preservice teachers using ideas I learned from observing the Number and Operations course at WMU. My hope is that this will support these teachers in developing their future students' reasoning and thus encourage them to develop flexible, efficient and accurate strategies for solving computation problems.

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## From Kalamazoo to Kenya by Mary Ochieng

I am on leave from Strathmore University in Kenya to study mathematics education at WMU. When I return to Kenya upon completing my PhD, I will be the only mathematics educator at the university. While this may be daunting, I know the ideas I bring back with me from WMU will help me enhance Strathmore's academic contributions. For example, since 2011 Strathmore has organized and hosted a biennial conference that brings together mathematicians from different areas—pure, applied, statistics and mathematics education—with the aim of building research capacity. The mathematics education strand of the conference has always been organized by mathematics educators from other universities, since Strathmore had no mathematics educators. This past year, however, I was able to collaborate with others from the US, Sweden, and Kenya to design and implement the mathematics education strand of the conference.

We were granted funding from PME to support 20 graduate students from Kenya, Uganda, Tanzania and Rwanda to attend the mathematics education strand. During the conference, my main role was to facilitate a discussion connecting the qualitative and quantitative research sessions to focus on how mixed methods can be used to arrive at synergistic understandings. To facilitate this discussion, I drew heavily from a research course I had taken at WMU. Without it I am not sure I would have had the knowledge necessary to facilitate meaningful conversations around this topic. I am hopeful that the two-day experience was useful to the participants and will support them as they continue their research work and submit proposals to present their work at conferences.

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# News from WMU Graduates

## Anna Kruzinga (2006)

After completing my master's degree from WMU in 2006, I gained the perspective that I wanted to pursue teaching positions in districts that were striving to improve their instructional practices in mathematics using the research-based methods that I had learned about at WMU. I knew it was only in this way that I would continue to grow as an educator. I began at Black River Public Schools in Holland, MI working with a team of teachers striving to implement the NSF funded Core-Plus Mathematics curriculum. I felt that my experience as a graduate assistant for the Core-Plus project provided me with the knowledge needed to support the team of teachers in this endeavor, but that there was still so much more to learn. The atmosphere at Black River was one of learning and growing not only for students, but for educators as well, and we challenged ourselves to participate in opportunities provided by WMU, GVSU, and Ottawa ISD to analyze the data we collected from students and identify ways to continuously improve upon our practices to provide classroom experiences that resulted in top rated scores and programs.



In 2011 I accepted a position at Plainwell Community Schools. Both the middle school and high school had been identified as focus schools in the area of mathematics in years prior, and the district was searching for answers on how to improve curriculum and instructional practices. I remember being asked in the interview process, "How will you fix our math problem?" and feeling terrified that the things I'd learned over the prior 5 years at Black River might not work everywhere. I was soon charged with leading the way in designing curriculum materials that supported best practice, which eventually led to a position as a 6-12 Math Coordinator and Math Coach. Through continued relationships with WMU and opportunities for myself and other teachers to participate with grants and research studies, we were able to build a culture for supporting educators in better understanding and changing their practices to align with the Standards for Mathematical Practice outlined by the Common Core State Standards. Our teachers grew to embrace research-based methods for teaching and learning mathematics as the foundation for decision making in the classroom. In recent years, the district has seen its highest scores on standardized tests, and the achievement gap for lower achieving students has closed significantly as educators have strived to better understand the ideas of equity for all and how to differentiate instruction in the mathematics classroom. Most importantly though, teachers in the district have found a new passion and love for teaching mathematics.

Over the past 11 years, I have become increasingly passionate about supporting and encouraging other teachers in implementing research-based practices and in participating in opportunities offered by local universities to be part of research studies. Both I and the districts I've taught in have seen firsthand that while participation in studies can push you outside of your comfort zone, it offers opportunities to grow and develop in significant ways, and student test scores naturally improve as larger groups of teachers in a district band together to learn and grow together. Therefore, I will always be grateful for being welcomed as part of the math education community at WMU.

## Kevin Dykema (2000)



I am currently in my 23<sup>rd</sup> year of teaching 8<sup>th</sup> grade math: the first four in Kalamazoo Public Schools and the remainder at Mattawan Middle School. Earning my masters degree in math education from WMU in my early career prepared me well, both for teaching in my own classroom, and for contributing to the broader math education community. One of the ways I have contributed to the math education community is through service at the state and national levels.

For the past 10 years, I have conducted numerous professional development sessions as well as presented at many conferences throughout the United States focused on using manipulatives as a tool to develop conceptual understanding. Doing this has allowed me to stay current in the field and has provided opportunities to learn from many outstanding mathematics educators.

I have long been an active member of the Michigan Council of Teachers of Mathematics. From 2009 to 2012, I served as a regional director on the MCTM board, and was the conference chair for six years. Six years ago I founded the MCTM online book club, and have served as the coordinator since its inception. Attendees sign up to read a book that I choose and we read and reflect on it as a community. Three years ago, I was part of a team that started a math conference focused on meeting the needs of students with disabilities. This is a joint venture between MCTM and the Michigan Council for Exceptional Children (Michigan's special education professional organization). In 2013, I was awarded the MCTM Service Award.

In April 2016, I began a 3-year term on the Board of Directors for the National Council of Teachers of Mathematics. This has been a very exciting and rewarding opportunity and I am honored to be able to help bring a classroom voice to the Board and to continue to help promote mathematics education for each and every student.

In June 2017, I was honored to be selected as a Michigan state-level finalist in math for the Presidential Award for Excellence in Mathematics and Science Teaching. I'll find out in spring 2018 if I am the state awardee. This was a very rewarding process and helped me grow as a professional. Although I have had many growth opportunities, I will always fondly remember that many of my roots were planted as a member of the WMU math education community.

# Upcoming Presentations

## ASTE, Baltimore, MD, January 2018

**Browning, C.** *Standards for Preparing Teachers of Mathematics: Connections to Preparing Teachers of Science.*

## AMS/MAA Joint Meetings, San Diego, CA, January 2018

Hart, L., **Browning, C.**, Feldman, Z., Holm, J., and Oesterle, S. *Teaching Mathematics Content to Prospective Elementary Teachers: Strategies and Opportunities.*

## AMTE, Houston, TX, February 2018

**Browning, C.** *Transforming an Idea into an AMTE Publication: Getting Feedback.*

**Ghalyoun, O.** *Developing K-8 Preservice Teachers' Informal Statistical Inference In A Dynamic Software Environment.*

Leatham, K. R., Stockero, S. L., **Ochieng, M. A.**, **Van Zoest, L. R.**, & Peterson, B. E. *Teachers' orientations around using student mathematical thinking as a resource during whole-class discussion.*

**Lu, Y.** *Elementary/Middle School Preservice Teachers' Understanding Of Variability And Use Of Dynamical Statistical Software.*

**Ochieng, M. A.**, **Ruk, J. M.**, **Arslan, O.**, **Van Zoest, L. R.**, Leatham, K. R., Peterson, B. E., & Stockero, S. L. *The nature of student thinking available in a secondary mathematics classroom.*

## RUME, San Diego, CA, February 2018

Satyam, V. R., **Levin, M.**, Smith, J., **Grant, T. J.**, Voogt, K., Satyam, R., Bae, Y. *Graphing as a Tool for Exploring Students' Affective Experience as Mathematics Learners.*

**Mingus, T.** & **Levin, M.** *A Department-Level Protocol for Assessing Students' Developing Competence with Proof Construction and Validation.*

## AERA, New York, NY, April 2018

**Levin, M.** & Walkoe, J. *Seeing the Seeds of Algebraic Thinking in Young Children's Game Playing Activity.*

**Van Zoest, L.R.**, Peterson, B. E., Stockero, S. L., & Leatham, K. R. *Beyond the "Move": A Scheme for Coding Teachers' Responses to Student Mathematical Thinking.* Part of the symposium *Analyzing Teachers' Responses to Student Mathematical Contributions during Whole-Class Interactions: Goals, Grainsizes and Coding Schemes.*

## NCTM Research Conference, Washington, DC, April 2018

**Davis, J.**, Drake, C., Roth McDuffie, & A., Choppin, J. *Middle School Mathematics Teachers' Perceptions of Curriculum Design.*

Choppin, J., Roth McDuffie, A., Drake, C., & **Davis, J.**, *Investigating Alignment in Teachers' Understanding and Use of Curriculum.*

## Re(s)ources, Lyon, France, May 2018

**Kim, O.** *Teacher Capacity for Using Existing Resources Productively.*

## 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 math 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 the upcoming year for our graduate programs; the deadline for applications is February 15, 2018. For application procedures, see [wmich.edu/apply/graduate](http://wmich.edu/apply/graduate). Also, feel free to send any questions you have about our programs to: [math-ed@wmich.edu](mailto:math-ed@wmich.edu).

The MOST project has received an additional four years of funding from NSF. For information about MOST Research Assistantships, see the [MOST RA](#) flyer on the project website [BuildingonMOSTs.org](http://BuildingonMOSTs.org)



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