



Genéa Stewart
University of North Texas
Department of Educational Psychology
1155 Union Circle, #31135
Denton, Texas, 76205
Ph: 347-525-4162; Email: Genea.stewart@unt.edu

Mr. Brent Ladd
Director of Education, Center for Science of Information
Computer Science Department
Purdue University
305 N. University Street
West Lafayette, Indiana 490

March 10, 2020

Subject: Mid-Year Progress Report

Dear Mr. Ladd,

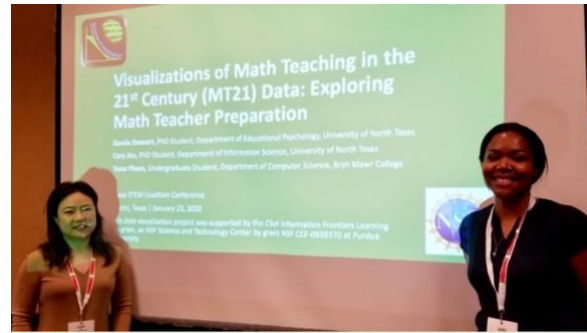
Thank you again for funding the project, *Implications of teacher knowledge and attitudes: A cross-national exploration of secondary math teacher preparation!* This report details some of our most recent accomplishments, lessons learned, and next steps.

Presentation at the T-STEM 2020 Conference

Our primary goal was to present data visualizations at two conferences. We are proud to report that our team's proposal to present at the Texas STEM conference was accepted. Cary and Genéa prepared for the workshop by reviewing extensive literature related to the field of math teacher education. Because the two are located near one another geographically, they were able meet on a bi-weekly basis throughout the fall semester to review potential plans for visualizations reflecting the most salient findings of the Mathematics Teaching in the 21st Century (MT21) research.

Genéa drafted several preliminary graphs with Excel (bar graphs) and SPSS (box plots and sub-group plots). Cary grew the team's storytelling efforts using Tableau, the final platform for the data visualizations (see link to dashboard: <http://tiny.cc/MT21VIZ>). Tessa also contributed virtually to the development of this workshop by providing online organization via a shared Google drive discussion board for the team. In this location, she shared best practices such as the seven-step approach to data visualization that we learned about at Purdue the previous summer.

Finally, in February of this year, Genéa and Cary facilitated a 90-minute workshop for a community of middle school teachers and administrators interested in exploring cultural differences across educational systems that contribute to gaps in student performance on international assessments such as the Programme for International Student Assessment (PISA).



Cary Jim and Genéa Stewart presenting at T-STEM

To encourage participation, we designed the workshop to be very interactive. As participants arrived, they were given different case studies detailing a day in the life of a secondary math teacher in one of six countries (e.g. Bulgaria, South Korea, Germany, Mexico, Taiwan, and the USA). Below is a snapshot of the worksheet we used to guide participants through a qualitative reflection prior to discussion of aggregated data trends in math teacher preparation across countries. Essentially, we wanted to prime the participants to consider whether these cross-national studies are comparing apples to apples, or apples to oranges (see slide).

MT21 Cross-National Teacher Preparation (Handout)

Domains	How is the teacher in your case study the same?	How is the teacher in your case study different?
Organization of K-12 Schooling		
Role of Math Teachers		
Teaching Load & Content		
Teaching Resources		
Organization of Future Teacher Education		

The participants shared many rich insights which helped to flesh out our understandings of this landscape. For instance, after reflecting on the South Korea case study, one middle school principal remarked that some cultural aspects highlighted in the MT21 study downplay extreme realities of such a competitive educational system. Indeed, the text certainly discussed the prominent roles of private tutors and the prevalence of studying for several hours after the school day. But some felt that a less delicate portrayal might have been more truthful, given that there is knowledge of authorities needing to often shut down extreme tutoring operations that keep children up studying late into the night.

Genéa pushed the participants to think critically about the material and how it compared to their own lives. Another participant discussed the reality that the samples selected for comparison on international math measures are not created using equivalent forms of a sampling frame. For

instance, In some countries, many students must first pass certain qualifying or competitive screening measures in order even to advance to the grade level were these tests occur. So, while the United States sample may include students of all levels of academic ability, other countries may only have their best and brightest student taking these tests at the secondary level which allows for biased interpretations of any aggregate results (and respective visualizations) if these issues are not made transparent.



Middle school administrator participating in the T-STEM workshop

Ultimately, the visualization portion was very well-received. The participants enjoyed manipulating the Tableau dashboard and comparing effects by country. This process was supported by a practice portion using one of Cary’s previous dashboards to illustrate the functionality of the site.

At the end of the workshop, one of the principals who is currently pursuing a Ph.D. mentioned that “this workshop was so much better than the rest of the conference”. He said, “I came to learn, and everyone else is trying to sell me something.” Another participant said, “You guys should present this at the other STEM conference this spring”.

Lessons Learned: Data Procurement

One issue that we did not anticipate was that many of the variables we wanted to use in the MT21 data were restricted. Essentially, we were not able to predict teacher knowledge in math education from beliefs, attitudes and coursework as we intended because the knowledge scores were not provided. Also, the international student assessments PISA and Trends in International Mathematics and Science (TIMSS) did not have the relevant data for all countries surveyed for the MT21 study that we could use for aggregate data graphs. Most importantly, we were limited in the kinds of predictions we could make since the student data was not linked to the preparing teachers. Going forward, we are making it a priority to extract relevant data from other up-to-date international databases, such as the Teaching and Learning International Survey (TALIS).

Next Steps: Upcoming Conference

Our team is also excited to share the news that we have been accepted to present at the national level on this topic. For the Modern Modeling Methods conference, we will be enlisting the support of a faculty member at the University of North Texas who is an expert in Bayesian multi-level modeling methods and a big supporter of open science. As we prepare for this presentation, we will be pre-registering the hypotheses online via the Center for Open Science’s Open Science Framework which supports transparent research practices:

https://osf.io/institutions/cos/?gclid=EAJaIQobChMI2Y3xureR6AIVEvDACH28sgGiEAAAYASAAEgL5Pfd_BwE

Please see below for a full abstract for the accepted poster proposal.

Modern Modeling Methods

2020 Conference | 9th Annual Meeting | Poster Proposal

Type of Submission: Poster

Title: Using Markov Chain Monte Carlo Methods and Bayesian Estimation to Investigate Cross-National Teacher Preparedness and Professional Practices

Authors and Affiliations:

- *Genéa Stewart, Ph.D. Student, Department of Educational Psychology, The University of North Texas*
- *Cary Jim, Ph.D. Student, Department of Information Science, The University of North Texas*
- *Jaret Hodges, Ph.D. Department of Educational Psychology, The University of North Texas*
- *Milushka Elbulok-Charcape Ph.D. Student, Department of Educational Psychology, The City University of New York*

Abstract (150-200 Words):

Oftentimes, social science and policy researchers wish to examine how various macro-level country factors relate to differences in outcomes. However, many secondary datasets only offer small cluster sample sizes for multi-country data which severely restricts researchers' ability to estimate multi-level effects on outcomes and draw any robust conclusions. Bryan and Jenkins (2013) recommended the use of Bayesian estimation methods for more reliable estimations when the country level sample size is smaller than traditionally recommended 30. Using cross-national data from the 2018 International Questionnaire of the Teaching and Learning International Survey (TALIS), we will investigate model fitting of variance components for teachers' preparation, instructional practices, and beliefs across 15 countries. We will demonstrate this method using the Bayesian Regression Models (brms) package in R. This project is supported by Purdue University's Information Frontiers Learning Program at the Center for the Science of Information, a National Science Foundation Center.

Financial Reporting: T-STEM Conference

So far, we have only spent money towards the T-STEM conference. Genéa incurred charges of \$656.23 which included conference registration (\$299.00) plus one night at the hotel (\$109.98) and regional travel. Cary incurred similar total charges of (\$717.88) which also included the same conference registration and lodging expenses. In sum, we have spent \$1,374.11, which leaves a remaining balance of \$6,094.89.

Sincerely,



Genéa Stewart, M.A.

PhD Student, Department of Educational Psychology
University of North Texas