
Introducing Mathematical Literacy PDSAs into a Partnership Team

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Abstract

The 2016 presidential election campaigns and post-election dissonance has highlighted the need to reflect on what are taken as reliable (sources) and valid (facts, data). In what has been labeled the “post-fact” age, truth and what constitutes as truth have become daily talking points. Differences in peoples’ perspectives relate, in part, to where they receive their news and information (e.g., CNN, Fox News). Individuals also receive news and information, socially, from a variety of sources, including Facebook, Twitter, Reddit, or face-to-face; each of which add their own nuances to how items are interpreted. Mathematical Literacy provides a means to confront “fake news,” “alternative facts,” and non-factual thinking, reasoning, and decision-making by focusing on meanings (i.e., understandings) and how each of us: makes sense of and interprets data, reasons, constructs arguments, responds to the arguments of others, explores the validity of our own and others’ conjectures and conclusions, and receives and disseminates information. This report describes one team’s efforts to integrate Mathematical Literacy into its work with pre-service and in-service math teachers and math intervention specialists. Using PDSA cycles, the team works to support teachers’ establishment of professional learning communities and continued professional growth, and engage local institutions (universities, school districts, city officials, businesses, PTA, residents) in transformational stewardship and leadership. Working with colleagues in other subject areas (e.g., language arts, social studies), the team assists citizens, including Grades 6-12 students, identify reliable and valid data and sources, make sense of and interpret data, reason, construct arguments, and explore the validity of one’s own and others’ conjectures and conclusions.

Keywords: reasoning and sense making, data interpretation, Mathematical Literacy, institutional transformation

Introduction

The 2016 presidential election campaigns and post-election dissonance has highlighted the need to reflect on what are taken as valid (facts, data) and reliable (sources). In what has been labeled the “post-fact” age, truth and what constitutes as truth have become daily talking points (Drezner, 2016; Flood, 2016; Heer, 2015; Kurtzleben, 2017; Pazzanese, 2016; Slack, 2017). Differences in peoples’ views and perspectives relate (in part) to where they receive their news and information. Such distinctions arise (in part) from praise and criticism leveled by or at President Trump throughout his campaign and presidency, such as: Fox News, The Rush Limbaugh Show, InfoWars, Breitbart News, New York Post, and the so-called “mainstream” media (e.g., ABC, CBS, CNN, and NBC News; New York Times; Washington Post). Individuals also receive news and information, socially, from a variety of sources, each of which add their own nuances to how items might be interpreted: Facebook, Twitter, Instagram, Pinterest, Reddit, Tumblr, YouTube, texting, and face-to-face. With all of these filters, how do we begin to think of one another as simply having different points of view, but all being concerned citizens wanting a healthy America and planet?

Since 2015, the Kent State University Mathematics Teacher Education Partnership (KSU-MTE-Partnership) has struggled to retain its membership in the larger MTE-Partnership with the dissolution of the Knowledge-for-Teaching-Mathematics Tasks (KTMT) Research Action Cluster (RAC)—in essence, leaving KSU-MTE-Partnership “RAC-less.” KSU-MTE-Partnership views Mathematical Literacy as a bridge to not only foster its increased presence in MTE-Partnership, but also to promote the tenets of Guiding Principle 6, Professionalism, Advocacy, and Leadership (MTE-Partnership, 2014). In particular, through its focus on Mathematical Literacy, KSU-MTE-Partnership advances Guiding Principle 6 by modeling and promoting actions that are “ethical, open, honest, and forthright,” and “democratic principles . . . [exhibiting] high expectations for *all* students, while recognizing and honoring their diversity” [authors’ italics] (p. 5).

As such, Mathematical Literacy provides a means to confront “fake news,” “alternative facts,” and non-factual thinking, reasoning, and decision-making, by focusing on meanings (i.e., understandings) and how each of us makes sense of and interprets data, reasons, constructs arguments, responds to the arguments of others, explores the validity of our own and others’ conjectures and conclusions, and receives and disseminates information. The definition for Mathematical Literacy most aligned with that employed by KSU-MTE-Partnership comes from the Organisation for Economic Co-operation and Development (OECD):

Mathematical Literacy is an individual’s capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens. (OECD, 2016, p. 28)

Mathematical Literacy, as conceived of and employed by KSU-MTE-Partnership, aligns with aspects of work being done by the Equity Working Group and the Transformations Working Group. In addition, KSU-MTE-Partnership’s vision of Mathematical Literacy intersects with multiple RACS (e.g., Active Learning Mathematics) and the larger Mathematics Teacher Education Partnership.

Methods

Over the past nine months, KSU-MTE-Partnership has begun integrating Mathematical Literacy ideas into pre-service courses and in-service professional development. Such work has allowed for the exploration of data and resources with likeminded and non-likeminded individuals and created spaces for mindful discourse. Furthermore, mindful discussions allow for the potential to build consensus among ideas through mutual concessions, provided there is a focus on meanings.

Meanings are the substance of thinking and reasoning. As such, the meanings (i.e., understandings) we think with, reason with, converse with, and debate with are critical. In order to have any clear idea what we are thinking about, communicating about, reasoning with and about, debating about, presenting to others, we need to: (1) articulate our meanings to ourselves, (2) articulate our meanings to others, and (3) expect others to do the same. Therefore, making clear how you understand ideas, concepts, and issues and asking others to do the same is critical—and perhaps so self-evident we rarely do it—in any discussion regarding: mathematics, science, language arts, social studies, finance, politics, technology, education, poverty, taxes, mental health, domestic violence, hate and extremism, etc.

KSU-MTE-Partnership relies on the Plan-Do-Study-Act (PDSA) cycle—a core improvement science principle—allowing for rapid cycles of learning from practice at small scale to study the impacts Mathematical Literacy has on pre-service teachers, in-service teachers, and their students (Bryk, Gomez, & Grunow, 2015; Lewis,

2015). In addition, KSU-MTE-Partnership partners with educators in other subject areas (e.g., social studies, science, journalism) and local officials and parent organizations (e.g., PTA) to enhance and broaden the impact of its work. Some of the areas KSU-MTE-Partnership has focused on are described below.

Polls and Polling

In addition to working with teachers and students to productively interpret and create polls and surveys, instruction (and professional development) focuses on addressing the following questions: What is a sample? If N is the number of people polled, is it all right for N to vary for each poll? Why does N sometimes involve adults nationwide and sometimes registered voters nationwide? What is a “margin of error”? How do polling organizations determine whom to poll? Do poll organizations ask their questions online, by phone, or in-person, and does it matter? Who pays for these polls? Why aren’t more people polled? How do we know people aren’t lying when they answer poll questions?

Representation and Voting

KSU-MTE-Partnership involves teachers and their students in exploration and examination of Democratic and Republican congressional member demographics compared to national, state, and congressional district demographics (e.g., percent female, Hispanic, Veteran, foreign born, with a disability, LGBTQ). Such instruction leads to examination of data involving and discussions around: voter turnout, voter identification, voter suppression, congressional offices, and congressional district gerrymandering.

Data Resources

KSU-MTE-Partnership works with pre-service and in-service teachers to integrate data into their lessons in authentic ways. Using easily accessible data from a variety of sources (e.g., U.S. Census Bureau, National Center for Education Statistics, United Nations, World Health Organization, National Center for Health Statistics, Bureau of Labor Statistics) and various representation tools (e.g., Gapminder, Excel, GeoGebra, Desmos), KSU-MTE-Partnership helps teachers focus lessons on discussions around data validity, interpretation, dissemination, and extrapolation.

Conclusion

KSU-MTE-Partnership believes a re-focused grassroots effort should be placed on Mathematical Literacy. Furthermore, we believe the MTE-Partnership can be a driving force in making such an effort practicable. Mathematics teachers (at all grade levels, including mathematics teacher educators) can assist their fellow citizens (from all age groups) determine where to find reliable and valid facts, data and sources. Mathematics teachers can use their content and pedagogical expertise to help others make sense of and interpret data, reason, construct arguments, respond to the argument of others, and explore the validity of one’s own and others’ conjectures and conclusions.

Furthermore, efforts should be expanded by: (1) integrating the work of mathematics educators with educators and organizations from other disciplines (e.g., sociology, public health, journalism, U.S. government, contemporary world issues, technology, social justice studies, environmental studies, constitutional law, criminology, and business), and (2) developing partnerships among schools, districts, universities, parents and parent organizations, local and federal officials, the media, and charitable organizations. Such integrated partnerships can serve as Networked Improvement Communities (NIC) that work together to understand and confront a variety of data-informed issues, where “confront” means mindfully discussing each issue and coming to consensus through mutual concessions.

We are by no means claiming Mathematical Literacy and a focus on meanings is a panacea to heal all of the issues and polarization that currently trouble America. But, as characterized by Bertrand Russell (1919), “Mathematics, rightly viewed, possesses not only truth, but supreme beauty” (p. 60). KSU-MTE-Partnership believes everyone would agree we need a little truth and beauty in America right now.

For More Information

- Website: Re-Making the Case for Mathematical Literacy <https://scourtn5.wixsite.com/meaningsmatterml>
- Contact: Dr. Scott Courtney at Kent State University (scourtn5@kent.edu)

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