
Exploring the AMTE Standards: Social Contexts of Mathematics Teaching and Learning and NCTM's Catalyzing Change in High School Mathematics

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Headlines from the news, June 2018:

“College Apologizes to Native American Brothers Detained After Joining Campus Tour”; “Toronto Principal Faces Resignation Calls After Making a List of Black Students”; and “After Melania Trump’s Jacket, People are Buying ‘I really do care’ T-shirts to Raise Money for Immigrant Charity”

Given that every other headline today wreaks of inequities that exist in society, it is more important than ever before that secondary mathematics teacher candidates are well prepared to ensure each and every student is cared for in a manner that will allow the student to reach his/her full potential. Caring in education has many meanings. In fact, Noddings (1995, p. 24) stated the following:

All teachers should be prepared to respond to the needs of students suffering from the death of friends, conflicts between groups of students, pressure to use drugs or engage in sex, and other troubles of today’s children. Too often schools rely on experts—“grief counselors” and the like—when what children really need is the continuing compassion and presence of adults who represent constancy and care in their lives. Artificially separating the emotional, academic, and moral care of children into tasks for specially designated experts contributes to fragmentation of life in schools.

Recognition that school is a place in which students are cared for and learn to care should be powerful in guiding policy.

Secada (2003) discussed a continuum of caring. On one end of the continuum, caring could be used to protect students’ emotional and psychological well-being. In this case, a teacher may seek to avoid all risk of adding further to children’s trauma. For example, a teacher may not push a student from a low socioeconomic status home to do challenging work. In the moment, the teacher may feel that she is shielding the student from additional stress; however, in the long run, the student will not have developed problem-solving skills or other skills that would benefit the student in and beyond the classroom. On the other end of the continuum, caring could be used to motivate proactive interventions, in which teachers push students to increase their knowledge in order to have a variety of options in life.

The video case of Amari Mitchell, a 16-year-old junior at Hoover High School, demonstrates the importance of a caring teacher (Dunigan, 2017). In the video, Amari, an African American student, describes an academic year in which he had one white mathematics teacher for half of the year and another white mathematics teacher for the second half of the year. He stated that the first teacher did not appear to care about him. He felt as if she did not seek to ensure that he was learning. He felt that the teacher ensured that the white students got what they needed, but she did not reach out to him. He said that his parents became his teachers, instead of his teacher. He stated that some teachers don’t care about certain students. They care about students that look like them. He felt that he was solely responsible for his learning. During the second half of the year, he had a different white teacher in the class who pushed him to get help from her and to work hard himself. He talked about how

this teacher reached out to his mother to ensure that he was doing his work. He stated that this teacher was not going to allow him to fail and that the only reason he would fail was if he allowed himself to fail. Amari helped us to see that teachers' actions as well as their inactions send students micromessages that either encourage them and move them forward or make them feel less than and discouraged.

Furthermore, Amari made it clear that some students face inequities in school due to their race/ethnicity. Amari's depiction of what happened to him is in alignment with the following quote:

There is a long-standing, thoroughly documented, and seemingly intractable problem in mathematics education: inequity. Children of certain racial, ethnic, language, gender, ability, and socioeconomic backgrounds experience mathematics education in school differently, and many are disaffected by their mathematics education experience. (Aguirre et al., 2017, p. 125)

As mathematics teacher educators, we must ensure that secondary mathematics teacher candidates are able to not only understand and address the issues mentioned in the preceding quote, but that they must also be able to address and understand their beliefs about and the needs of lesbian, gay, bisexual, transgender, queer or questioning (LGBTQ) students, and address the needs of students who identify as being in the intersection of multiple groups.

In addition, teacher candidates must understand that "educational equity means that every student has access to the educational resources and rigor they need at the right moment in their education across race, gender, ethnicity, language, disability, sexual orientation, family background and/or family income" (The Aspen Education & Society Program and the Council of Chief State School Officers, 2017, p. 3). Teacher candidates also need to understand that bidirectional relationships between schools and families support equity—that is, equity should be extended from a unidirectional exchange as primarily benefitting the growth of students and student groups that have historically been denied equal access, opportunity, and outcomes in mathematics to a reciprocal approach (Civil, 2007). Culturally sustaining pedagogy (CSP) is a means through which teacher candidates can create an equitable classroom environment (Paris, 2016). Below are characteristics of CSP:

- CSP describes teaching and learning that seeks to perpetuate and foster linguistic, literate, and cultural pluralism as part of the democratic project of schooling and as a needed response to demographic and social change.
- CSP takes dynamic cultural and linguistic dexterity as a necessary good, and sees the outcome of learning as additive, rather than subtractive, as remaining whole rather than framed as broken, as critically enriching strengths rather than replacing deficits.
- CSP builds on decades of crucial asset-based pedagogical research that has countered pervasive deficit approaches, working against the backdrop of beliefs in White superiority and the systemic racism they engender, to prove that practices and ways of being as students and communities of color are legitimate and should be included meaningfully in classroom learning. (Paris, 2016, p. 6)

Another aspect of caring for students is to provide them with information about possible career paths and the road maps for attaining the different professions. Teachers need to especially share information about science, technology, engineering, and mathematics (STEM) careers. People from underrepresented groups have made some progress in STEM but remain underrepresented in STEM as a whole and are particularly underrepresented in some STEM fields, notably engineering, mathematics, computer science, and some of the physical sciences (Committee on Equal Opportunities in Science and Engineering 2015–2016 Biennial Report to Congress, Executive Summary, p. i).

There are two national documents that can be used to help develop the sociopolitical awareness and agency of secondary mathematics teacher candidates: the Association of Mathematics Teacher Educators (2017)

Standards for Preparing Teachers of Mathematics and *Catalyzing Change in High School Mathematics* (National Council of Teachers of Mathematics [NCTM], 2018). In this session, both documents were discussed with regards to their emphasis on the sociopolitical context of mathematics teaching and learning and how each can be used in preparing secondary mathematics teacher candidates.

Standards for Preparing Teachers of Mathematics (SPTM)

The SPTM is a set of comprehensive standards describing a national vision for the initial preparation of all teachers, pre-K–12 who teach mathematics. These standards are aspirational, rather than describing minimum levels of competency needed by beginning teachers. Their purpose is to guide the improvement of teacher preparation programs, inform policies and practices, and promote national dialogue and action (AMTE, 2017). The structure of the SPTM document is listed as follows:

- Ch. 1: Assumptions and Overview
- Ch. 2: Candidate Knowledge, Skills, and Dispositions
- Ch. 3: Program Characteristics to Develop Candidate Knowledge, Skills, and Dispositions
- Ch. 4-7: Grade-Band Elaborations (Early Childhood, Upper Elementary, Middle Level, and High School)
- Ch. 8: Assessing Mathematics Teacher Preparation
- Ch. 9: Enacting Effective Preparation of Teachers of Mathematics

Assumption #1 of the SPTM specifically focuses on equity in mathematics education:

Ensuring the success of each and every learner requires a deep, integrated focus on equity in every program that prepares teachers of mathematics. (AMTE, 2017, p. 1)

Within the text related to the assumption the authors make it clear that equity must be both addressed in its own right and embedded within every standard. They further assert that every standard must be built on the premise that it applies to each and every student, recognizing that equity requires acknowledging the particular context, needs, and capabilities of each and every learner rather than providing identical opportunities to students (AMTE, 2017, p. 1). Standard C.2 provides an example of how equity is a strand in every standard (see Figure 1).

Standard C.2. Pedagogical Knowledge and Practices for Teaching Mathematics

Well-prepared beginning teachers of mathematics have foundations of pedagogical knowledge, effective and equitable mathematics teaching practices, and positive and productive dispositions toward teaching mathematics to support students' sensemaking, understanding, and reasoning.

- C.2.1. Promote Equitable Teaching
- C.2.2. Plan for Effective Instruction
- C.2.3. Implement Effective Instruction
- C.2.4. Analyze Teaching Practice
- C.2.5. Enhance Teaching Through Collaboration with Colleagues, Families, and Community Members

Figure 1. Standard C.2 from the AMTE (2017) Standards (p. 126).

Standard C.4 is the standard that specifically addresses mathematics education in its sociopolitical context (see Figure 2).

Standard C.4. Social Contexts of Mathematics Teaching and Learning

Well-prepared beginning teachers of mathematics realize that the social, historical, and institutional contexts of mathematics affect teaching and learning and know about and are committed to their critical roles as advocates for each and every student.

Indicators include

C.4.1. Provide Access and Advancement

C.4.2. Cultivate Positive Mathematical Identities

C.4.3. Draw on Students' Mathematical Strengths

C.4.4. Understand Power and Privilege in the History of Mathematics Education

C.4.5. Enact Ethical Practice for Advocacy

Figure 2. Standard C.4 from the AMTE (2017) Standards (p. 129).

Chapter 7 is the Grade-Band Elaboration chapter for Grades 9–12. Within this chapter are vignettes and other resources that may be used by mathematics teacher educators to help teacher candidates to understand and develop competencies related to the standards. For example, Figure 3 contains an indicator for Standard C.4, an accompanying vignette from Chapter 7, and some discussion questions related to the vignette.

C.4.2. Cultivate Positive Mathematical Identities

Well-prepared beginning teachers of mathematics recognize that their roles are to cultivate positive mathematical identities with their students.

Hs.4. Cultivating Positive Mathematical Identities in Each and Every Student

Well-prepared beginning teachers of mathematics at the high school level draw on students' strengths to cultivate positive mathematical identities. [Elaboration of [C.4.2](#) and [C. 4.3](#)]

Vignette 7.3. Mathematical Identity

I am Michael Davis, an African American junior in a geometry class. I am motivated to do well in this class because I want to go to college, and if I make good grades, I might get a scholarship. I actually like this class because I am given opportunities to solve problems in groups with my peers. I like the discussions that we have, especially debates when we do not agree on a solution. I like activities that allow me to discover important connections between different topics of mathematics, between my life and mathematics, and between mathematics and what is going on in social media and the world. I also like making conjectures and testing them to find out if they are true. (SPTM, 2017, p. 130)

Possible Discussion Questions Related to the Vignette

- Why might Michael feel the way he does about mathematics class?
- Given that Michael is a Black male, what might be noteworthy about his experience?
- Why might he enjoy working in a group? What does it take to develop meaningful *group-worthy* problems for students to solve?
- What would support the development of a classroom culture in which group work is valued? What are the differences between problems and exercises?
- Why might Michael care about relating mathematics to other topics, his life, social media, and the world? Should these connections be made between things with which he is already familiar, or can they also expand this knowledge? How does a teacher orchestrate this discussion well? (SPTM, 2017, p. 130)

Figure 3. Vignette 7.3 from the AMTE (2017) Standards (p. 130).

In addition to the information in Chapter 7 of the SPTM, mathematics teacher educators may discuss identity and agency in more detail as a supplement to the discussion about the vignette. The following sources are helpful for the discussion: Aguirre, Mayfield-Ingram, and Martin (2013); NCTM (2018); and Solomon (2009). Figure 3 provides one example of how rich discussion can be built around the SPTM and the elaboration chapter.

Catalyzing Change in High School Mathematics

The purpose of *Catalyzing Change in High School Mathematics* (NCTM, 2018) is to open serious discussions among the key stakeholders in high school mathematics education to engage in resolving the barriers that have long impeded meaningful and necessary change in high school mathematics education. The document contains four key recommendations:

- Each and every student should learn the Essential Concepts in order to expand professional opportunities, understand and critique the world, and experience the joy, wonder, and beauty of mathematics.
- High school mathematics should discontinue the practice of tracking teachers as well as the practice of tracking students into qualitatively different or dead-end course pathways.
- Classroom instruction should be consistent with research-informed and equitable teaching practices.
- High schools should offer continuous four-year mathematics pathways with all students studying mathematics each year, including two to three years of mathematics in a common shared pathway focusing on the Essential Concepts, to ensure the highest-quality mathematics education for all students.

NCTM (2018) is a must read for secondary mathematics preservice teachers and can serve as a companion to the SPTM Grades 9–12 elaborations chapter. It is important for teacher candidates to be cognizant of the different purposes of mathematics so that they are able to provide their students with the opportunity to learn meaningful mathematics that will give them tools and open doors to a variety of career options. It is important for teacher candidates to discuss the perils of tracking and other inequitable school structures so that they will develop a sense of agency that drives them to advocate for each and every student’s right to a mathematics education that will allow them to be career- and workforce-ready. Moreover, NCTM provides action steps that teachers and others can take to ensure that students receive an equitable mathematics education.

Challenge for the MTE-Partnership

It is imperative that the MTE-Partnership examine SPTM (AMTE, 2017), NCTM (2018), and other resources that will enable the Partnership to develop an equity lens to oversee the work that we are doing to tackle the “wicked” problem of the downward cycle in mathematics education described by Suzanne Wilson and adapted to the MTE-Partnership research action clusters (RACs) by W. Gary Martin (Martin & Strutchens, 2018). See Figure 4.

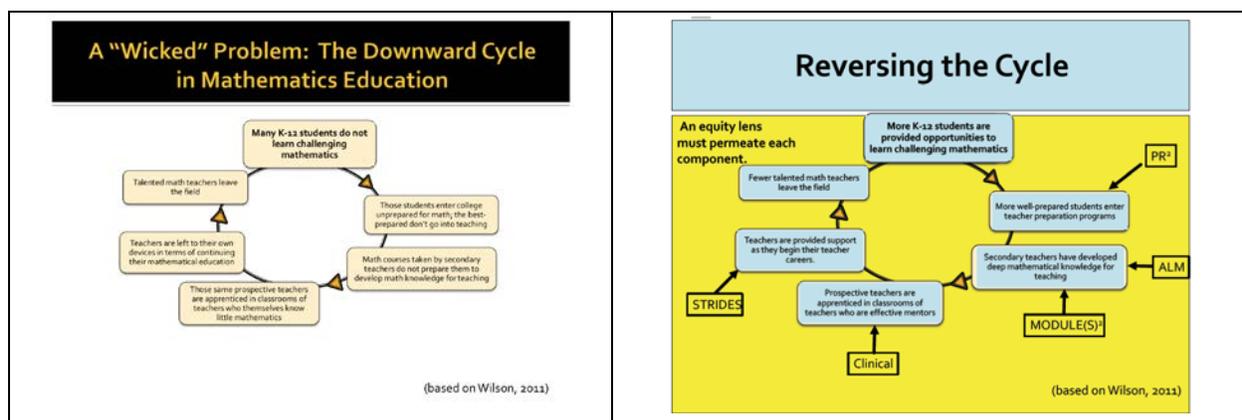


Figure 4. The “wicked” problem in mathematics education and reversing the cycle.

Through an equity lens, the Program Recruitment and Retention RAC can develop modules and other resources that will help colleges to recruit and retain more well-prepared students from a variety of backgrounds including racial, socioeconomic, linguistics, and others into teacher preparation programs. Through an equity lens the Actively Learning Mathematics RAC will develop courses and other resources that will enable mathematics professors to provide teacher candidates and other mathematics majors with the opportunity to learn mathematics in a manner that helps them to understand the mathematics and apply it their lives daily. Moreover, the MODULE(S)² RAC will develop resources to help secondary mathematics education programs to provide courses in which the teacher candidate develop mathematical knowledge for teaching. Through an equity lens the Clinical Experience RAC will develop resources that will provide professional learning for the mentor teachers who host teacher candidates in their classrooms to ensure that the teacher candidates are being apprenticed by mentor teachers who care deeply about the well-being and mathematical success of each of their students. Through an equity lens the STRIDES RAC will develop resources that will help secondary mathematics teacher education programs to follow up with their program completers and build partnerships with schools in order to support and retain well-prepared beginning teachers. And if the equity lens is used well throughout each of the MTE-Partnership RACs and partnership teams (mathematicians, mathematics teacher educators, mentor teachers, school administrators, and teacher candidates) work together, more K–12 students will be provided opportunities to learn challenging mathematics.

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