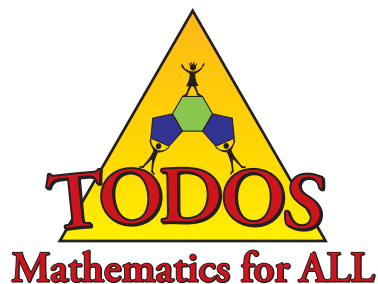


Vol. 9, No. 1

Spring 2018

ISSN 2153-0173 online

TEACHING FOR EXCELLENCE AND EQUITY IN MATHEMATICS



An Affiliate Organization of the National Council of Teachers of Mathematics

TEACHING FOR EXCELLENCE AND EQUITY IN MATHEMATICS

Editor-in-Chief

Marta Civil
The University of Arizona

Editors

Ksenija Simic-Muller
Pacific Lutheran University

M. Alejandra Sorto
Texas State University

Craig Willey
Indiana University-Purdue University Indianapolis

Associate Editor

Lawrence M. Lesser
The University of Texas at El Paso

Founding Editors

Cynthia Oropesa Anhalt, The University of Arizona
Miriam A. Leiva, University of North Carolina Charlotte, Emerita
Lawrence M. Lesser, The University of Texas at El Paso



IN THIS ISSUE

From the Editors.....5

Forging New Terrain in Critical Mathematics Teacher Education: The Role of Collaborative Reflective Practice6
 Craig J. Willey, Indiana University – Purdue University Indianapolis
 Stefanie D. Livers, Missouri State University

TODOS Mission and Goals.....16

Illustrating Effective Teacher Reflection and Instructional Practices That Support English Learners in Mathematics17
 Sara Morales, New Mexico State University
 Terri Sainz, New Mexico State University
 Kathryn Million, Las Cruces Public Schools
 Kathe Kanim, New Mexico State University

Current TODOS Publications25

Differentiating Mathematics Instruction for Multilingual Students Using Critical Sociocultural Practices26
 Annela Teemant, Indiana University-Purdue University Indianapolis
 Brandon J. Sherman, Indiana University-Purdue University Indianapolis
 Amy Wilson, Indiana University-Purdue University Indianapolis

Call for Manuscripts for *TEEM*36

TODOS 2017-18 Leadership.....37

TODOS 2017-18 Accomplishments.....38

In Memoriam: Carol A. Edwards39

From the Editors

We are happy to present this ninth issue of *Teaching for Excellence and Equity in Mathematics (TEEM)* in time for the 2018 TODOS Conference. We have made some changes to the structure of the Editorial Team. We now have an Editor-in-Chief (Marta Civil) and three Editors (Ksenija Simic-Muller, M. Alejandra Sorto, and Craig Willey). This team handles all the submissions and review process. We also count on the wonderful support of Lawrence M. Lesser as Associate Editor and Susie W. Håkansson as Layout Editor.

The journal is a vehicle to provide a scholarly and pedagogical resource for mathematics educators, practitioners, leaders, and administrators at all levels. *TEEM* uses a rigorous double-blind review process to ensure that a paper is judged on its merits without the external reviewers knowing the identity of the author(s) and vice-versa. For information on reviewing or writing for *TEEM*, please see the *TEEM* webpage <http://www.todos-math.org/teem>. On that webpage, you will also find a link to a webinar on writing and reviewing for *TEEM*.

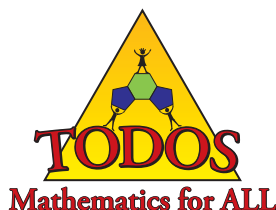
The current issue of *TEEM* includes two externally peer-reviewed articles and an invited article. The issue starts with a contribution by Craig J. Willey and Stefanie D. Livers. This article was reviewed and accepted prior to Craig Willey becoming an Editor of *TEEM*. Their article, “Forging New Terrain in Critical Mathematics Teacher Education: The Role of Collaborative Reflective Practice,” reports on a collaborative self-study describing the stories of two mathematics teacher educators where the authors examine their own perspectives and priorities in preparing future mathematics teachers. As a result of their analysis and critical interrogation of themselves, they provide a framework that can serve as a model for other teacher educators in their efforts to improve their practice.

The second article is by Sara Morales, Terri Sainz, Kathryn Million and Kathe Kanim. These authors wrote this piece to honor the memory of their friend and colleague, Cathy Kinzer, who was a charter member of TODOS. Their article entitled “Illustrating Effective Teacher Reflection and Instructional Practices that Support English Learners in Mathematics,” examines strategic use of positioning, authority, and authentic mathematics experiences of teachers in two Dual Language kindergarten classrooms. They describe how to provide teachers with opportunities and structures to examine their practices reflecting on how their decisions impact English Learners.

The invited article “Differentiating Mathematics Instruction for Multilingual Students Using Critical Sociocultural Practices” by Annela Teemant, Brandon J. Sherman, and Amy Wilson, describes a three-tiered approach to supporting teachers’ differentiation through changing classroom organization, designing activities to promote learning, and cultivating a culture of recognition. Drawing on longitudinal data, the authors highlight the pedagogical challenges and successes of elementary and secondary mathematics teachers as they receive sustained instructional coaching and implement critical sociocultural practices that have yielded significant results on multilingual students’ language and mathematics development.

TEEM gratefully acknowledges the support of all the leaders in our sponsoring organization, TODOS: Mathematics for ALL. We hope *TEEM* continues to serve the TODOS membership, and provides an inspiring pedagogical and scholarly resource for the broader mathematics education and education communities.

Marta Civil, Ksenija Simic-Muller, M. Alejandra Sorto, and Craig Willey



Forging New Terrain in Critical Mathematics Teacher Education The Role of Collaborative Reflective Practice

Craig J. Willey

Indiana University-Purdue University Indianapolis

Stefanie D. Livers

Missouri State University

Abstract

Despite symbolic declarations by leading mathematics education organizations, critical mathematics educators have questioned whether we are serious about preparing teachers to provide equitable mathematics opportunities for children of color. This collaborative self-study of two mathematics teacher educators aimed to examine their own histories, perspectives, and priorities in preparing future mathematics teachers. Our analysis and resulting framework are guided by documents put forth by the National Board of Professional Teaching Standards (NBPTS). We conclude that self-study, or critical interrogation of self, can serve as a model to sharpen a pedagogical focus to serve student groups who have experienced neglect.

Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. What do you do to provide equitable mathematics learning opportunities for children of color?
2. In what ways, specifically, do equitable mathematics learning opportunities impact the learning of children of color?
3. What can mathematics teacher educators address in courses to better prepare future mathematics teachers to be critical mathematics teachers?
4. How do you interpret the notion that mathematics teaching is an inherently political act?

Craig J. Willey (cjwilley@iupui.edu) is an Assistant Professor of Mathematics Education and Teacher Education at Indiana University School of Education in Indianapolis. His research focuses on the preparation of culturally relevant mathematics teachers and the mathematics teaching and learning process with Latinas/os, specifically through teachers' creation of Mathematics Discourse Communities.

Stefanie D. Livers (stefanielivers@missouristate.edu) is an Assistant Professor in the department of Childhood Education and Family Studies at Missouri State University. Her research agenda focuses on teacher preparation, teacher support, and equitable teacher practices. Specifically, her interests lie in teacher candidate beliefs and knowledge and preparation programs, professional development and instructional coaching, and teaching practices that provide equitable opportunities for diverse learners to learn mathematics.

Forging New Terrain in Critical Mathematics Teacher Education: The Role of Collaborative Reflective Practice

Craig J. Willey and Stefanie D. Livers

Introduction

The responsibility of becoming strong mathematics teacher educators (MTEs) is layered and consequential. MTEs are trusted to assess the evolving nature of what characterizes a quality mathematics teacher, and the subsequent decisions they make as teachers, researchers, and stewards of the profession directly impact how future generations will come to experience mathematics. Part of this responsibility includes supporting novice or prospective mathematics teachers (PMTs) to develop deep content and pedagogical knowledge that is necessary for teaching mathematics, and also the critical knowledge to ensure equitable teaching practices for children of color, who, historically, have not been served well by schools and institutions. Mathematics education, as one such domain, has contributed to and perpetuated the status quo that exists in society (Martin, 2011; Stinson, 2004), in part through the (false) conventional wisdom that there are “math people” and “non-math people.” Without a critical perspective aimed at disrupting ideologies and practices that marginalize children of color, mathematics teaching and learning will continue to remain stagnant, and challenging opportunity gaps will remain a struggle (Flores, 2007).

As mathematics teacher educators, we realize our role in the production of mathematics teaching is not inconsequential, and, thus, warrants a critical analysis of our own approaches (Hamilton & Pinnegar, 1998) to supporting teachers to conceptualize and implement equity-based practices. This, however, is rarely best accomplished in isolation; therefore, we enlisted each other’s support to navigate the “everyday data” that ought to inspire and motivate us to craft our curriculum and instruction: the dominant social narratives around mathematics teaching and learning, and those that our PMTs have brought to the table. The goal of this collaborative self-study is to develop political clarity about these narratives and our own positioning so that it will enable us to engage with teachers in a way that,

similarly, helps them develop political clarity and sociocultural consciousness with respect to mathematics teaching with children of color.

Our vehicle to achieve this goal was self-interrogation designed to assess our effectiveness and to provide us with continued professional growth and development as educators (Fletcher & Bullock, 2015; Lunenberg, Zwart, & Korthagen, 2010). We recognize that we ask much of our PMTs by way of re-thinking and changing mindsets. This is a direct departure from the often isolated professional world, confined by rigid schedules, and where few opportunities are provided to directly name and confront stubborn inequities found in mathematics teaching and learning.

Position Statements Spark Inquiry

For decades, there have been calls for fundamental shifts in the way we frame, talk about, and deliver mathematics education in order to achieve more equitable outcomes (e.g., Aguirre, 2009; Gutiérrez, 2002, 2007b; Khisty, 1995; Martin, 2000, 2003; Secada, 1989). NCTM’s position statement regarding closing the opportunity gap calls for all students to have high-quality mathematics instruction, learn challenging grade-level content, and receive the support necessary to be successful (NCTM, 2012). The organization further identifies “differential access” as the culprit for inequities in mathematics teaching and learning. In NCTM’s *Principles to Action* (2014), equity and access are the key components in enacting a strong, standards-based practice that provides high quality teaching and learning for all students. The publication identifies necessary shifts in beliefs and practice to help support teachers in implementing an instructional practice around rigorous standards. The National Council of Supervisors of Mathematics (NCSM) and TODOS: Mathematics for All (2016) have an expanded position statement regarding social justice, making a stronger call to establish a “just, equitable, and sustainable system of mathematics education for all

children.” The statement calls for acknowledgement, action, and accountability:

There must be acknowledgment of the unjust system of mathematics education, its legacy in segregation and other forms of institutional systems of oppression, and the hard work needed to change it. The actions taken must be driven by commitments to re-frame, re-conceptualize, intervene, and transform mathematics education policies and practices that do not serve to promote fair and equitable mathematics teaching and learning. And there must be professional accountability to ensure these changes are made and sustained (NCSM & TODOS, 2016, p.1).

Given these current declarations, we, the authors, have questioned whether we are preparing PMTs in effective ways to provide equitable mathematics teaching and learning opportunities children of color (e.g., Martin, 2015). Gutstein (2006) and Gutiérrez (2012), among others, have argued for mathematics teachers and PMTs to develop political knowledge in order to become aware of the ways in which mathematics teaching and learning can marginalize or empower learners, particularly children of color. Martin (2015), in his plenary address at the annual meeting of NCTM, highlighted the magnitude of the problem: “This is true because most systems and institutions in our society, including mathematics education, are not set up to serve the collective Black” (p. 21). He argued that position statements, ideologies, and mottos are not actions that could create equitable mathematics practices. These messages are reason to question our teaching practice as White MTEs in the design and implementation of elementary mathematics methods.

We find ourselves questioning our effectiveness, as MTEs, to certify teachers who critically understand that the responsibility of teaching mathematics means working to acknowledge and dissolve various forms of privilege and normativity (e.g., White, class-based, Christian) that serve to oppress many youth and communities that fall outside of normalized, dominant spaces. We have found that PMTs mean well and believe that they will work to meet the needs of all of their students. But, as MTEs, we asked ourselves, “Have we helped them develop a critical lens and disposition that

allows them to question contemporary structures and practices that perpetuate inequities that would qualify them as critical mathematics teachers (CMTs)?” The approach to elementary mathematics methods needs interrogation of the primary domains that tend to constitute “good” preparation of mathematics teachers: content, pedagogy, and critical perspective (Aguirre, 2009; Felton-Koestler, 2015). Elementary mathematics methods courses can provide MTEs with the opportunity to identify and address misconceptions about students and content through coursework, field experiences, and class discussions, in addition to highlighting the power and privilege that comes from teaching mathematics. PMTs must be empowered to teach differently, using a lens of social justice. In our minds, this is the variable that will turn the profession, but the pathway to achieving this goal is not clear. This self-study was designed to hold up the mirror to ourselves (Gutiérrez, 2007a) in order to critically interrogate our professional practices and dispositions.

Methods

Research Questions and Approach to Research Design

We, two MTEs, are generally interested in understanding how MTEs’ perspective on quality (and critical) mathematics teaching manifests in their mathematics methods courses with prospective teachers. The following research questions guide this work: 1) How do MTEs come to understand the necessary components of preparing PMTs to teach equitably? 2) How do MTEs prioritize the development of PMTs’ knowledge, skills, and dispositions related to content, pedagogy, and critical stance? 3) What would be the core propositions for critical mathematics teacher educators and prospective mathematics teachers?

To ensure a thorough examination of “beliefs and actions,” or “walking our talk,” which are often the purpose of self-study (Hamilton & Pinnegar, 1998, p. 239), we opted to examine our own histories, perspectives, and priorities through the use of collaborative auto-ethnographic methods. We recognized a need to understand the layers in which MTEs make meaning of their work preparing future mathematics

teachers. In the first phase of this process, we wrote and examined our 1) autobiographies and 2) narratives around current tensions surrounding our mathematics teacher preparation work and visions for equitable and socially just mathematics classrooms, particularly for children of color and other marginalized groups (Martin, 2015). We each wrote our autobiographies beginning with our childhood through our first experiences teaching mathematics methods, thus capturing our histories. Following grounded theory methods (Glaser & Strauss, 1967), we initially used open coding to bring forth the most compelling and significant themes across this written work. Next, in the form of additional narratives, we responded to key questions from one another regarding our autobiographies. These supplementary narratives dug deeper into the layers of influence – the previously under-examined experiences – that shaped our perspectives over time. Both the autobiographies and the narratives sought to capture perspectives that developed as a result of our past, and these perspectives ultimately shaped our priorities in the development of our mathematics methods courses and corresponding field experiences. Once again, we

followed grounded theory methods (Glaser & Strauss, 1967) for coding to move forward with our analysis.

In the second phase, we used the emergent themes from our written autobiographies (histories) and narratives as provocations for dialogue around key tensions in our respective perspectives and priorities pertaining to equitable mathematics instruction. These recorded conversations were coded using an axial coding process, where relationships could be drawn between particular themes. We found it useful to organize these themes (and the relationships among them) by classifying them as background, midground, and foreground (Saldaña, 2009). *Background* refers to the origins, or historical roots, of particular belief systems and practices. *Midground* represents tensions around program and schooling structures, as well as our teaching practices, that serve differentially well to support PMTs to develop knowledge, skills, and dispositions necessary for equitable mathematics teaching. In *Foreground*, we include themes relating to our vision for, or ideals that signify, more socially just teaching and learning spaces. Table 1 depicts the summaries of the major themes that emerged from our analyses.

Table 1

MTEs' background, midground, and foreground: Equitable mathematics teaching

Craig	Background	Stefanie
<p>Attended public schools in suburban Milwaukee with mostly White student population; many teachers in family; attended college to be an actuary but taught middle school math on probationary license in bilingual program in Denver Public Schools; while teaching, received critical mentorship from teacher-colleagues (one Latino, one Latina, one White woman) and school leadership (two Black women, one Black man, one Chicano, and one bilingual White woman) in the form of a particular set of values and approaches to working with Spanish-speaking children</p>	<p>Grew up in a small, farming town, population 1000 (mostly White); daughter of a teacher and farmer/ businessman; Christian home with high expectations for life (give 110%); decided to become a teacher because of younger brother's school experience (out to change the profession); urban MAT teaching program; successful teacher for 9 years and National Board Certified Teacher (NBCT) and instructional coach for 3 years</p>	<p>Believed all kids can learn at high levels; believed in the vision of Lisa Delpit, Marva Collins, Jonathan Kozol; believed it was my job to empower not embarrass, label or break down my students; believed in a strength-based practice instead of a deficit model; recognized problems within an unjust educational system and fought them – head on and with creative insubordination; believed in treating teachers as professionals and building capacity</p>
<p>Intuitively understood that relationships with kids mattered in supporting their math learning, but lacked pedagogical and content knowledge; in graduate school, research activity in after-school club and urban classrooms helped me deconstruct the problematic nature of mathematics teaching and learning with Latinas/os and see what might be possible if alternative spaces – ones with Latinas/os' general interests, identities, and affinity to mathematics in mind – were created and refined</p>		

Midground

Current struggles are rooted in seeing unengaging and uninspiring mathematics (and literacy) lessons by student teachers at the very end of the program; unclear how to design learning activities that demonstrate the need to re-think how we teach math and what constitutes mathematical engagement

Similarly, what kinds of learning experience illuminate math learning as a racialized experience, and help teachers consider, believe in, and enact math instruction grounded in principles of culturally relevant pedagogy?

Working under NCLB, I honestly believed in that mission; however, when getting results administrators and peers worked to break me down - did they really want student success for all? As an instructional coach, faced with practices of tracking students and biased decisions.

Designing and teaching methods, focused on content knowledge (Ma, 1999); each year added more experiences, readings, around critical perspective due to language like, “these kids,” “that side of town,” and “the parents don’t care.” Project Teach Math modules were added to my teaching

Foreground

I believe notions of identity and affinity need to be foregrounded in math instruction to guide significant change in classroom practice and learning outcomes; interpersonal relationships and productive discourse are central to achieving equitable classrooms

Equitable math teaching will not come without respect for children of color, their families, and communities; each of these is the source of inspiration and learning resources; also, broader (critical) perspectives need to be developed around what children of color or poor children deserve to get from schooling and what we think they’re capable of, which will allow for race-conscious innovation to occur in the classroom

Dialogue and discussions about children of color have improved, but, in prospective teachers’ teaching reflections, the biases re-emerge; the terms power and privilege are now prevalent in the course

I wonder about their placements; they don’t have someone to provide a counter- narrative to the dominant and marginalizing math teaching practices taking place. I wonder if the mentor teachers and culture of the school provides a barrier to apply the issues and concerns that the methods class addressed? I wonder am I doing enough?

The third phase of this work included connecting our self-study to the core propositions of the National Board of Professional Teaching Standards. Seeking a similar mechanism for a reflective teaching practice, this model for professional development was a logical parallel to the self-study we were undertaking to examine our practice as MTEs.

Findings

Understanding that our identities are shaped by histories in relation to the inherent power and privilege of being White mathematics teacher educators was the first step in working toward a critical vision for preparing PMTs. Two things have become clear and are supported by multiple data points. First, as MTEs we recognized that our perspectives and priorities as MTEs are shaped by

our histories, which include our past experiences as teachers and learners, sociocultural influences, and mentors. Second, the elementary mathematics methods curriculum is complex in that it is fueled by the intersection of multiple knowledge bases (i.e., content, pedagogical, critical perspective) and the responsibility to promote social change. The next two sections document movement in our thinking around our work with mathematics teachings as a result of our ongoing dialogue and analysis of our teaching practices, and how these practices emerged from our histories and perspectives and led to pedagogical priorities. Specifically, we report our thoughts around why large shifts towards more critical mathematics teaching are slow to gain momentum, and what we recognize we need to do with prospective teachers (in the form of learning activities) in order to help them feel like they

are on solid theoretical and moral ground from which they can launch equitable mathematics instruction for children of color.

Background: The Shaping of Our Perspectives on Equitable Math Teaching

While examining our historical experiences and considering how they shaped our present-day perspectives and decision making, we focused on and interrogated our underlying beliefs around teachers' effectiveness with mathematics instruction. Craig often wondered about the primary sources of teachers' belief systems, since that is what drives their curricular and pedagogical decision-making processes. In discussing how many teachers do not identify positively with mathematics, he asked Stefanie, "To what do you attribute teachers' affinity for or alienation from mathematics?" While expecting Stefanie to comment on socialization processes and historical experiences, he was a bit surprised when Stefanie started sharing stories about doing instructional coaching with teachers in the schools where she has worked. Stefanie spoke freely about how teacher growth occurs once a culture has been established that emphasizes professionalism in non-trivial ways. As a primary step towards growth, teachers were asked not to make excuses for children's underperformance. Too often it is easy to conjure up reasons why a child "isn't getting it." However, this absolves teachers from accepting the impact of their role in the teaching and learning process, and, in the context of working with children of color, often signals instances of deficit thinking or Whiteness at work (Gutiérrez, 2008).

We noticed a clear distinction in the ways that we see the sources of teachers' practices and the necessary conditions to catalyze change. Craig places a lot of weight on the historical experiences of teachers as a major contributor to the way they determine what is appropriate and effective mathematics teaching practices. From infancy to adulthood, family members, community members, teachers, institutional (i.e., school) culture, peers, and commercial or non-commercial curricula all play a role in shaping teacher's perspectives, mathematics ideologies, and subsequent

practices; in short, it is a sociocultural and sociopolitical experience.

While not denying these influences, Stefanie views teachers' decision-making processes and outlooks as an outgrowth of institutional culture and interpersonal relationships. As alluded to above, she has powerful firsthand experiences serving as instructional coach and having responsibility to instigate teacher change. She credits a school leader for establishing a positive tone around children, and notes the responsibility of the teacher to perpetually seek and refine practices to meet the needs of (struggling) children. Furthermore, teachers were expected to adopt a disposition in which they introspectively recognized a need for improvement, and the principal accepted responsibility for providing the tools with which to achieve increased success with students.

Just as teachers may grow increasingly confident in their approaches to helping children learn, we have found that it is quite easy to become sure of our own approaches to teaching mathematics methods to PMTs. Similarly, it is quite easy to locate any inadequacies among the teaching performances of these teachers *within* the teachers themselves; in other words, it's the PMTs' fault they are not taking up the ideas presented in the course readings and discussions. Throughout our discussions, we both acknowledged a sense of elitism or disconnectedness from the PMTs' reality. Interestingly, this sounds remarkably like what often happens between teachers and children: over time, teachers might become increasingly confident in their craft, which leads to fewer instances in which they might take up opportunities to check and adjust their perspective and teaching practices so that they are serving those who most deserve mathematics support. The collaborative process between MTEs, where we purposefully interrogated one another's historical trajectory and traced current decision-making practices to historical events, produced valuable new insights. It's reasonable to conclude that this form of collaborative self-study could serve as a mechanism for teacher reflection and growth, especially around the development of critical consciousness and corresponding approaches to equitable teaching.

Elementary Mathematics Methods Courses and Clinical Experiences

As we compared our priorities pertaining to the approach of teaching mathematics methods, it was clear that our histories and perspectives influenced our priorities. Craig's strong sociopolitical education in graduate school and early teaching led to his inclusion of activities within his two methods courses that focus on acknowledging and leveraging the learning resources that naturally exist in children's homes and communities. Stefanie's priorities were situated in the development of strong content knowledge, a decision that can be traced to her reception of societal perspectives surrounding elementary teachers. Historically, she was bombarded with messages about teachers' lack of intelligence, and that she was too smart to become a teacher. She also grappled with the international data highlighting American teachers as inferior to their international peers (Ma, 1999). Another influential factor for both authors was their experiences in graduate programs with an acute focus on urban education and teaching diverse learners. In addition, both authors committed considerable time within methods courses to dissect issues of pedagogy, especially the conceptual teaching of fractions.

In addition to priorities, we also analyzed our histories and perspectives regarding teacher change and development. Unsurprisingly, our interactions with and observations of practicing teachers directly inform our stance and instructional design with prospective teachers. One of our recorded conversations about teacher change and teachers' willingness to consider, try, and commit to new, more critical approaches to mathematics teaching led us to the notion of trust. Certainly, there is a political dimension to critical mathematics teaching, and there is a confluence of factors that might inhibit or enable pedagogical change. However, in recounting Stefanie's stories about the struggles and successes as she worked with teachers, it became apparent that teacher change rarely happens without a trusting relationship. As Stefanie candidly once told a teacher who expresses hesitancy, or skepticism around the motives of the observations, "We can't move forward until you understand that there is no one right way to teach math effectively." She (Stefanie)

also shared that she was not looking for the teacher to teach exactly like she would; the teacher first needed to trust that Stefanie respects her intentions and efforts, and that she was there merely to see, learn, and perhaps provoke new considerations through discussion of the observation.

Similarly, prospective mathematics teachers (PMTs) require the same assurances before they can "hear" the counsel related to developing equitable teaching practices from their instructors or mentors. This parallel resonated with Craig, as he has recognized how he has lost sight of this fundamental component of supporting neophyte teachers: trust. PMTs need to trust that instructors have good reason for promoting the approaches to mathematics teaching that they do, they need to trust that instructors will not judge them for their shortcomings and will maintain a professional level of confidentiality, which will allow them to take risks and be honest in sharing their thinking, and PMTs need to trust that the instructors or instructional coach/mentor will be able to help them get to the level of proficiency that they desire. Without a trusting relationship undergirding the complex learning environment that characterizes, say, student teaching, PMTs are not likely to develop critical competencies or a polished skill set necessary to support the learning of children of color. Just as designing and managing a methods course involves multiple dimensions, we recognize that becoming a teacher is multi-dimensional in that it inherently requires PMTs to reconcile at least three strands of information: 1) new ideas about schooling and mathematics pedagogy they have been asked to consider and incorporate into instruction, 2) the sense they have made historically of their own schooling experiences, and 3) the socialization process teachers experience in schools, including poignant messaging about children, families and communities. If MTEs are not prepared to address each of these dimensions in conjunction with the others, we, as a field, run the risk of promoting mediocrity among teachers, especially those serving children of color.

New Terrain: Propositions for Critical Mathematics Teachers and MTEs

& Goldhaber, 2015; Hakel, Koenig & Elliott, 2008; Goldhaber & Anthony, 2007). Because of the reflective nature of the National Board process, we use it as a means to guide the reflective practice of a self-study and identify parallel core propositions for mathematics teacher educators and critical mathematics teachers. In order for MTEs to support the development of PMTs towards becoming critical mathematics teachers, we propose this set of core propositions that would provide a consistent set of beliefs without standardizing methods courses or binding our course content.

In 1987, the National Board of Professional Teaching Standards (NBPTS) changed the criteria and description of what it means to be an accomplished teacher through the intense process of reflective professional development. Since then, there have been numerous studies recognizing the benefits of National Board Certified Teachers (NBCTs) on student achievement (Cantrell, Fullerton, Kane & Staiger, 2008; Chingos & Peterson, 2011; Clotfelter, Ladd & Vigdor, 2007; Cowan

Table 2
Core Propositions offor NBPTS, MTEs, and Critical Mathematics Teachers

National Board of Professional Teaching Standards (NBPTS) Propositions	Proposed Critical Mathematics Teachers (CMTs) Propositions	Proposed Mathematics Teacher Educators (MTEs) Propositions
Teachers are committed to students and their learning	CMTs are committed to mining and developing the mathematical brilliance of children.	MTEs are committed to preparing and supporting high quality mathematics teachers and their practices.
Teachers know the subject they teach and how to teach those subjects to students	CMTs have a strong understanding of mathematics learning trajectories and how to flexibly move within and among these trajectories.	MTEs know mathematics and pedagogy, and understand that how these are represented in classrooms and beyond matters significantly in how children affiliate with mathematics.
Teachers are responsible for managing and monitoring student learning	CMTs are responsible for monitoring student learning and its intersection with learners’ identities.	MTEs are responsible for managing and monitoring PTs learning and dispositions.
Teachers think systematically about their practice and learn from the experience	CMTs think systematically about their practice and how it represents or disrupts dominant or harmful ideologies about mathematics teaching and learning.	MTEs think systematically about their practice and how it represents or disrupts dominant or harmful ideologies about mathematics teaching and learning.
Teachers are members of learning communities	CMTs are resourceful, continually seeking and sharing new knowledge from and with learning communities.	MTEs are resourceful, continually seeking and sharing new knowledge from and with learning communities.

With these propositions we would like to draw a parallel between teacher growth (e.g., staying current with professional literature, collaborate, be open to change) and MTE growth (e.g., research, collaboration, staying current with classroom teaching practices and context). We, as MTEs often lament the fact that classroom teaching is disconnected/dissociated from rich theory

and research, but we can be the bridge between these worlds, and teachers can, too. But this takes explicit support, in the form of explaining why and demonstrating how. It means providing concrete representations of abstract concepts - collaborating, fumbling, improving, honoring and believing in children, reading and using research, resisting (see

creative insubordination [Gutiérrez, 2016]), and building trusting, professional relationships. This also means being living examples of quality mathematics teaching and, through our discourse with teachers, demystifying what quality mathematics teaching and learning looks like.

We need to position ourselves as credible knowers, producers, and consumers of new knowledge. This means being in schools and classrooms, at a minimum, and demonstrating teaching needs to be a more central feature of our practice. We teach prospective teachers to know their students, but first they must know themselves. Effectiveness as MTEs is predicated on forming productive and trusting relationships with our pre-service teachers; this reflective process of critical self-study has helped illuminate this reality. Strong content and pedagogy will only take them so far. It is important to reiterate that we're not interested in standardizing mathematics methods courses; rather, we'd like to treat it with the same professional scrutiny, and through the same critical, reflective process, that we know is central to teachers' growth.

Summary

The development of the next generation of CMTs to plan and enact mathematics instruction effectively with children of color is vital in changing the structure that so strongly marginalizes many. Through intentional teacher preparation and support where MTEs collaborate, study, and reflect on their effectiveness and their instructional practice, the landscape can start to change. There is an urgency as our children of color continue to have fewer meaningful mathematics opportunities, thus keeping them marginalized. By being CMTs, we recognize our histories, perspectives, and priorities all play crucial roles in the development of our elementary mathematics methods course, but also in our work with practicing teachers. Without collaborative efforts like this self study, there is a decreased likelihood of forwarding a serious, shared, and progressive mission or vision for the preparation of CMTs, one that disrupts decades of stagnancy in the field with respect to inequitable opportunities to learn mathematics.

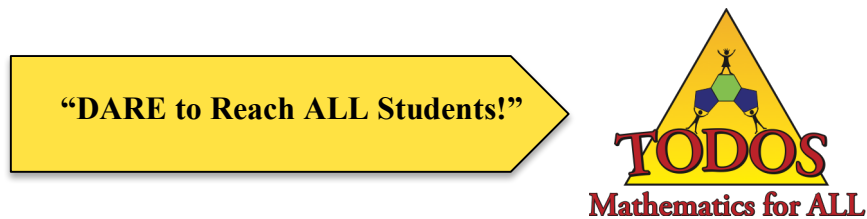
References

- Aguirre, J. (2009). Privileging mathematics and equity in teacher education: Framework, counter-resistance strategies and reflections from a Latina mathematics educator. In B. Greer, S. Mukhopadhyay, S. Nelson-Barber, & A. Powell (Eds.), *Culturally responsive mathematics education* (pp. 295–319). New York: Routledge.
- Cantrell, S., Fullerton, J., Kane, T. J., & Staiger, D. O. (2008). National board certification and teacher effectiveness: Evidence from a random assignment experiment. National Bureau of Economic Research Working Paper No. 14608.
- Chingos, M. M., & Peterson, P. E. (2011). It's easier to pick up a good teacher than to train one: Familiar and new results on the correlates of teacher effectiveness. *Economics of Educations Review*, 30(3), 449-465. doi:<http://dx.doi.org/10.1016/j.econedurev.2010.12.010>
- Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2007). Teacher credentials and student achievement: Longitudinal analysis with student fixed effects. *Economics of Education Review*, 26(6), 673-682. doi:<http://dx.doi.org/10.1016/j.econedurev.2007.10.002>
- Cowan, J., & Goldhaber, D. (2015). National board certification and teacher effectiveness: Evidence from Washington state. *Journal of Research on Educational Effectiveness*, 9(3), 233-258. doi:10.1080/19345747.2015.1099768
- Felton-Koestler, M. D. (2015). Mathematics education as sociopolitical: Prospective teachers' views of the What, Who, and How. *Journal of Mathematics Teacher Education*, 20(1)1-26. doi:10.1007/s10857-015-9315-x
- Fletcher, T., & Bullock, S.M. (2015). Reframing pedagogy while teaching about teaching online: A collaborative self-study. *Professional Development in Education*, 41(4), 690–706.
- Flores, A. (2007). Examining disparities in mathematics education: Achievement gap or opportunity gap? *The High School Journal*, 91(1), 29-42.
- Glaser, B., & Strauss, A. (1967). *Grounded theory: The discovery of grounded theory*. Chicago: Aldine.
- Goldhaber, D. & Anthony, E. (2007). Can teacher quality be effectively assessed? National board certification as a signal of effective teaching. *The Review of Economics and Statistics*. 89(1), 134-150. Retrieved from <http://www.jstor.org/stable/40043080>

- Gutiérrez, R. (2002). Enabling the practice of mathematics teachers in context: Towards a new equity research agenda. *Mathematical Thinking and Learning*, 4(2-3), 145-187. doi:10.1207/S15327833MTL04023_4
- Gutiérrez, R. (2007a). Context matters: Equity, success, and the future of mathematics education. In *Proceedings of the 29th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1-18). Stateline (Lake Tahoe), NV: University of Nevada, Reno.
- Gutiérrez, R. (2007b). (Re)defining equity: The importance of a critical perspective. In N. Nasir & P. Cobb (Eds), *Improving access to mathematics: Diversity and equity in the classroom*, (pp. 37-50). New York: Teachers College Press.
- Gutiérrez, R. (2008). A "gap-gazing" fetish in mathematics education? Problematizing research on the achievement gap. *Journal for Research in Mathematics Education*, 39(4), 357-364.
- Gutiérrez, R. (2012). Embracing *Nepantla*: Rethinking knowledge and its use in mathematics teaching. *REDIMAT Journal of Research in Mathematics Education*, 1(1), 29-56. doi:http://dx.doi.org/10.4471/redimat.2012.02
- Gutiérrez, R. (2016). Strategies for creative insubordination in mathematics teaching. *Special Issue Mathematics Education: Through the Lens of Social Justice*.
- Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. New York: Routledge.
- Hakel, M. D., Koenig, J., & Elliott, S. W. (2008). *Assessing accomplished teaching: Advanced-level certification programs*. Washington, D.C.: National Research Council, National Academic Press.
- Hamilton, M. L. & Pinnegar, S. (1998). The value and the promise of self-study. In M.L. Hamilton (Ed.), *Reconceptualizing teaching practice: Self-study in teacher education* (pp. 235-246). London: Falmer.
- Khisty, L. L. (1995). Making inequality: Issues of language and meanings in mathematics teaching with Hispanic students. In W. G. Secada, E. Fennema, & L. B. Adajian (Eds.), *New directions for equity in mathematics instruction* (pp. 279-297). Cambridge, UK: Cambridge University Press.
- Lunenberg, M., Zwart, R., & Korthagen, F. (2010). Critical issues in supporting self study. *Teaching and Teacher Education*, 26(6), 1280-1289.
- Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Martin, D. B. (2000). *Mathematics success and failure among African-American youth: The roles of sociohistorical context, community forces, school influence, and individual agency*. Mahwah, NJ: Erlbaum.
- Martin, D. B. (2003). Hidden assumptions and unaddressed questions in mathematics for all rhetoric. *The Mathematics Educator*, 8(1), 7-21. Retrieved from <http://tme.journals.libs.uga.edu/index.php/tme/article/view/127/118>.
- Martin, D. B. (2011). What does quality mean in the context of white institutional space? In B. Atweh, M. Graven, W. Secada, & P. Valero (Eds.), *Mapping equity and quality in mathematics education* (pp. 437-450). New York: Springer.
- Martin, D. B. (2015). The collective black and principles to actions. *Journal of Urban Mathematics Education*, 8(1), 17-23. Retrieved from <http://education.gsu.edu/JUME>
- National Council of Supervisors of Mathematics & TODOS: Mathematics for All. (2016). *Mathematics education through the lens of social justice: Acknowledgement, actions, and accountability*. Retrieved from http://www.todos-math.org/assets/docs2016/2016Enews/3.pospaper16_wtodos_8pp.pdf
- Saldaña, J. (2009). An introduction to codes and coding. *The coding manual for qualitative researchers* (pp. 1-31). London: Sage.
- Secada, W. G. (1989). Agenda setting, enlightened self-interest, and equity in mathematics education. *Peabody Journal of Education*, 66(2), 22-56. Retrieved from <http://www.jstor.org/stable/1492537>
- Stinson, D. W. (2004). Mathematics as "gate-keeper"?: Three theoretical perspectives that aim toward empowering all children with a key to the gate. *The Mathematics Educator*, 14(1), 8-18.

Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. What are the primary roles of the next generation of CMTs if we intend to provide equitable mathematics learning opportunities for children of color?
2. What is the value in self-study as a vehicle to promote change among mathematics teachers?
3. What would it take to develop a productive self-study in your professional context?
4. How can teacher preparation programs provide PMTs with provocative experiences that challenge conventional practices and foster the development of dispositions that serve as conduits to equitable mathematics teaching with all children?

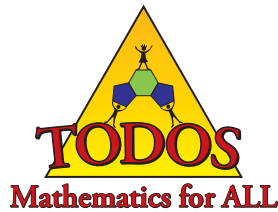


TODOS Mission and Goals

The mission of TODOS: Mathematics for ALL is to advocate for equity and high quality mathematics education for all students— in particular, Latina/o students.

Five goals define the activities and products of TODOS: Mathematics for ALL

1. To advance educators' knowledge and ability that lead to implementing an equitable, rigorous, and coherent mathematics program that incorporates the role language and culture play in teaching and learning mathematics.
2. To develop and support educational leaders who continue to carry out the mission of TODOS.
3. To generate and disseminate knowledge about equitable and high quality mathematics education.
4. To inform the public and influence educational policies in ways that enable students to become mathematically proficient in order to enhance college and career readiness.
5. To inform families about educational policies and learning strategies that will enable their children to become mathematically proficient.



Illustrating Effective Teacher Reflection and Instructional Practices that Support English Learners in Mathematics

Sara Morales

New Mexico State University

Terri Sainz

New Mexico State University

Kathryn Million

Las Cruces Public Schools

Kathe Kanim

New Mexico State University

Abstract

Equity-based practices include positioning students as sources of expertise; distributing authority among students and teachers; and creating authentic experiences that explore mathematical ideas (Aguirre, Mayfield-Ingram & Bernard, 2013). This article describes how positioning, authority, and authentic experiences may empower English Learners (ELs). We worked with two separate Dual Language kindergarten classrooms to generate ideas for effective mathematics teaching so that each child succeeds. Our purpose was to: a) provide teachers opportunities and structures to examine their practices and reflect on how their decisions impact ELs, and b) examine the strategic use of positioning, authority, and authentic math experiences.

Discussion And Reflection (DARE) Pre-Reading Questions

1. In what ways do you reflect on your teaching practices?
2. What does equitable mathematics teaching for English Learners look like? Give an example.

Sara Morales (smorales@nmsu.edu) is a researcher for Mathematically Connected Communities (MC²) at New Mexico State University (NMSU). A native of Puerto Rico, former resident of Hawaii and Florida, and now residing in New Mexico, she has always worked with diverse populations and has a strong commitment to English Learners (ELs).

Terri Sainz (tsainz@nmsu.edu) is a K-12 Outreach Specialist for MC² at New Mexico State University. Her area of concentration is technology and cultural diversity. As a former district/school administrator, she influenced teachers resulting in positive changes in teaching practices by engaging in action research projects in their classrooms.

Kathryn Million (kmillion@nmsu.edu) is an education instructor for Doña Ana Community College and has also taught in the K-3 Dual Language program in the Las Cruces Public Schools District. As a graduate of the MC² Leadership Institute for Teachers (LIFT), her classroom has been utilized as an exemplary learning model for educators and instructional leaders.

Kathe Kanim (kkanim@math.nmsu.edu) is a Co-Principal Investigator (Co-PI) and Mathematics Education Specialist for MC² at New Mexico State University. Her focus is providing authentic professional learning experiences for teachers and administrators in K-12 mathematics, with emphasis on content and pedagogy in high schools.

Acknowledgement: This article honors the memory of our friend and colleague, Dr. Cathy Kinzer, NMSU Associate Professor, who initiated and conceptualized this research project as her sabbatical study. Dr. Kinzer's dedication to mathematics equity and access for all children remains at the forefront of our work.

Illustrating Effective Teacher Reflection and Instructional Practices that Support English Learners in Mathematics

Sara Morales, Terri Sainz, Kathryn Million, and Kathe Kanim

An excellent mathematics program requires that all students have access to a high quality curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential (NCTM, 2014). However, typical math instruction sometimes falls short of equitable teaching for English Learners (ELs). Equity-based practices include positioning students as sources of expertise, distributing authority among students and teachers, and creating authentic experiences that explore math ideas (Aguirre, Mayfield-Ingram & Bernard, 2013). In working with teachers, Gutiérrez (2009) finds it useful to explain four key dimensions of equity (Access, Achievement, Identity, and Power) and concludes that equity is ultimately about the distribution of power. One way to measure the power dimension is by voice in the classroom -- for example, who gets to talk.

New Mexico State University (NMSU) College of Education faculty, Mathematically Connected Communities (MC²) staff, a federal/state funded project, and Las Cruces Public Schools (LCPS) educators joined efforts to develop a plan for implementing change to improve equitable math instruction in early grades through teacher reflection and the implementation of instructional practices which empower ELs in the classroom including positioning, authority, and authentic math experiences. We looked deeper into how mathematics teaching and learning can support and strengthen the ways teachers and other students interact with ELs in the classroom and the importance of teacher reflection. Research substantiates the role of reflection in teachers' professional growth. With deliberate thinking, an educator purposefully seeks more information than the immediate context provides by, for example, talking with colleagues (Danielson, 2009). Our purpose was to

a) provide teachers opportunities and structures to examine their practices and reflect on how their decisions impact ELs and b) to examine the strategic use of positioning, authority, and authentic math experiences.

Background

At the time Tombaugh Elementary was selected to carry out our plan for implementing change, the school served over 600 students of which approximately 19% are ELs. Schoolwide math proficiency was 17% for all students and less than 2% for ELs. A Two-Way Dual Language model was being implemented at the school, in which 70% of instructional time targets a student's first language and 30% is in the student's second language. Instruction consists of each Spanish-dominant student (SDS) being paired with an English-dominant student (EDS), Language Arts taught in the students' primary language, all science in Spanish due to the many cognates found in the content vocabulary, social studies in Spanish, and all mathematics taught in English since, with few exceptions, the system for representing numbers and algorithms does not need translation.

Our twofold plan for implementing change consists of (1) a student component including surveys, interviews, pre-/post-assessments, and team-building strategies and (2) a teacher professional learning component comprised of unit/lesson planning, co-teaching and observations, implementation videos, and reflection/debrief. A master schedule provided guidance for the timeline of recurring activities. Although we implemented both components, only the teacher professional learning plan (Table 1) is discussed in this article.

Table 1
Teacher Professional Learning Plan

Unit/Lesson Planning	A 3-week math unit with six lessons was jointly planned by teachers and other district staff members during the fall semester. Each person was asked to bring two ideas addressing grade-specific Common Core standards to the planning sessions. This process was then replicated in the spring. A total of 12 lessons were co-developed.
Co-teaching & Observations	Teachers observed district staff co-teaching one lesson during each math unit. Teachers co-taught one lesson with district staff in each unit. Teachers and district staff were video-taped while teaching and these recordings were later used to reflect/debrief.
Implementation Videos	All 12 lessons were filmed by NMSU students while four students in the class wore GoPro cameras to capture footage from a different perspective.
Reflection/ Debrief	The lesson plan template was revised by teachers/district staff as a result of viewing implementation videos, analyzing student work, and discussions. The template was used as a guide for reflecting on instructional practices and informed equitable math instruction.

Instructional Practices

Following the teacher professional learning plan described above, we examined the strategic use of teacher reflection, positioning, authority, and authentic math

experiences, in selected Dual-Language kindergarten classrooms. A brief description of these instructional practices (Table 2) is provided, followed by examples of how each may empower ELs.

Table 2
Description of Instructional Practices

Instructional Practice	Description
Teacher Reflection (Danielson, 2009)	<ul style="list-style-type: none"> • Provides good sense of when the teacher needs to step back and think deeply • Promotes better understanding of what is/isn't working by learning more • Purposefully seeks more information than immediate context provides • Should be part of all teachers' toolkit
Positioning	<ul style="list-style-type: none"> • How ELs are situated by teachers and fellow students as sources of expertise (Aguirre, Mayfield-Ingram & Bernard, 2013) • <i>Tentative/Submissive/Incompetent</i> vs. <i>Math Thinker/Knower/Doer</i> (Chval & Pinnow, 2015)
Authority	<ul style="list-style-type: none"> • Being seen as mathematically solid by yourself and/or others (Schoenfeld, 2014) • Teacher as Sole Authority vs. Sharing Authority with Students (Aguirre, Mayfield-Ingram & Bernard, 2013)
Authentic Math Experiences (Aguirre, Mayfield-Ingram & Bernard, 2013)	<ul style="list-style-type: none"> • Play a role in how students are positioned • Play a role in how authority is shared • Provide authentic experiences for students to explore mathematical ideas

Teacher Reflection

High levels of reflection are a practice that is best fostered with colleagues. When colleagues collaborate in drafting a plan for implementing change and formally schedule follow-up discussions, this encourages the less experienced teachers to self-monitor and reflect further (Danielson, 2009). Selected teachers in dual language classrooms planned and reflected/ debriefed 12 lessons with district/university staff using the Launch/Explore/Summarize (LES) Teaching Model (Lappan, Fey, Fitzgerald, Friel, & Phillips, 2002).

Although LES was developed by Connected Math Project (CMP) for middle school grades, those involved in lesson planning were familiar with the model and expanded it to better support ELs in kindergarten classrooms. A video at <https://www.youtube.com/watch?v=FMDvMoOAX6s> shows an example of a lesson planning session. The italicized text in the *Expanded LES Template* (Figure 1) shows edits made during lesson reflection/debrief to better understand changes in positioning, authority, and/or authentic math experiences and purposefully incorporate these in future lessons.

Topic:	Date:
Organizing/Grouping Students for Success:	
<ul style="list-style-type: none"> • How will students be organized and/or grouped so that all students are successful? • <i>How will all students share their thinking with their partner, group, class, and/or teacher?</i> 	
Supplies/Materials:	
<ul style="list-style-type: none"> • <i>How will the materials be shared? How will students know how to share and use the materials?</i> 	
Part One: Goals and Objectives	
CCSS-M Content Standards:	
Learning Targets:	
<ul style="list-style-type: none"> • What specific content should the students develop within this standard(s)? • <i>How will I share this learning target so that all students can understand the focus of the lesson?</i> 	
Criteria for Success:	
<ul style="list-style-type: none"> • How will students know if they have achieved the learning target? • How will I design an assessment that demonstrates their level of success with the learning target? 	
Language Objective:	
<ul style="list-style-type: none"> • <i>How can I support students' use of math vocabulary (reading, writing, listening, speaking)?</i> • <i>Are there sentence stems that will support student discussion? If so, how will I help students feel comfortable with the sentence stem?</i> 	
Part Two: Teaching Model	
Launch (5-10 minutes):	
<ul style="list-style-type: none"> • How can I launch this problem? • What prior knowledge do my students need? • How can I make the launch meaningful, relevant, and engaging for my students? • <i>How can I incorporate movement, role play, and song to support engagement in the math? Can I use a classroom or cultural story context that supports the math and connects to students' lives?</i> • <i>During launch, ask specific math questions and use turn and talk so all kids participate?</i> • <i>Can I give students Think Time and time for Turn and Talk before calling on individuals to respond to questions? (once individual student has answered, revoice student thinking so all students hear ideas)</i> • <i>How can I provide multiple opportunities for students to use math terminology?</i> • <i>How can I chart the students' math thinking?</i> 	
Explore (15-25 minutes):	
<ul style="list-style-type: none"> • What strategies might students develop through the task? • What questions can I ask to help move their thinking forward? • <i>How can I design a problem/situation/task that is open-ended so that students are engaged in the Explore?</i> • <i>If in partners or groups, how will the task be divided so that each member has a meaningful role when sharing (thoughts, ideas, materials, etc.)?</i> • <i>How can I position all students as math thinkers, learners, doers in group interactions?</i> • <i>How can we make the task deep enough so that students have extended time exploring the math concept?</i> 	
Summarize (15-25 minutes):	
<ul style="list-style-type: none"> • How can I orchestrate the discussion so the students summarize the thinking in the problem? • <i>How can students use the summary to reflect on their own Explore of the problem by using concrete examples to Turn and Talk to summarize student thinking?</i> • <i>Which groups will I select to demonstrate misconceptions, learning, and new thinking?</i> • <i>How will these selected students support other students' thinking through the summary?</i> • <i>How can I facilitate the discussion so that ALL students summarize their thinking in the problem?</i> • <i>How can I get all students engaged in the discussion?</i> • <i>What ideas need to be emphasized so they become part of classroom learning (anchor charts, digital photos, textbooks, etc.)?</i> 	

Figure 1. Expanded Launch/Explore/Summarize Template

Videographers and GoPro cameras, worn by students, captured small/large group classroom instruction, interactions, and conversations. While viewing and reflecting upon these unedited recordings, we recognized the need for change in future instruction to better address the needs of EL students. Using the revised LES template to guide our discussions, the group then made adjustments and documented strategies that promote equity. The LES model enabled us to look deeper at how to support ELs throughout the lessons.

Positioning

Regular, active participation (discussing, explaining, writing, presenting) is crucial to ELs' success in math as they learn English (NGA & CCSSO, 2010). Teachers and fellow students both play roles in positioning ELs as *tentative, submissive, and possibly incompetent* or as *math thinkers, knowers, and doers* (Chval & Pinnow, 2015).

Tentative, submissive, incompetent. Ms. M unknowingly positioned her SDS as *tentative, submissive, and possibly incompetent*. Even though she values and cares about all her students, when calling on partners to share their work with the class, she gave preference to the EDS and so the SDS became disengaged. When the SDS shared her thinking, the teacher said she used the same strategy as the EDS. A video example of this type of positioning is available at <https://www.youtube.com/watch?v=v88qBFTP9T8> or refer to the transcript below.

Ms. M: Sofia & Lily had this one. OK, Lily, can you please tell us how you counted these.
English-dominant Student (EDS): I counted them by moving them back.
Ms. M: Oh, can you show me how to do that?
EDS: Uh huh, I scooted them back.
Ms. M: So you...you...let's see...OK. So you moved them back to the side.
EDS: Yeah.
Ms. M: Ok. Can you show me how? Count and show me how you did it exactly.
EDS: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
Ms. M: OK, did you see how she did it? She moved them to the side and made a row to count ten. That is

a good strategy! Now, how did you counted yours...these, uh...Sofia G?

Spanish-dominant Student (SDS): I'm counting like 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Ms. M: See, she used the same strategy that Lily did so they moved them to the side to count. So that's a good strategy...moving your objects to the side.

Math thinker, knower, doer. This time Ms. M positioned the same SDS as a *math thinker, knower, doer* by asking her to share first which gave her the opportunity to be better able to express her thinking. A video example of this type of positioning is available at <https://www.youtube.com/watch?v=KzbZLm3qpnc> or refer to the transcript below.

Ms. M: Sophia and Lily, both partners come over here and show me your thinking. Sophia, which one did you pick? Do you remember which one you picked when you were doing it? So, Sophia, can you please tell us. How are these [different]? Look. You put them the same.

Spanish-dominant Student (SDS): Because they are

Ms. M: Tell me more. How are these the same?

SDS: And it has circles.

Ms. M: Do you guys see that? Let's say it louder. OK?

SDS: And there and it has the circle.

Ms. M: Did you guys see both? She said another thing. There's another attribute about these two shapes. What is the other attribute you said? They both are what?

SDS: (inaudible)

Ms. M: Yeah, but how are they the same?

SDS: (whispers in teacher's ear in Spanish)

Ms. M: She's saying in Spanish that both of them are round. Where are they round at? Can you show me?

SDS: (points)

Ms. M: Oh, you see. Both of them are round.

Excellent!

Authority

Schoenfeld (2014) defines authority as recognition for being mathematically solid. The extent to which students are positioned in ways that afford opportunities to make conjectures, explain, make math arguments, and build on one another's ideas contributes to developing authority. Teachers can position themselves as sole authority or share authority with students.

Teacher as sole authority. Teachers may unintentionally position themselves as the sole authority which withholds opportunities from English Learners. When reflecting on GoPro camera footage at the debrief session, we noticed that although Mr. L kept the students’ attention, he had positioned himself as the sole authority. His students attentively followed the presentation for fifteen minutes with no opportunity to have a voice.

Teacher sharing authority. Later, Mr. L made changes in authority by using *Productive Talk Moves* (Chapin, O’Connor & Canavan Anderson, 2013) and *Norms of Collaboration* (Garmston & Wellman, 2009) including

revoicing/paraphrasing, adding on/posing questions, wait time/pausing, and putting ideas on the table as described in Table 3.



Figure 2. Teacher Sharing Authority with Students

Table 3
Productive Talk Moves and Norms of Collaboration

Productive Talk Moves	Norms of Collaboration
Revoicing can be used anytime with no introduction. Simply try to repeat part or all what student said and ask if that’s correct. For example, “So, are you saying that you think it’s an odd number? Is that right?”	Using paraphrase starters and following efficient paraphrase assists group in hearing/understanding one another as they converse and make decisions. For example, “Let me see if I understand you correctly. You said…”
Adding On is very general and needs little introduction. Simply asking others to respond to recent contributions of one or more students signals that you are inviting everyone in on the discussion. For example, “Who has something to add to what was said?”	Posing questions may be posed to explore perceptions, assumptions, and interpretations, and to invite others to inquire into their thinking. Use focusing questions to increase the clarity and precision of group’s thinking. For example, “What do you mean by…?”
Wait Time gives students time to think before sharing their ideas. Asking a conceptual question and waiting only one or two seconds likely frustrates students and can diminish productivity of discussions. For example, “Take 30 seconds to think quietly about what you want to say.”	Pausing before responding or asking a question allows time for thinking and enhances dialogue, discussion, and decision-making. For example, “Take one-minute personal Think Time before you discuss it with your group.”
Turn & Talk may increase the number of students willing to talk during whole class discussion. For example, ask students to report on what partner said.	Putting Ideas on the Table is the heart of meaningful dialogue and discussion. For example: “Here is one idea…”

You can see how Mr. L facilitated a large group conversation and demonstrated ways to share authority with students regardless of their dominant language in a video available at

https://www.youtube.com/watch?v=WVc-Us_b0yY.

The video transcript below annotates the associated *Productive Talk Moves* and *Norms of Collaboration*.

Mr. L: What does that math term (putting together) mean? (*Posing Questions*)
All Students: You’re putting together.

Mr. L: You’re putting together?
 (*Revoicing/Paraphrasing*) What can you put together?
 (*Posing Questions*)
Student 1 (S1): You could put some cookies together and count them.
Mr. L: Let me see if I understood you correctly. So you have some cookies and you put all the cookies together to find out how many you have.
 (*Revoicing/Paraphrasing*) What happens if you put the cookies together? (*Posing Questions*)
Student 2 (S2): You can make something with it.
Mr. L: You can make something like what? (*Posing Questions*)

S2: A gingerbread house.

Mr. L: So you can find out how many and you can also put them together to make a shape.

(*Revoicing/Paraphrasing*) What else can “put together” mean? (*Posing Questions/Adding On*)

Student 3: Two shoes and two more.

Mr. L: So when you have two shoes and then you take two more shoes and put them together, you make four shoes? (*Posing Questions*) Can I write your ideas down here on the board? (*Putting Ideas on Table*)

Mr. L: You were saying that you can put them all together to find out how many. Is that what you were saying? (*Revoicing/Paraphrasing*)

S1: You could just get a little bit of cookies and then count them.

Mr. L: So count them to know how many you have? (*Posing Questions*) (writes S1 response on board) (*Putting Ideas on the Table*) What were you saying? (*Posing Questions*)

S2: You can make a gingerbread house.

Mr. L: You can put together cookies or things like that and then it makes a shape. That’s a different way of thinking. (*Revoicing/Paraphrasing*) (writes S2 response on board) (*Putting Ideas on Table*) What were you saying “put together” means? (*Posing Questions*)

S3: You have two shoes and two shoes and that makes four.

Mr. L: So you were saying to “put together” is you can take two shoes and then two more shoes and then you put them together and that makes four. (*Revoicing/Paraphrasing*) So I’m going to put that here. So put together two groups. (*Putting Ideas on Table*)

Authentic Math Experiences

Positioning and authority also play a role in authentic math experiences. These two instructional practices should be embedded in tasks that explore mathematical ideas since they encourage *math thinkers, knowers, and doers* and the sharing of authority.

Sole authority of math experiences. This may position students as *tentative, submissive, and possibly incompetent*. For

example, a student pair worked to revisit concepts of “putting together” and “taking away”. Student 1 used Spinner A to



Figure 3. Teacher as Sole Authority of Authentic Math

select the number of cookies and then represented that amount in a five-frame. Student 2 used Spinner B to tell how many were “eaten” and Student 1 took away the cookies “eaten” from the five-frame. Ms. M acted as sole authority by only having the students repeat what she asked them to say and/or accepting simple responses such as *four*, without allowing them to share their thinking.

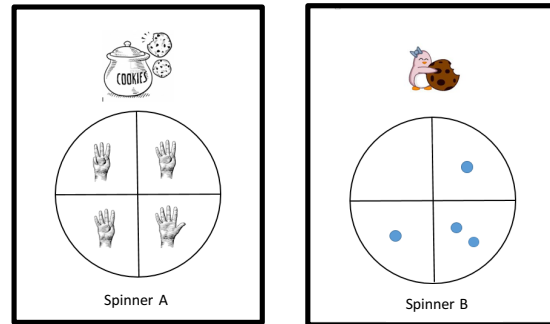


Figure 4. Math Experience Used to Revisit Concepts of “Putting Together” and “Taking Away”

View a video example of sole authority of authentic math experiences available at

<https://www.youtube.com/watch?v=gaFMDicP6vk>.

Shared authority of authentic math experiences. On the other hand, sharing authority may position students as *math thinkers, knowers, and doers*. This time, the math

task also reinforced the concept of “putting together” by having working pairs; however, authority was now shared with the students. The EDS was given a baggie with eight Froot Loops™ and the SDS received four in her bag. The students placed their cereal on one of the blanks as addends of an equation, then one student entered the agreed-upon sum. They interacted and constructed arguments using the cereal as concrete objects. The SDS referred to a cue card to ask *what happened*. A video example of shared authority of authentic math experiences is available at

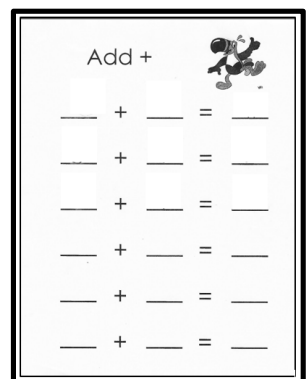


Figure 5. Authentic Math Experience Used of shared authority of authentic math experiences is available at

<https://www.youtube.com/watch?v=gPYQ51h7tDg> or refer to the transcript on the next page.

Spanish-dominant Student (SDS): You got more than mine.
English-dominant Student (EDS): No, you give me more but we're just going to...um. 1, 2, 3, 4...
SDS: But don't eat them.
EDS: ...5, 6, 7...
SDS: Wait a second.
EDS: ...8. So, I have eight and you have? Now you count them and put them there.
SDS: You can have more. Here. (Hands baggie of 4 Fruit Loops to other student)
EDS: OK, so you gave them to me and then 1, 2, 3, 4. So there's 1, 2, 3. 1, 2, 3...
EDS & SDS: ...4, 5, 6, 7, 8, 9, 10, 11, 12.
SDS: You write the 12.
EDS: So 12 altogether.
SDS: What happened now?
EDS: Let's just say 12.
SDS: Which number was it?
EDS: Um, I have 12. Ok, now we just do...now we just...
SDS: Count them. 1, 2, 3, 4, 5, 6, 7. You put 7 here and you put 3 here.
EDS: No.
SDS: Yes!
EDS: 1, 2, 3, 4, 5, 6...
SDS: You have to count to that one.
EDS: ...7, 8, 9...
SDS: You didn't listen to the teacher, right?
EDS: ...10, 11, 12.
SDS: OK, my turn.

Conclusion

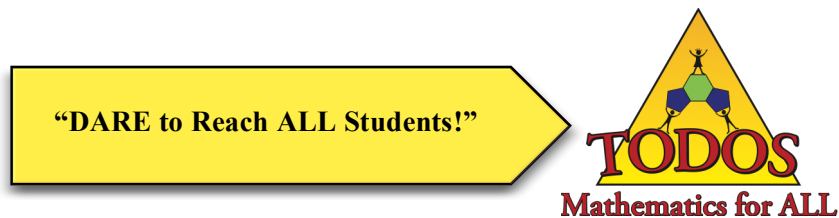
Effective change requires collaboratively developing and implementing a structured plan. After the teachers experienced collegial interactions while unit/lesson planning, co-teaching, and reflecting, they were better able to enhance equitable math instruction for English Learners. Continual reflection makes teachers more aware of what they do and why they do it (Danielson, 2009). The power of using videos as a reflection tool is integral in making informed decisions and evolving classroom practices. Gutiérrez (2009) states that voice in the classroom measures the power dimension. Positioning ELs as sources of expertise and sharing authority gives them that voice. Thoughtful teacher reflection, positioning, authority, and authentic math experiences may be replicated with diverse populations and have the potential to empower all students.

References

- Aguirre, J., Mayfield-Ingram, K., & Bernard Martin, D. (2013). *The impact of identity in K-8 mathematics: Rethinking equity-based practices*. Reston, VA: NCTM. <http://www.learner.org/workshops/missinglink/support/>
- Chapin, S. H., O'Connor, C. & Canavan Anderson, N. (2013). *Classroom discussions in Math: A teacher's guide for using talk moves to support the Common Core and more* (3rd ed.). Sausalito, CA: Scholastic, Inc.
- Chval, K.B., Pinnow, R.J., & Thomas, A. (2015). Learning how to focus on language while teaching mathematics to English language learners: A case study of Courtney. *Mathematics Education Research Journal*, 27(1), 103-127.
- Garmston, R. & Wellman, B. (2002). *The adaptive school: Developing and facilitating collaborative groups*. El Dorado Hills, CA: Four Hats Seminars.
- Gutiérrez, R. (2009). Framing equity: Helping students "Play the Game" and "Change the Game". *Teaching for Excellence and Equity in Mathematics*. 1(1), 4-8.
- Danielson, L. M. (2009). Fostering reflection. *Educational Leadership*, 66(5). Additional online content retrieved from <http://www.ascd.org/publications/educational-leadership/feb09/vol66/num05/Fostering-Reflection.aspx>
- Lappan, G., Fey, J. T., Fitzgerald, W. M., Friel, S. N., & Phillips, E. D. (2002). *Connected mathematics project*. Ann Arbor, MI: Dale Seymour Publications.
- National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: Author.
- National Governors Association for Best Practices & Council of Chief State School Officers. (2010). *Application of Common Core State Standards for English Language Learners*. Retrieved from <http://www.corestandards.org/assets/application-for-english-learners.pdf>
- Schoenfeld, A.H. (2014). What makes for powerful classrooms, and how can we support teachers in creating them? A story of research and practice, productively intertwined. *Educational Researcher*, 43(8), 404-412.

Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. What did the teachers do to position the students as *math thinkers, knowers, and doers*?
2. In what ways do teachers unknowingly use sole authority to withhold opportunities from English Learners? What are some concrete ways teachers could try departing from a “sole authority” stance?
3. How would you use *Productive Talk Moves* and *Norms of Collaboration* to share authority with your students?
4. In what additional ways can you reflect on your teaching practices to better meet the needs of your EL students?



Current TODOS Publications

Teaching for Excellence and Equity in Mathematics (TEEM)

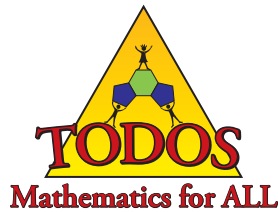
Refereed Journal Published Yearly

Noticias de TODOS

Newsletter Published Three Times a Year

Electronic News (Enews)

Published Monthly and Sent Electronically



Differentiating Mathematics Instruction for Multilingual Students using Critical Sociocultural Practices

Annela Teemant

Indiana University-Purdue University Indianapolis

Brandon J. Sherman

Indiana University-Purdue University Indianapolis

Amy Wilson

Indiana University-Purdue University Indianapolis

Abstract

This paper defines and elaborates on a three-tiered transformative approach to differentiating mathematics instruction for multilingual learners, which includes increasing use of small group instruction, improving the quality of assistance during learning, and creating a culture of recognition that affirms all learners. Using supporting evidence from instructional coaching studies, this paper identifies challenges faced by general education mathematics teachers at each tier of differentiation. While coached elementary and secondary teachers made significant gains in implementing this approach to differentiation, secondary mathematics teachers, in particular, had significantly less growth. Implications for increasing mathematics teachers' knowledge and skills in differentiating instruction for multilingual learners are addressed.

Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. What does differentiated instruction mean to you and what does it look like in your school or classroom?
2. What do you believe are essential components of effective pedagogy for multilingual learners?

Dr. Annela Teemant (ateemant@iupui.edu) is Professor of Language Education at Indiana University-Purdue University Indianapolis. Dr. Teemant's scholarship focuses on using critical sociocultural theory and pedagogy to prepare general education teachers for multilingual learners. She has been awarded five U.S. Department of Education grants focused on ESL teacher preparation.

Dr. Brandon J. Sherman (shermanb@iu.edu) is Project Manager of a National Professional Development Grant at Indiana University-Purdue University Indianapolis. Dr. Sherman's research has focused on social and cultural aspects of teacher use of instructional technology, dialogic interaction in instructional coaching, and job crafting in education.

Amy Wilson (amymwils@iupui.edu) is an adjunct faculty in the undergraduate English as a New Language Program and research assistant on the National Professional Development Grants at Indiana University-Purdue University Indianapolis.

Acknowledgements: Research discussed presented in this paper was supported by two National Professional Development Grants (T195N070233 and T365Z110203) from the U.S. Department of Education's Office of English Language Acquisition. All names used for teachers are pseudonyms.

Differentiating Mathematics Instruction for Multilingual Students using Critical Sociocultural Practices

Annala Teemant, Brandon J. Sherman, and Amy Wilson

Introduction

Stepping back and looking at how far my individual kiddos have really come was a big takeaway for me today [...] I mean looking at the difference. You get so used to hearing them come out now—and all shouting and having a voice and being excited about math—that you go, ‘We weren't always here.’ But the takeaway is definitely looking how far each of them have come, and how far I have come. My questioning is so different. The way I think about teaching is so different. I'm going to be 100% honest when I say that I feel like I am a lot smarter too, because they teach me stuff that I would have never thought of. (Mrs. Mullen, 3rd grade teacher)

Differentiating instruction (i.e., providing multiple ways of learning to students with varying abilities and/or needs) is a daily challenge for teachers tasked with meeting a wide range of learners’ needs in the general education classroom. Differentiating instruction for multilingual students, who are linguistically and culturally distinct from peers whose culture or language is historically dominant, adds another layer to this challenge. Multilingual students may benefit from 30-minute pull-out or push-in English as a Second Language (ESL) support, yet they still spend the vast majority of their day with general education teachers. More often than not, general education teachers have not been prepared with sustained professional development or coursework for making content accessible to, or promoting English development among, multilingual students (Hollins & Guzman, 2005; Lucas & Grinberg, 2008; Wei, Darling-Hammond, & Adamson, 2010). As Horn (2012) observed, minority students have historically been underserved in mathematics classrooms. Mathematics teachers are not exempt from this critique.

Teachers’ pedagogical practices are a major factor influencing multilingual student engagement and success

in mathematics (Horn, 2012; Crisp & Nora, 2012). Unfortunately, all too often standard teacher pedagogy in K-12 schools remains whole-class, lecture-dominated, worksheet-driven, and behaviorist in orientation with little evidence of meaningful differentiation (e.g., Teemant, 2014; Teemant, Cen, & Wilson, 2015). Baglieri, Bejoian, Broderick, Connor, and Valle (2011) observed that such practices “teach to the middle” and are built upon assumptions of:

an unexamined normative center, a center built on the desirability (and therefore expectation) of all students being taught at the same time, in the same way, learning at the same rate, and demonstrating their knowledge and skills in the same way, presumably on the same examinations. (pp. 2137-38).

This paper aims to describe the necessary conditions for creating a learning environment for multilingual learners in general education mathematics classroom that is both more equitable and more effective. Built upon critical (Freire, 1994) and sociocultural perspectives (Vygotsky, 1978, 1997), we describe a three-tiered approach to meaningful and transformative differentiation based on changing classroom organization, designing activities to promote learning, and cultivating a culture of recognition. We draw on a synthesis of quantitative and qualitative research outcomes from several instructional coaching studies to capture elementary and secondary mathematics teachers’ pedagogical challenges and successes implementing critical sociocultural practices (i.e., Teemant, 2014, 2018; Teemant, Cen, & Wilson, 2015; Teemant, Leland, & Berghoff, 2014; Teemant & Hausman, 2018). After defining critical sociocultural pedagogy, we describe each tier of transformative differentiation from the perspective of mathematics teachers, identifying challenges, successes, and implications for practice.

What are critical sociocultural practices?

Broadly, sociocultural theory posits learning to be a socially mediated (as opposed to individually contained) and culturally situated (as opposed to culturally neutral)

phenomenon (Vygotsky, 1930-1934/1978). Critical perspectives on pedagogy focus on power dynamics both in classrooms and in larger society. Increasingly, sociocultural perspectives (Lucas & Villegas, 2011; Moll, 2001) and critical social theory (Gottesman, 2016;

STANDARDS FOR Effective Pedagogy

STANDARD 1 **Joint Productive Activity (JPA) Teacher and Students Producing Together**
Facilitate learning through joint productive activity among teacher and students.
Enacting Level: The teacher and a small group of students collaborate on a shared product.

STANDARD 2 **Language & Literacy Development (LLD)**
Developing Language and Literacy Across the Curriculum
Develop competence in the language and literacy of instruction across the curriculum.
Enacting Level: The teacher provides structured opportunities for students to engage in sustained reading, writing, or speaking activities; and assists academic language use or literacy development by questioning, rephrasing, or modeling.

STANDARD 3 **Contextualization (CTX)**
Making Meaning: Connecting School to Students' Lives
Connect teaching and curriculum to experiences and skills of students' home and community.
Enacting Level: The teacher integrates the new activity/information with what students already know from home, school, or community.

STANDARD 4 **Challenging Activities (CA) Teaching Complex Thinking**
Challenge students toward cognitive complexity.
Enacting Level: The teacher designs and enacts challenging activities with clear standards and performance feedback, and assists the development of more complex thinking.

STANDARD 5 **Instructional Conversation (IC) Teaching Through Conversation**
Engage students through dialogue, especially the Instructional Conversation.
Enacting Level: The teacher has a planned, goal-directed conversation with a small group of students on an academic topic; elicits student talk by questioning, listening, and responding to assess and assist student understanding; and inquires about students' views, judgments, or rationales. Student talk occurs at higher rates than teacher talk.

STANDARD 6 **Critical Stance (CS) Teaching to Transform Inequities**
Empower students to transform society's inequities through democracy and civic engagement.
Enacting Level: The teacher consciously engages learners in interrogating conventional wisdom and practices, reflecting upon ramifications, and seeking actively to transform inequities within their scope of influence in the classroom and larger community.

Center for Research on Education, Diversity & Excellence (CREDE) | <http://crede.berkeley.edu>
Center for Urban and Multicultural Education (CUME) | IUPUI | <http://education.iupui.edu/cume/>

Be On Target! **PROJECT TARGETT**
TRANSFORMING AND RENEWING GROWTH OF EDUCATORS AND TEACHERS OF TEACHERS

Figure 1. The Six Standards for Effective Pedagogy

Salazar, 2013) are being used as theoretical foundations for understanding and teaching multilingual and multicultural students. Critical sociocultural theory embraces both of these theoretical worlds. This theory forms the basis for the Six Standards for Effective Pedagogy (Six Standards, Figure 1) a system of pedagogical principles of learning that adhere to critical sociocultural perspectives (Tharp, Estrada, Dalton, & Yamauchi, 2000; Teemant et al., 2014).

From sociocultural theory, the Six Standards focus on the quality of teacher-student relationships, envisioned as an active, socially and culturally shaped spaces, filled with rich dialogue and assistance. More knowledgeable others, such as teachers, provide timely assistance in the process of learning in what is called a student's zone of proximal development. Teacher assistance is enacted pedagogically when learning is collaborative, language rich, contextualized in students' lived experiences, cognitively challenging, and dialogic in the co-construction of knowledge (standards 1-5 in Figure 1). Assistance in the learning process is intended to promote future self-regulation and automaticity in learning concepts and language.

From a critical perspective, the sixth standard—critical stance—invites and empowers students to transform the inequities in their worlds through dialogic cycles of reflection and engagement. Pedagogically, this happens as students learn to (a) question the status quo, (b) interrogate it from multiple sociopolitical viewpoints, and (c) take action to promote greater equity (Lewison, Flint, & Van Sluys, 2002; Teemant et al., 2014). For Michael Apple (cited in Gottesman, 2016), two principles guide critical education: relational thinking (i.e. understanding activities, such as schooling, as being situated within larger social institutions and movements) and political and cultural repositioning (i.e. understanding education through multiple perspectives, particularly those of the historically disadvantaged). Such learning uses school, home, and community knowledge in tandem to examine “asymmetries of power and privilege” (McLaren, 2007, p. 69) that shape students' identities, relationships, and agency in and outside the classroom.

Taken together, the Six Standards represent critical sociocultural principles of learning that guide teachers' instructional design. Teachers are supported in employing the Six Standards through a combination of a 30-hour summer workshop and seven cycles of individual instructional coaching across a school-year, with the ultimate goal of designing and implementing multiple, simultaneous, and differentiated small group activities that evidence at least three of the Six Standards employed concurrently. For example, an activity could create an extended opportunity for students to meaningfully collaborate and authentically use language to accomplish a shared task while also being cognitively challenging and/or contextualized (Standards 1, 2, 3, and/or 4). Six Standards classrooms have (a) multiple student-led small group activities with heterogeneously grouped students; and (b) a teacher-led activity with homogeneously grouped students. When a teacher is a full partner in the co-construction of knowledge in a small group, students receive the highest level of assistance to learn. (See chapters 6 and 7 in Tharp et al. [2000] for a rich description of the instructional model that accompanies use of the Six Standards pedagogy.)

Critical sociocultural perspectives, particularly as enacted through the Six Standards, expand conceptions and enactments of differentiation. In addition to focusing on alternative content, products, processes, or environments for learning, teachers also intentionally take into account the sociocultural, historical, political, economic, and relational conditions that have shaped students' identities, power, and agency in and outside the classroom. Learning for the sake of learning is replaced with learning to collaboratively and reflectively change self and society (Ettling, 2012; Freire, 1994). Differentiation, therefore, should result in teaching that is responsive and pluralistic, and students who are increasingly autonomous in their thinking, relationships, and choices.

The Three-Tiered Pedagogical Approach to Differentiation

Based on longitudinal studies of Six Standards instructional coaching with elementary and secondary teachers, including mathematics teachers (Teemant et al., 2014; Teemant & Hausman, 2018), we have defined three

pivotal changes teachers make to realize an enriched pedagogical approach to differentiation. Figure 2 presents the three tiers of this approach as an inverted pyramid. Tier One (the top of Figure 1) is the quickest, broadest, and easiest change teachers make in their practice. Tiers Two and Three represent more nuanced and difficult changes, requiring sustained and intentional effort on the part of teachers.

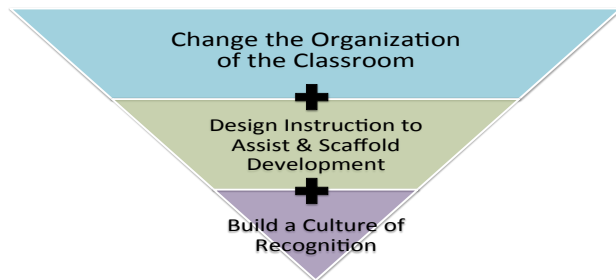


Figure 2. A three-tiered approach to transformative differentiation

1. Change Classroom Organization

It is an overarching theme in my class essentially when I tell my kids, we are going to start today with Math Centers. Woo-hoo!! I had taken a picture of that actually and my dad came to visit from Virginia, and he was looking through my pictures, and he said... “Now those are faces of children who love being and doing what they are doing.” He said, “That is a genuine smile.” I said, “That is because they wanted to answer a question that I asked. It was a very difficult question and they had worked for it and they were excited to answer.” (Mrs. Dinah, 3rd grade teacher)

To improve differentiation, the first shift teachers of mathematics have to make is more frequent use of small group learning activities. Increasing the amount and quality of small group work simultaneously increases the amount of student talk, negotiation and co-construction of meaning, and opportunities for peer or teacher assistance in the learning process. Verbal interactions make academic concepts and language more accessible to students. Teemant and Hausman (2013) found that use of collaborative small group activities, in particular, significantly increased student achievement among both native and non-native speakers of English. Such

arrangements also provide more opportunities for students to draw on and display their own funds of knowledge. A third-grade teacher in her tenth year of teaching described herself as an “old school” teacher, who lectured and asked students to complete textbook worksheets. After coaching, she had learned to trust her classroom management and her students:

I am more apt to letting the kids talk to each other and learn from each other, and just amazed at how much they can learn from each other without me being right there beside them the whole time, basically giving them the information. And they are able to help each other in ways that I didn't think was possible.

For all of the established benefits of small group work, our coaching studies revealed classroom management skills as the main challenge at this tier of differentiation for elementary and secondary teachers. Teemant (2014) and Teemant et al. (2015) found that by the end of seven cycles of coaching, 100% of elementary teachers and 89% of secondary humanities teachers were able to consistently manage small group activities, but only 25% of secondary mathematics and science teachers were able to do so. In focus group discussions, secondary mathematics teachers, in particular, shared that they lacked confidence in managing students working in multiple groups. One secondary teacher struggled with “Dealing with those [students] that are loud and boisterous and want to be disruptive on the other side of the room when you're trying to deal with a group over here.” He continued “that causes the centers to sometimes break down.” Another secondary teacher explained, “I've been much more inclined to stop, and if I notice conversations among students, find out—don't assume—that they're off task... to discern what's going on, and if there *is* learning going on.”

As the routines, procedures, behaviors, and expectations are consistently presented and reinforced, small group work can be productive. Without more frequent use of small group configurations, students remain passive in their learning and lose out on important opportunities for assistance in the process of learning, application of developing language skills, and connection of material to their own lived experience. This suggests mathematics teachers, especially secondary teachers, benefit from

concrete support, techniques, and procedures for shifting away from whole-class lecture to use of small group activities as a first step in improving differentiation.

2. Design Activities to Assist and Promote

Development

I think it is because I have always encouraged them to explain why. Explain your thinking. Give evidence. So even when we are talking, like when we are reviewing, saying, okay, great, you have finished with this puzzle, but now let's talk about it. And I think they are getting so used to taking the pieces apart again and talking about why they are where they are. Even when we were reviewing, all standing up together talking, they would say, "Oh, I like how the right angle is next to 90 degrees. Why? I love that you like that, but why?" Then they have to explain that farther, and then once they have that connection, then I will expand on the data, get someone else thinking and then they will chime in and it turns into.... I think they are getting used to that. (Mrs. Mullen, 3rd grade teacher)

As a second tier of differentiation, we found teachers benefitted in coaching from time to time to reflect and think of ways to improve on how they actually assisted students while learning. Our data showed that teachers, having implemented small group activities, spent a majority of their time floating around the classroom to monitor or audit learning rather than assisting students to learn. Figure 3 describes teacher practices at the highest level of fidelity in use of the Six Standards pedagogy based on the observation rubric (Doherty, Hilberg, Epaloose, & Tharp, 2002; Teemant et al., 2014). The Six Standards required teachers to hone their skills in asking questions, eliciting student talk, and pressing students for evidence to support their thinking. It asked them to become full participants with students in the co-construction of learning in small groups. Teachers focused on communicating

expectations, setting clear standards for quality work, and assisting and giving formative feedback. They started with students' informal understandings of concepts from home, school, or community, and consciously applied school learning to real-world settings, concerns, and inequities within the students' collective spheres of influence.

Teachers felt the standards of joint productive activity and the instructional conversation allowed them to create more student-centered classrooms. One teacher noted that her students "actually liked it better because they're getting more, not one-on-one tutoring, but more teaching in a very small group versus the entire class." An elementary teacher described her experience learning to assist student learning this way:

If we want to add this amount of money in because we want to purchase this, this is one way we can do it, and another student said, "Oh, that's a cool way. Let me show you how I did it." And, they were able to find different ways, and then later on when we were doing an assessment, I saw them doing that way that they hadn't done before. So it was a different way that was more comfortable for them. So that really helped out. But also, I was amazed by the conversations that they would have, even with me just sitting there. I would maybe guide them in a question, and they would talk to each other and have more of, I would say, an adult conversation that I didn't think kids could have. I thought it was all, you know, toys and movies and more current event things. I didn't think they could have a conversation about math as much. And so, they were able to have that conversation and build off each other and make observations around their world that I didn't think they even noticed. (Mrs. Dinah, 3rd grade teacher)

Individual Standards	Enacting Level of Fidelity for Individual Standards
Joint Productive Activity <i>Teacher and Students Producing Together</i>	The teacher and a small group of students collaborate on a joint product. (Teacher does not float.)
Language & Literacy Development <i>Developing Language and Literacy Across the Curriculum</i>	The teacher designs and enacts instructional activities that <i>generate</i> language expression and development of ‘content vocabulary,’* AND <i>assists student language use or literacy development</i> through questioning, rephrasing, or modeling. (Teacher can float.)
Contextualization <i>Making Meaning – Connecting School to Students’ Lives</i>	The teacher integrates the new activity/academic concepts with students’ prior knowledge from home, school, or community to connect everyday and schooled concepts. (Teacher does not have to be present. This can be about activity design.)
Challenging Activities <i>Teaching Complex Thinking</i>	The teacher designs and enacts challenging activities with clear standards/expectations and performance feedback, AND assists* the development of more complex thinking. (Teacher can float.)
Instructional Conversation <i>Teaching Through Conversation</i>	The teacher designs and enacts an instructional conversation (IC) with a clear ‘academic goal’; listens carefully to assess and assist student understanding; AND questions students on their views, judgments, or rationales. Student talk occurs at higher rates than teacher talk. (No floating.)
Critical Stance <i>Teaching to Transform Inequities</i>	The teacher designs or facilitates instruction that consciously engages learners in a) interrogating conventional wisdom and practices; AND b) reflection upon ramifications of such practices; AND c) actively seeks to transform inequities within their scope of influence within the classroom and larger community.

Figure 3. Highest Level of Fidelity for Enacting Critical Sociocultural Practices by Individual Standard

At a time when the Common Core State Standards Initiative (NGA & CCSSO, 2010) describes mathematics practices that encourage students to discuss, solve problems, and communicate findings (Johnson, 2010), the Six Standards provides a rich model for assisted learning. Six Standards coaching supported both elementary and secondary mathematics teachers to significantly increase the quality of collaboration, language use, contextualization, higher order thinking, and evidence-based dialogue to deepen learning.

Implementing these principles can be challenging, however, as in many ways they stand in stark contrast to the roles and approaches that teachers are familiar with. As one teacher noted,

I started with how I was taught. I modeled after, you know, how I was raised, like with math. Even last year, the kids would get a mini lesson which I did. They would work in their books. They would take home a worksheet for homework. They would turn it in, and the next

day we would go to the next unit. That was just that. That was the way that I grew up doing math. (Mrs. Mullen, 3rd grade teacher)

It can be difficult for teachers to adopt new pedagogies when they bear little resemblance to those they experienced as students (Lortie, 1977). Further, Teemant et al. (2015) found evidence that this challenge can vary across content areas, with secondary mathematics and science teachers implementing each of the Six Standards to a lesser extent than their humanities-focused secondary or elementary colleagues. In general, they consistently provided less assistance and feedback to students, with a common explanation being that teaching as telling (traditional, lecture-based pedagogy) is more efficient than teaching as meaningful dialogic interaction (critical sociocultural pedagogy).

When activities were designed to promote learning, the benefits were evident. Six Standards instructional coaching studies with elementary teachers of mathematics

have shown a consistent pattern of statistically significant gains in measures of student achievement and English proficiency (Teemant & Hausman, 2018). For example, students of coached teachers scored 10 points higher on the LAS Links overall score of English proficiency (2012-13 data) and 19 points higher on WIDA ACCESS overall score of English proficiency (2014-15) than students of uncoached teachers. On tests of mathematics achievement, students of coached teachers scored 15 points higher than peers taught by uncoached teachers (2012-2013 data) and 11 points higher on both the K-1 and 2nd grade spring NWEA math tests. When teachers actively and intentionally assisted students during the learning process by enacting critical sociocultural forms of assistance, there were statistically significant gains in student achievement and English proficiency for multilingual learners, which is similar to studies of elementary literacy findings (e.g., Doherty & Hilberg, 2007; Doherty, Hilberg, Pinal, & Tharp, 2003; Estrada, 2005; Saunders & Goldenberg, 1999; Teemant & Hausman, 2013).

3. Create a Classroom Culture of Recognition

So, now they are making those real-world connections and it is really cool. Even, Carla—outside—she was like “Ms. Mullen, I just want to let you know that four out of the ten slides or four out of the ten swings are being used right now.” I’m like “What do you mean?” She is like, “Four/tenths of the swings are being used right now.” I’m like, “Are you doing fractions? [laughter] At recess?” (Mrs. Mullen, 3rd grade teacher)

The most challenging, and often most ignored, aspect of differentiation is building a culture of recognition within the classroom that honors and affirms students’ identities as learners and people. As Rodriguez (2012) describes, this includes ongoing efforts to build meaningful relationships with students, which is not included in the standard pacing guides. It also means tailoring instruction to reflect students’ real-world experiences, their local community, their own voice and choices in learning, as well as forms of civic engagement to improve conditions in their sphere of influence. The Six Standards, especially the standard of critical stance, represent one way of accomplishing Rodriguez’s pedagogical and transformative aspects of teaching.

Building such a culture can be challenging, as this approach goes against the commonly held understanding of classrooms and content areas as culturally and politically neutral. A teacher might be wary of courting controversy by treating classrooms otherwise. However, a critical sociocultural perspective holds that this idea of neutrality is just another form of “teaching to the middle.” Differentiating instruction for multicultural learners means understanding that notions of neutrality are an illusion and that classrooms need to be open to students’ cultural perspectives and experiences, which may be different than dominant culture or the textbook. The secondary teachers highlighted the benefits of community building in the Six Standards model. A secondary teacher shared: “The more the kids got to know each other, the more they could co-participate and feel accountable to each other [...] That was a surprise, how well, how effective that was, building the community as a foundation to having a center.” A elementary teacher was pleased to see students “helping each other” to learn. Another elementary teacher explained how important it was to include her students’ home experiences in learning. She observed that asking them, “How many clocks do you have at home? What time do you cook dinner?” And have them looking for that stuff in their real world helps out a lot.” She continued that letting them “create from their own experiences has been really huge.”

Studies by Teemant et al. (2014), Teemant et al. (2015), and Teemant (2018) demonstrate that all elementary and secondary teachers, including teachers of mathematics, need more time and support to fully realize a culture of recognition in their classrooms. High stakes accountability has pressured teachers to pay more attention to testing at the cost of thoughtfully building on what students already know from home, school, and community. Teachers, unfortunately, feel they need permission to build relationships, tailor curriculum, or apply school concepts to the real world. Yet, there is evidence that even modest gains in teachers’ use of critical stance significantly increases both students’ content and English learning (Teemant & Hausman, 2018).

Conclusion

Improving mathematics teachers' abilities to differentiate instruction for the benefit of their multilingual students requires becoming more dialogic, responsive, and inclusive in practice. The Six Standards coaching studies have shown that teachers significantly increase multilingual students' achievement and English proficiency by increasing use of small group configurations, assisting students in the process of learning, and creating an affirming classroom culture that takes into account who learners are influenced by home, school, and community. While each tier of differentiation presents its own set of challenges, the findings from Six Standards instructional coaching also suggest teachers who receive timely, meaningful, and ongoing assistance are able to improve their skills in classroom management, providing assistance and feedback, and tailoring curriculum to students' life inside and outside the classroom. Teachers who are consciously competent in the Six Standards quantitatively and qualitatively improve students' learning experiences with mathematics. (For additional articles see this project site: <https://www.researchgate.net/project/Critical-Sociocultural-Instructional-Coaching-Six-Standards-Mixed-Methods>).

References

Baglieri, S., Bejoian, L. M., Broderick, A. A., Connor, D. J., & Valle, J. (2011). [Re]claiming 'inclusive education' toward cohesion in educational reform: Disability studies unravels the myth of the normal child." *Teachers College Record*, 113(10), 2122-2154.

Crisp, G., & Nora, A. (2012). Overview of Hispanics in science, mathematics, engineering, and technology (STEM): K-16 representation, preparation, and participation. Retrieved from http://www.hacu.net/images/hacu/OPAI/H3ERC/2012_papers/Crisp%20nora%20-hispanics%20in%20stem%20-%20updated%202012.pdf

Doherty, R. W., & Hilberg, R. S. (2007). Standards for effective pedagogy, classroom organization, English proficiency, and student achievement. *Journal of Educational Research*, 101(1), 24-35.

Doherty, R. W., Hilberg, R. S., Epaloose, G., & Tharp, R. G. (2002). Standards Performance Continuum: Development and validation of a measure of effective pedagogy. *Journal of Educational Research*, 96(2), 78-89.

Doherty, R. W., Hilberg, R. S., Pinal, A., & Tharp, R. G. (2003). Five Standards and student achievement. *NABE Journal of Research and Practice*, 1(1), 1-24.

Estrada, P. (2005). The courage to grow: A researcher and teacher linking professional development with small-group reading instructional and reading achievement. *Research in the Teaching of English*, 39(1), 320-364.

Ettling, D. (2012). Educator as change agent: Ethics of transformative learning. In E. W. Taylor, P. Cranton, & Associates (Eds.), *The handbook of transformative learning: Theory, research, and practice* (pp. 536-551). San Francisco, CA: Jossey Bass.

Freire, P. (1994). *Pedagogy of the oppressed*. New York: Continuum.

Gottesman, I. (2016). *The critical turn in education: From Marxist critique to poststructuralist feminism to critical theories of race*. New York, NY: Routledge.

Hollins, E., & Guzman, M. T. (2005). Research on preparing teachers for diverse populations. In M. Cochran-Smith & K. Zeichner (Eds.), *Studying teacher education: The report of the AERA Panel on Research and Teacher Education* (pp. 477-548). Mahwah, NJ: Lawrence Erlbaum.

Horn, I. S. (2012). *Strength in numbers: Collaborative learning in secondary mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Johnson, C. C. (2010). Transformative professional development for in-service teachers: Enabling change in science teaching to meet the needs of Hispanic English language learner students. In D. W. Sunal, C.S., Sunal, & E. L. Wright (Eds.), *Teaching science with Hispanic ELLs in K-16 classrooms* (pp. 233-252). Charlotte, NC: Information Age Publishing, INC.

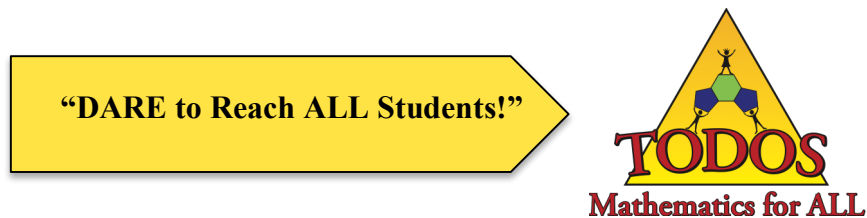
Lewis, M., Flint, A. S., & Van Sluys, K. (2002). Taking on critical literacy: the journey of newcomers and novices. *Language Arts*, 79(5), 382-392.

Lortie, D. C. (1977). *Schoolteacher: A sociological study*. Chicago, IL: University of Chicago Press.

- Lucas, T., & Grinberg, J. (2008). Responding to the linguistic reality of mainstream classrooms: preparing all teachers to teach English language learners. In M. Cochran-Smith, G. Feiman-Nemser, & J. McIntyre (Eds.), *Handbook of research on teacher education: Enduring questions in changing contexts* (3rd ed., pp. 606-636). Mahwah, NJ: Lawrence Erlbaum.
- Lucas, T., & Villegas, A. (2011). A framework for preparing linguistically responsive teachers. In T. Lucas (Ed.), *Teacher preparation for linguistically diverse classrooms* (pp. 55-72). New York, NY: Routledge.
- McLaren, P. (2007). Critical pedagogy: A look at the major concepts. In P. McLaren & J.L. Kincheloe (Eds.), *Critical pedagogy: Where are we now?* (pp. 69-96). New York, NY: Peter Lang.
- Moll, L. C. (2001). Through the mediation of others: Vygotskian research on teaching. In V. Richardson (Ed.), *Handbook of research on teaching* (4th edition) (pp. 111-129). Washington DC: American Educational Research Association.
- National Governors Association Center for Best Practices, Council of Chief State School Officers (2010). Common Core State Standards for Mathematics. National Governors Association Center for Best Practices, Council of Chief State School Officers, Washington, D.C. Retrieved from <http://www.corestandards.org/Math>
- Rodriguez, L. R. (2012). "Everybody grieves, but still nobody sees": Toward a praxis of recognition for Latina/o students in U.S. schools. *Teachers College Record*, 114 (1), 1-31.
- Salazar, M. (2013). A humanizing pedagogy: Reinventing the principles and practices of education as a journal toward liberation. *Review of Research in Education*, 37(1), 121-148.
- Saunders, W. M., & Goldenberg, C. (1999). *The effects of instructional conversations and literature logs on the story comprehension and thematic understanding of English proficient and limited English proficient students*. Santa Cruz, CA: Center for Research on Education, Diversity & Excellence.
- Teemant, A. (2014). A mixed methods investigation of instructional coaching: Understanding teacher transformation and sustainability. *Urban Education*, 49(5), 574-604. doi: 10.1177/0042085913481362
- Teemant, A. (2018). Elementary and secondary teacher development in use of sociocultural pedagogy: A comparison study. Manuscript in preparation.
- Teemant, A., Cen, Y., & Wilson, A. (2015). Effects of ESL Instructional Coaching on Secondary Teacher Use of Sociocultural Instructional Practices. *INTESOL Journal*, 12(2), 1-29. Retrieved from <https://journals.iupui.edu/index.php/intesol/index>.
- Teemant, A., Leland, C., & Berghoff, B. (2014, April). Development and validation of a measure of Critical Stance for instructional coaching. *Teaching and Teacher Education*, 39, 136-147. Retrieved from <http://dx.doi.org/10.1016/j.tate.2013.11.008>.
- Teemant, A., & Hausman, C. S. (2013). The relationship of teacher use of critical sociocultural practices with student achievement. *Critical Education*, 4(4). Retrieved from <http://ojs.library.ubc.ca/index.php/criticaled/article/view/182434>.
- Teemant, A., & Hausman, C. S. (2018). [Mathematics coaching and student achievement data from a 2012-2013 and 2014-15 coaching intervention years]. Unpublished raw data.
- Tharp, R. G., Estrada, P., Dalton, S. S., & Yamauchi, L. (2000). *Teaching transformed: Achieving excellence, fairness, inclusion, and harmony*. Boulder, CO: Westview Press.
- Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. (M. Cole, V. John-Steiner, S. Scribner, & E Souberman, Eds.). (A. R. Luria, M. Lopez-Morillas & M. Cole [with J. V. Wertsch], Trans.) Cambridge, MA: Harvard University Press. (Original manuscripts [ca. 1930-1934]).
- Vygotsky, L.S. (1997). *Educational psychology*. Boca Raton, Florida: St. Lucie Press.
- Wei, R. C., Darling-Hammond, L., & Adamson, F. (2010). *Professional development in the United States: Trends and challenges*. Retrieved from the National Staff Development Council website: <http://www.nsd.org/news/NSDCstudytechnicalrep>

Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. How different is it to view learning with a social and cultural context instead of just within individual learners?
2. What does it mean for teaching to be culturally neutral? Would you describe your own teaching this way? Explain.
3. Which of the Six Standards for Effective Pedagogy (Figure 1) resonates most for you? Which do you find hard to understand or implement? Why do you think that is?
4. What is one concrete change you could readily try soon in your teaching that would lead to more differentiation?



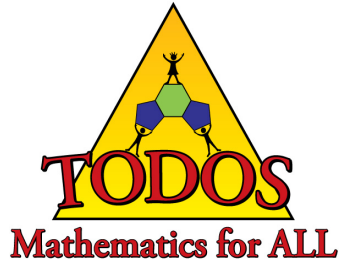
Call for Manuscripts for *TEEM*

We encourage the submission of manuscripts, including applied or action research, literature surveys, thematic bibliographies, commentary on critical issues in the field, professional development strategies, and classroom activities and resources. While contributions in English are recommended, *TEEM* will also consider contributions in languages such as Spanish. The *TEEM* Editors welcome query emails about the suitability of proposed topics: email at teem@todos-math.org.

TEEM is very interested in receiving manuscripts from classroom teachers and/or teacher educators. The following are suggested ideas for manuscripts in this category:

- A description, discussion or reflection on implementation of a particular teaching strategy
- A specific classroom-tested TODOS-oriented “excellence and equity” activity accompanied by a blackline worksheet for classroom use
- A focus on some aspect of the TODOS mission and related goals:
 - to advocate for an equitable and high quality mathematics education for all students;
 - to implement lessons and programs that incorporate the role that language and culture play in learning mathematics;
 - to inform the public, including parents, and influence educational policies in ways that enable students to become mathematically proficient: and
 - to inform teacher education programs.

For more details on the guidelines for papers, see <http://www.todos-math.org/teem>.



**2017-18
ELECTED LEADERSHIP**

Diane Kinch
President

Mathematics Education Consultant
Claremont, CA

Diana Ceja
President-Elect

Riverside County Office of Education
Riverside, CA

Marta Civil
Vice President

University of Arizona
Tucson, AZ

Julia Aguirre
Director

University of Washington, Tacoma
Tacoma, WA

Kyndall Brown
Director

University of California Los Angeles
Los Angeles, CA

Silvia Llamas-Flores
Director

Chandler-Gilbert Community College
Chandler, AZ

Carlos LópezLeiva
Director

University of New Mexico
Albuquerque, NM

M. Alejandra Sorto
Director

Texas State University
San Marcos, TX

APPOINTED LEADERSHIP

Nora Ramirez
Appointed Executive Secretary

Mathematics Education Consultant
Tempe, AZ

TODOS 2017-2018 Accomplishments

The following list describes some of the TODOS Accomplishments that occurred during 2017-2018.

- Worked collaboratively with other mathematics education organizations on the second year of A Collective Call to Action
- Published *TEEM 8*
- Published Noticias de *TODOS*
- Published Enews monthly
- Established the TODOS Blog
- Continued TODOS Live!, now Season 9
- Presented the Iris M. Carl Equity and Leadership Award
- Presented Student Awards at the National Council of Teachers of Mathematics (NCTM) in San Antonio, TX; Ohio Council of Teachers of Mathematics (OCTM) in Columbus, OH; and California Mathematics Council-South in Palm Springs, CA
- Awarded the TODOS-MET Grant, *Fostering Support of Mathematics Learning in Multilingual Classrooms*, to provide financial assistance to Pre K-12 schools for in-service to increase understanding and expertise in fostering support of multi-language development when teaching mathematics
- Provided two professional development workshops on teaching mathematics through the lens of social justice
- Presented pre-sessions at the National Council of Supervisors of Mathematics (NCSM) and NCTM on teaching mathematics through the lens of social justice
- Continued to focus efforts on states with the largest number of and/or largest percentage of Latina/o population (Arizona, California, Colorado, Florida, Georgia, Illinois, Nevada, New Jersey, New York, New Mexico, and Texas)
- Had a TODOS Exhibit Booths or tables at the following conferences: NCSM, NCTM, Association of Mathematics Teacher Educators, Conference on the Advancement of Mathematics Teaching, American Mathematical Association of Two-Year Colleges, Colorado Council of Teachers of Mathematics, School Science and Mathematics Association, NCTM Regional Conferences in Orlando and Chicago, NCTM Innov8 in Las Vegas, OCTM, CMC-South, the Northwest Mathematics Conference in Portland, and the Greater San Diego Mathematics Council Conference
- Attended Conference Board of Mathematical Sciences (CBMS) Meetings
- Prepared for the TODOS 2018 Conference

In Memoriam: Carol A. Edwards

Carol Shigeko Abe Edwards was a nationally recognized mathematics teacher and mathematics education leader. Born in Hawaii, she later moved to the mainland, earned her Ph.D. in mathematics at the University of Illinois and went on to become a leader in mathematics education at the community college level and within many national organizations. Working with students, teachers, and leaders was her passion. She used her organizational skills to support many national mathematics associations.



Carol was a charter member of TODOS: Mathematics for ALL. She became a member of the TODOS Board in 2005 and served as Chair of the TODOS Conference Committee for four years and a Director (then called Member-at-Large) for two years. She was Executive Secretary from 2009-2015, serving two three-year terms. She was Conference Chair again from late 2015 until her untimely death. Carol worked diligently and tirelessly “behind the scenes” planning and organizing efforts. TODOS offered Carol the opportunity to work with mathematics educators from around the world. Whether it was K-12, community college, or university level activities, Carol found opportunities to actively participate in the organization’s activities and support the efforts of the different committees.

In 2011, TODOS awarded Carol the Iris M. Carl Equity and Leadership Award that recognizes an individual who has made significant contributions to the quality of mathematics education provided to underserved students. She also shared her journey with all of us in a special invited column in *TEEM 3*, the Fall 2011 issue: “Passion for Equity: An Asian-American Mathematics Educator’s Journey.”

Carol was also involved with the National Council of Supervisors of Mathematics over a 10-year period, actively serving in multiple leadership roles. In addition, Carol served on several National Science Foundation (NSF) panels, reviewing proposals for programs in mathematics and mathematics education. While in St. Louis at a community college, Carol was a co-founder of a mathematics contest for local middle schools, sponsored by Math Educators of Greater St. Louis (MEGSL). The contest is now approaching its 40th year and continues to promote student interest in Science, Technology, Engineering and Mathematics (STEM).

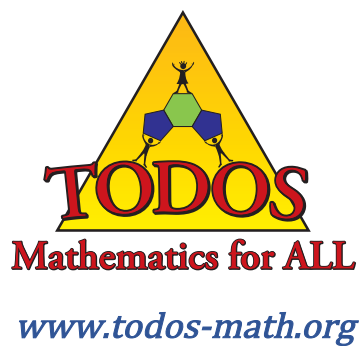
After retiring in 1999, Carol stayed active in national mathematics organizations while taking a part-time position with Chandler Gilbert Community College where she continued to tutor and mentor students and teachers at all levels.

In 2012, the National Council of Supervisors of Mathematics (NCSM) awarded Carol the prestigious Ross Taylor/Glenn Gilbert National Leadership Award, recognizing her unique and dedicated life-long contributions to mathematics education. Carol's vision and inspiration lives on through all of the countless students, colleagues, friends and family who had the good fortune to know her.

TODOS established the Carol A. Edwards Speaker Fund in her memory. This fund provides partial support for TODOS members speaking as part of a TODOS strand at conferences. If you wish to make a donation, please click on the link <http://bit.ly/EdwardsDonation> (login required) or send the contribution to TODOS: Mathematics for All, P.O. Box 25482, Tempe, AZ 85285-5482 and indicate on the memo “Carol A. Edwards Speaker Fund.”

Carol will be missed by all whose lives she touched.

Submitted by Annette Kitagawa



The publications of *TODOS* present a variety of viewpoints. The views expressed or implied in this publication, unless otherwise noted, should not be interpreted as official position of *TODOS*. *TODOS* is a 501(c)(3) non-profit organization.

© 2018 *TODOS*: Mathematics for ALL