

Abstract Title: Culture in the Math Classroom: A Path to Improving Student Success

MSP Project Name: Mathematics Teacher Leadership Center

Author(s): Freida Parker

Presenter(s): Tonya Bartell, Jodie Novak, Frieda Parker

120 word summary:

The Mathematics Teacher Leadership Center had chosen intercultural competence as one of its foci because culture plays a significant role in the teaching and learning of mathematics. As part of this focus, we created a course, *Culture in the Math Classroom*, in our Master's Program for in-service secondary mathematics teachers with the goal of supporting mathematics teachers in developing the knowledge, skills, and motivation to implement culturally responsive pedagogies in their classrooms. The goal is that their students become internally motivated and, ultimately, more successful math learners. In this talk, we report on the nature of the course, preliminary results on how it is impacting teachers' interactions with their students, and the potential to increase student success.

Section 1: Questions for dialogue at the MSP LNC.

1. Are there other projects that have created and/or implemented a course like our Culture in the Math Classroom course? What do these courses look like? What were the outcomes?
2. Are other projects working to develop teachers' intercultural competence? How is this being done? What are the outcomes?

Section 2: Conceptual framework.

The Mathematics Teacher Leadership Center (Math TLC) involves the University of Northern Colorado, the University of Wyoming, and school districts in northern Colorado and Wyoming. The Math TLC's goal is to improve K-12 student mathematics learning by improving the effectiveness of mathematics teachers by focusing on deepening the content proficiency, intercultural competence, and pedagogical expertise of teachers. In this talk, we describe a course we created, *Culture in the Math Classroom* (CIMC), for our Master's Program for in-service secondary mathematics teachers to support the development of teachers' intercultural competence. We present preliminary findings on the teacher-participant learning outcomes in this course and how these outcomes relate to student success in learning mathematics. We also describe the Math TLC's larger research program around "student success" for both adult teachers and the young people they teach.

The Math TLC's emphasizes intercultural competence because culture plays a role in the teaching and learning of mathematics. As Stigler and Hiebert (1999) note in their book *The Teaching Gap*, "teaching is a cultural activity...[and] recognizing the cultural nature of teaching gives us new insights into what we need to do if we wish to improve it" (p. 12). Following the work of Hammer, Bennett, and others, our working definition of culture is: *A dynamic social system containing the values, beliefs, behaviors, and norms of a specific group, organization, society or other collectivity that are learned, shared, internalized, and changeable by all members of the society.* Intercultural competence, then, is the knowledge of how similarities and differences among cultures operate in human interactions (Bennett, 2004). In the education

literature, applying intercultural competence in the classroom has been theorized in several ways, including *culturally relevant pedagogy* (Ladson-Billings, 1995) and various approaches to *culturally responsive teaching* – including culture-as-stable (Gay, 2000) and culture-as-local (Davis, Hauk & Latiolais, 2009; Hodge & Cobb, 2010). Research to date suggests culturally responsive pedagogy is effective in improving student learning across demographic groupings.

The goal of the CIMC course was for mathematics teachers to develop the knowledge, skills, and motivation to implement culturally responsive pedagogy in their classrooms with the intention that students become internally motivated and, ultimately, more successful math learners. We adopted two frameworks as the conceptual foundations of the course which provide complementary perspectives on defining student success.

The first framework was Ladson-Billings' theoretical perspective on culturally relevant teaching whose three tenets are 1) students must experience academic success, 2) students must develop and/or maintain cultural competence, and 3) students must develop a critical consciousness. In her research, Ladson-Billings found that culturally responsive teachers held beliefs related to knowledge that informed their thinking about students' academic success.

These included:

- Knowledge is not static; it is shared, recycled, and constructed.
- Knowledge must be viewed critically.
- Teachers must be passionate about knowledge and learning.
- Teachers must scaffold, or build bridges, to facilitate learning.
- Assessment must be multifaceted, incorporating multiple avenues for demonstrating achievement and excellence.

Ladson-Billings found that students in these teachers' classes not only achieved in terms of standardized test scores, but also had the ability "to read, write, speak, compute, pose and solve problems at sophisticated levels" (p. 475). In this theory, student success is a multi-dimensional construct involving critical thinking skills not always measured on standardized tests.

The second framework was the Motivational Framework for Culturally Responsive Teaching, developed by Wlodkowski and Ginsberg (Ginsberg, 2005) whose foundational principal is that when students are internally motivated, they are more likely to learn successfully. This framework is based on the premise that four conditions support internal motivation in myriad balances across cultural groups, and that all students' learning is supported when these conditions exist and are sustained in the classroom. These conditions are: inclusion, positive attitude, meaning, and competence. *Inclusion* exists when students feel valued and respected by their teacher and peers. A *positive attitude* is indicated when students have a favorable disposition towards learning. *Meaning* exists when students perceive themselves to be engaged and challenged by the classroom learning. *Competence* exists when students feel confident in their ability to learn and value their knowledge as a means to both an authentically possible and hopeful future. Wlodkowski and Ginsberg developed an observational protocol for assessing the motivational conditions in the classroom. Using this protocol and descriptions of the framework, we developed a survey for teacher-participants to use in their classrooms as a means of assessing students' perceptions of the four conditions.

To assess outcomes for teachers-participants, we began a phenomenological study to explore the nature of the teachers' perceptions of how the course influenced their thinking about the role of culture and how that was manifested in their reflection, planning, and teaching practice. We want to understand how the teachers' knowledge, attitudes, or beliefs may have changed to better support students' mathematical learning. We are exploring this by examining action research

projects the teachers completed during the course. In one project, the teachers identified measures of student success, such as better class attendance and higher homework completion rates. In another project, the Motivational Framework survey results were used as a measure of classroom conditions that support student success. The data for the overall research consists of the recorded online classes, the online discussion boards, the teachers' work (including the three projects), and interviews with five of the teachers. We are using inductive, deductive, and constant comparative coding for the data analysis.

Related Ongoing Work: Besides the CIMC research, the Math TLC research team is conducting large-scale mixed-methods research on teacher-participants' learning and that of their students. The primary goal is to advance knowledge about the content and impact of the professional development of mathematics teachers by researching the mathematical understandings, pedagogical content knowledge, and practices among Math TLC participants and the achievement of K-12 students. The research team has collected classroom observations for Math TLC teacher-participants and is collecting state assessment and demographic data for students in teacher-participants' classes, along with aggregate comparison data for non-participant mathematics teachers and their students in the same districts. In particular, the team expects to report in 2012 on results driven by the question: *What is the relationship among Math TLC teacher-participants' activities, teaching contexts, and their students' achievement?* In this ongoing work, student achievement in mathematics is measured by state standardized test scores and increased numbers in advanced mathematics courses (beyond algebra).

Section 3: Explanatory framework.

The CIMC class was taught online in Fall 2010 with 14 middle-school and high-school mathematics teachers who had completed 4 semesters of the Math TLC Master's Program together. The course was divided into two parts; the first laid a theoretical foundation and the second emphasized applying theory into practice. In the theoretical section, teachers learned about various definitions of culture, the existence and role of culture in mathematics teaching and learning, the tenets of Ladson-Billings' (1995) culturally relevant pedagogy, and Wlodkowski and Ginsberg's Motivational Framework. Topics in the theory to practice section included facilitating effective small group and whole class discussions, complex instruction, language in the mathematics classroom, and an investigation of teaching for social justice.

Three projects made up the bulk of the assignments: 1) the Cultural Inquiry Process (CIP) project, 2) the Community Engagement project, and 3) the Wlodkowski and Ginsberg (W&G) project. The CIP project centered on the cultural inquiry process designed by Evelyn Jacob at George Mason University (Jacob, Johnson, Finley, Gurski, & Lavine, 1996) to help teachers maximize student success through action research about cultural influences on students' mathematics participation and learning. The Community Engagement project was designed to have teachers gain culturally grounded knowledge of their students by engaging with their students' communities. The teachers were provided with several choices for community engagement including visiting a student's home, mapping a community, interviewing someone with insider knowledge of a community, and researching the assets of a community, all with the goal of identifying resources and assets the community holds. The W&G project, like the CIP project, was a type of action research. The teachers surveyed their students using the Motivational Framework survey we developed, designed instructional changes based on the survey results, implemented those changes, and then administered a post-survey to evaluate the effectiveness of the instructional changes.

We have preliminary findings from our phenomenological study from reviewing the interviews and the teachers' CIP and W&G projects. The semi-structured, 15 to 40 minute interviews were conducted two or three weeks prior to the end of the semester. Since the five interviewed teachers were volunteers, we do not know how representative this group of teachers is with respect to their perceptions of what they learned until we do further data analysis.

All interviewed teachers said they had never had any other educational experiences like the CIMC class. Prior to the class, they had never considered the role of culture in the teaching and learning of mathematics beyond some broad stereotypes. One teacher mentioned she had been taught in an undergraduate course that Hispanics placed a higher priority on family than on education. Two teachers discussed how their belief going into the class was that all students had to be treated fairly, but that what they deemed to be fair was generated from their own perspective, not from the perspective of their students. These teachers both felt the course opened their eyes to the possibility that their students had different cultural backgrounds from their own and consequently, equal treatment of students did not necessarily result in equity for all students.

All the interviewed teachers said they felt the course had already impacted their practice and they planned to consider future changes. Two teachers mentioned using the Motivational Framework survey in their classes to assess the conditions for promoting students' motivation. One teacher mentioned revising her math autobiography assignment to get different information about her students. One teacher planned to revise his assessments to better meet students' needs. Two teachers mentioned using ideas they had learned about complex instruction in their practice. Another teacher mentioned how she was more likely to question a student about their behavior rather than making judgments about it. A sentiment expressed by several teachers was represented by one teacher's statement: "I definitely will look at my students differently, and will have a different attitude about how I get to know them and the kinds of information that I need to know about them."

For the CIP project, teachers selected a student they did not understand well and who likely needed some change in their school environment to be more successful in their mathematics class. Several themes are emerging from these projects. First, many teachers were surprised at what they learned about their focus student. Second, the intervention strategy the teachers developed were often multi-faceted and included changing how they interacted with the student, and included getting other teachers and school personnel involved in helping the student. Third, most teachers discussed how taking the time to have more personal interactions with their students resulted not only in their understanding the student better, but in the student exhibiting more productive behaviors, such as participating more in class or turning in more homework.

Two important themes emerged from reflections teachers wrote about what they learned from hearing their peers present their W&G projects. First, the teachers felt they learned a variety of strategies from each other and reported this sort of sharing was beneficial to their teaching practice. Second, several teachers commented on how much small instructional changes could impact the four motivational conditions. Overall, the teachers found the Motivational Survey useful for understanding their students' perspectives and felt there were relatively quick and practical instructional strategies to improve students' perceptions.

At this point in our research, we have several reflections about the effectiveness of the CIMC course on student success. The CIP projects indicated that many of the teachers were able to see better outcomes for their focus students in terms of behavior and/or grades. However, it is not clear whether the individual and collective efforts of the adults who participated in the interventions are sustainable. Related to this is how scalable the teacher-designed interventions

are. The teachers spent significant amounts of time understanding the backgrounds and experiences of their focus students as well as planning and implementing the interventions. An unanswered question is how what was learned from these individual cases might be used to inform institutional/school practices in ways that reach more students. What is clear is that these CIP projects may serve as a foundation for better understanding how to best support students who are struggling in teacher-participants' mathematics classes.

The teacher experiences with W&G projects indicate that many teachers fostered an increase in one or more of the motivational conditions in their classroom through short (3-5 classes) instructional experiments. The potential of this work is that relatively small instructional changes could be shown to improve the classroom culture. However, outstanding questions include whether these improvements hold over time and whether they can be connected to traditional measures of student achievement.

In designing this course, we identified two characteristics we felt would be critical for successfully nurturing the development of intercultural competence in the teachers who participated in the CIMC class. From the interview data, we believe these characteristics were indeed instrumental in the course outcomes for the teachers. The first characteristic was that the course had to be a safe place for the teachers to explore the sometimes uncomfortable feelings that arise when discussing issues related to culture. To that end, we felt the teachers had to be able to work from where they were with respect to their beliefs and attitudes and not be pushed too quickly into new or different ways of viewing the world. Two of the teachers said they felt trepidations prior to the course and even felt uncomfortable at times during the course. However, they felt the course structure allowed them to meaningfully explore their beliefs without feeling judged or negatively pressured to change.

The second characteristic, that course content had to be meaningful and practical to the teachers, drove several course structures. First, whenever possible, the required readings were related to mathematics teaching and learning. Second, we focused on the Wlodkowski and Ginsberg framework because it connected ideas from cultural relevance and responsiveness with students' motivation and we believed most teachers were interested in improving their students' motivation. Third, we purposefully selected theory-into-practice topics we felt were accessible and relevant for teaching mathematics. Finally, we developed projects that supported teachers to implement what they were learning during the course. All interviewed teachers said they would recommend this course to other mathematics teachers and several said it was the best pedagogy course they had ever taken. These attitudes, we believe, were partly based on the course being immediately applicable to the participants' teaching practice.

We are debating when teachers should take the CIMC course. For this first offering, most teachers were in their fifth of six semesters. We believe a condition contributing to the success of the course was the camaraderie the teachers had built working together prior to the CIMC course; therefore, we want the teachers to be in the program long enough to build relationships with each other before the CIMC course. However, we want teachers to take the course early enough in the program so that it can inform what they learn in other mathematics and mathematics education courses in the program.

References

Bennett, M. J. (2004). Becoming interculturally competent. In J. Wurzel (Ed.), *Towards multiculturalism: A reader in multicultural education* (pp. 62-77). Newton, MA: IRC.

- Davis, M. K., Hauk, S., & Latiolais, M. P. (2009). Culturally responsive college level mathematics. In B. Greer, S. Nelson-Barber, & A. P. and S. Mukhopadhyay (Eds.), *Culturally responsive mathematics education* (pp. 345–372). Mahwah, NJ: Erlbaum.
- Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice*. New York: Teachers College Press.
- Ginsberg, M. B. (2005). Cultural diversity, motivation, and differentiation. *Theory into Practice*, 44(3), 218-225.
- Hodge, L. L., & Cobb, P. (2010). Two views of culture and their implications for mathematics teaching and learning. Preprint. Retrieved November 10, 2010 from [http://peabody.vanderbilt.edu/Documents/pdf/tl/Hodge and Cobb 2010 Culture and Math.pdf](http://peabody.vanderbilt.edu/Documents/pdf/tl/Hodge%20and%20Cobb%202010%20Culture%20and%20Math.pdf)
- Jacob, E., Johnson, B. K., Finley, J., Gurski, J. C., & Lavine, R. S. (1996). One student at a time: The cultural inquiry process. *Middle School Journal*, 29-35.
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Education Research Journal*, 32(3), 465-491.
- Stigler, J., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: Free Press.
- Stronge, J. (2007). *Qualities of effective teachers*. Alexandria, VA: ASCD.