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Letter from the Editors

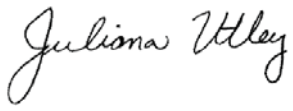
The adoption of the Common Core State Standards for Mathematics brings with it a renewed focus on literacy in mathematics as well as other content domain areas. This likely leaves many of us not only asking how do we develop literacy in mathematics but what does it mean to be literate in mathematics. Since the publication of the first NCTM standards in 1989, interpretations of what it means for students to communicate in mathematics has varied and has included ideas about having students present their problem solving processes to peers in class, explain their thinking both verbally and in writing, and journal about a myriad of mathematical concepts as well as their feelings about mathematics. The notion of mathematically literate students and citizens includes the ability to communicate one's mathematical process and thinking both verbally and in writing but it also encompasses the idea of mathematical empowerment. Not only should students be able to communicate what they are thinking, defend their processes but in order to be "literate" they should have a flexible command of the mathematics they know.

As teachers of mathematics, there are several ways to integrate practices and activities in our classes to help all of our students develop as mathematically literate citizens while also helping them develop many of the Mathematical Practices. Consider adding any or all of the following to your practices:

- Integrate the use of children's literature in your mathematics lessons
- Have students journal about specific mathematics concepts on a weekly basis
- Have your students explain their mathematical thinking about problems on a regular basis
- Ask students to prepare presentations of their mathematical processes for problem solving to be share with their peers
- Have students write graph stories
- Use Construct and Describe problems with geometry concepts
- Stress the use and understanding of multiple representations in mathematics.

Below are a few sources to help get you started. If you are already doing great things with your students to help develop their literacy in mathematics, please consider sharing your ideas in the form of an article in the next issue of OkJSM.

Sincerely,



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- http://mathwire.com/writing/writing1.html
- Mathematics Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction, and Learning (Keeley & Rose)
- Uncovering Student Thinking in Mathematics: 25 Formative Assessment Probes (Tobey, Minton & Arline)
- Writing in Math Class: A Resource for Grades 2-8 (Burns)

Leaping without Bridges: Implementing the Common Core with Students Not Previously Instructed Within Its Expectations

By Gabriel Matney and Tami Matney

Teachers in most states across the nation are now engaged in transitioning their instruction and content focus to the domains of the Common Core State Standards for Mathematics (CCSSM). They are working very hard to make adaptive decisions about their practice and they are serious about understanding the ways in which the CCSSM "are not intended to be new names for old ways of doing business" (CCSSI, 2010, p. 5). As the states transition to the CCSSM many teachers will be working with students whose mathematics instruction took place under a different set of mathematics learning expectations. In our work with our own students and through the CCSSM professional development that we have provided for other teachers in multiple states, we have observed how difficult this transition can be for both teachers and students. The purpose of this article is to share what we have found to be productive ways for teachers to leap into the CCSSM and overcome the fact that many students are missing curricular and instructional bridges that might have otherwise made the transition smoother.

Method

We recently conducted CCSSM professional developments for 106 K-5 teachers of mathematics in a Midwestern state. These teachers' provided their experiences and descriptions of CCSSM implementation through submitted reflections. From this larger group a closer look was taken with 23 teachers; all of whom were actively working to implement CCSSM based instruction for the first time. Furthermore, their students had little or no prior exposure to CCSSM instruction. These teachers received 100+ hours of professional development on teaching the CCSSM. As part of this profession development teachers provided lesson plans, videos of instruction, and reflections. Each lesson plan, video, and reflection was from the same learning segment. Teachers were asked to openly share and explain the difficulties they encountered as they implemented CCSSM based instruction and work together to develop strategies to overcome these difficulties. After the

data were collected an interpretive analysis (Hatch, 2002) was done to reveal pertinent and salient themes involving the dilemmas and solutions of CCSSM implementation. We viewed the lesson plans, videos, reflections, and recorded teacher explanations to get a sense of the whole data set. Next, we reviewed the data again making memos that identified our impressions from the data. Once the reading of data and watching of video data was completed we studied these memos for salient interpretations. The data was then reexamined and coded where interpretations were supported or challenged. These interpretations were then reviewed with participants and summarized.

Findings

After studying the CCSSM and receiving substantial professional development in the spring and summer, teachers set out to develop CCSSM based units, utilizing their district curriculums when appropriate and including other tasks to supplement instruction. Teachers began the process of teaching with the CCSSM the next fall. From the many pitfalls and experiences the teachers encountered during this endeavor five actions emerged that led to what teachers considered a successful implementation of the CCSSM. We found that these actions are most effective when implemented together rather than as separate pieces:

1) **Persevere in Changing Norms:** Persevere in establishing norms (preferably from day 1) that promote the 8 Standards for Mathematical Practice
2) **Focused Effort on Mathematical Practices:** Focus on one or two Standards for Mathematical Practice at a time throughout your lesson planning, instruction, assessment, and reflection
3) **Plan to Help Students Understand the New Standards:** Create and enact a plan to help students understand the new standards and why the expectation for explaining their own thinking is more rigorous in these standards
4) **Modify Existing Curriculum:** Carefully consider how district curriculums can be modified to promote coherent content and the Standards for Mathematics Practice
5) **Learn How Standards Connect across Domains and Grades:** Know the CCSSM for at least 2 grade levels above and below your grade level and understand how prior standards connect to later ones

From these five we have further categorized them into two main themes that were continuously brought out in the data. The first three can be understood as efforts to develop

a CCSSM learning environment and the last two as content specific curriculum organization. In what follows, we explicate the difficulties and triumphs that led to the emergence of these five actions as sufficient to bring about positive transitions with the CCSSM for both teachers and students.

Developing a CCSSM Learning Environment

Teachers found that students initially had difficulty in engaging in mathematics learning through the mathematical practices of the CCSSM. Teachers explained that the students were reluctant to engage in solving tasks in which they would have to construct their own viable arguments. According to the teachers, the students' previous mathematical learning experiences did not allow for their own thinking to be promulgated. The teachers reported that their students came from more "direct instruction classrooms" or as one teacher described, a curriculum environment in which

> My students are used to sitting and watching how to work particular problems. When questions are asked they just sit there until the teacher gives the answer. It's like my students have been conditioned to wait and the teacher will give them the answers. So there is very little thinking on the part of the students. So whenever students have to make sense of and persevere in problem solving they have no understanding about what it means to try things, mathematically.

The first several weeks of the school year teachers reported and discussed the difficulty of having students enact the mathematical behaviors of the CCSSM. As teachers persevered in establishing the norms *(1)* and the sociomathematical norms (Yackle & Cobb, 1996) necessary to foster the Standards for Mathematical Practice they began to see large returns. According to Yackle and Cobb (1996) sociomathematical norms are accepted classroom understandings such as "what counts as mathematically different, mathematically sophisticated, mathematically efficient, and mathematically elegant (p. 461)." Some common norms and sociomathematical norms were that students had to come up with a solution, determine if their solution made sense mathematically to others through small group discussion, and collaborate to offer up possible solutions to the larger class in an efficient manner. Teachers actively worked to promote students' thinking and to focus the class on deciding what is involved in a good mathematical explanation.

Teachers who were describing the most success with students had chosen to only focus on one or two Standards for Mathematical Practice *(2)* and had developed a plan in

which they were discussing the changes in curriculum expectations *(3)* with the students. Other teachers quickly adapted based on these findings and began seeing drastic changes in their students' orientations to thinking mathematically and sharing mathematical ideas. One teacher who chose to focus on the third Standard for Mathematical Practice "Construct Viable Arguments and Critique the Reasoning of Others" (CCSSI, 2010, p. 6) reflects on these happenings.

> I can even remember the day when students were no longer unengaged, sitting and waiting for someone else to speak. Before this day it was like pulling teeth to get anyone to talk with one another or provide ideas for discourse. I have been working on standard three and trying to develop a culture were ideas are shared and critiqued freely without students waiting for *the* answer to be given. This day, I had students share their thinking by drawing out their strategies on the interactive white board. It was as if a switch went off and students realized, seemingly all at once, that their ideas would be valued and presented to the class for discussion. They were excited by this! And now it's a struggle to find a good stopping point for all the new mathematical ideas they have.

As teachers worked to focus students on the value of their own mathematical ideas, the students became more willing to think and share. Teachers reported a new classroom "energy" that had been missing from their previous mathematics instruction and explained their own newly formed excitement in teaching. Teachers enthusiastically shared many events happening in their classrooms, such as problem strategies developed by students that were unique and previously unknown to the teacher and students who the teacher had consider to be low achievers demonstrating increased engagement and contributing some of the most significant solutions.

Another component that led to these rich outcomes involved the teachers helping students understand the expectations of the new standards, with a special focus on the reasons for why their own mathematical thinking is important to the learning process *(3)*. Teachers found that students often had different understandings of what it meant to explain their thinking. Teachers expressed that students had been taught to stack and add (standard algorithm) in the first grade and that it was difficult for students to explain why that process made sense and even more difficult for them to flexibly come up with and use alternative ways of thinking about addition. Teachers noticed that the students' understanding of what

constitutes a mathematical explanation was enshrouded by their rote knowledge of the stack and add procedure. As one teacher put it, "So long as the students wrote down the 'one' as it was 'carried over,' they felt that was sufficient, although they could not explain what the meaning of the 'one' was or why it was written up there."

In addition to helping students understand the new and different expectations of the CCSSM teachers also found it beneficial to explain the meaning of particular mathematical practices. In what follows, a third grade teacher describes the experience where she and her third grade teaching partners came to this realization.

> After banging my head against the wall the first few weeks of class one of my students asked "Why do I have to explain my thinking? Why isn't this good enough?" I realized I needed to explain to my students what is happening with the Common Core. We [the schools 3rd grade teaching team] had to take a step back and spend some time explaining to the students about the 8 mathematical practices and how it affects their learning. Like number one 'persevering in problem solving' they would moan and groan when I gave them a problem to think about but after we had the discussion about what perseverance means I saw a major difference in my students. They started trying stuff and using some objects we provided if they couldn't do it in their head. While this was not easy for them, there was a greater willingness to try, without complaint.

The teachers recognized that the transition to the CCSSM not only meant adjustments in their instructional practices but also adjustments for students' thinking about and learning of mathematics. Teachers went on to develop lessons from which discussions about what it means to "practice mathematical thinking" could emerge.

A strategy in overcoming the initial resistance from students and the struggle to engage them involved perseverance in establishing norms, a focus on one or two mathematical practices at a time, and a plan for discussions of the new mathematical thinking expectations with students. From these three actions involving the learning environment teachers saw transformations in students mathematical thinking that align with the expectations of the CCSSM. These actions on the learning environment were enveloped by teachers' actions on the organizing of curriculums and the art of negotiating ones practice within the delimiters of district policy.

Organizing a CCSSM Curriculum

In their work to establish rich mathematical learning environments teachers drew heavily from their knowledge of the connections between CCSSM domains and grade level content on either side of the grade they were teaching. During professional development, teachers were given the task of denoting the way standards connected across domains and grades to form a coherent set *(5)*. Teachers found this knowledge to be vital as they sought to develop CCSSM aligned units from their district purchased curriculums *(4)* and engaged students who had been taught previously with other curricular expectations. Having a good knowledge of the CCSSM across grade levels allowed teachers to precisely notice where the gaps were in their students' content knowledge. A third grade teacher explains,

> Because the state standards focus on some different things than the Core [CCSSM], I found that my students didn't have any experience in adding and subtracting three digit numbers. I had to go back and drop down to second grade Common Core to meet my students were they are. We [her and her 2nd grade teaching colleague] worked together on teaching ideas to get them caught up and build place value understanding.

The power of knowing what is to be learned by students in the grade levels prior and subsequent to the grade being taught was found to be especially important. Since teachers across grade levels were armed with this knowledge, they had a larger set of colleagues from which to collaborate and reported they were more likely to go outside of their grade level team for help. Within these teams a variety of worthwhile tasks were created and then scaled up to meet the increasing rigor for older grade levels. This collaboration saved the teachers time and gave those who taught in small schools a critical mass of other teachers doing similar things so that discussions of the students' mathematical ideas could occur.

Teachers used their knowledge of the connections among content standards across the domains and grade levels to adapt existing problems in their district curriculums *(4)* as well. They would carefully consider what tasks in their curriculums were worthwhile (NCTM, 2007) and modify those that were not. The creation and use of these tasks played a vital role in helping the teachers establish a mathematically productive learning environment. A fifth grade teacher who was part of a larger team of K-5 teachers attending the professional development from the same school explains,

> After the summer we decided to use the CCSSM as the focus of our curriculum. Our old curriculum texts and materials became a tool; which we use to make learning tasks to engage students, but we didn't use all the tasks and other problems we changed. There were a lot of things we had to change because they didn't promote any of the mathematical practices. That was a big eye opener for us! How are students going to persevere or critique others ideas about visual fraction models if the teacher is always the one giving the solution!? Oh, and we saw a major change in our student's engagement when we used the modified problems instead of the normal curriculum. We think it's important to take whatever curriculum your school has and think about how to make it deeper and worthwhile so that students are thinking at the level expected by the CCSSM.

The idea that school curriculums needed to be modified to meet the expectation of the CCSSM was pervasive among the teachers. Within the explanation above, the reciprocity between the teachers' actions to create a learning environment to promote the mathematical practices and their actions on curriculum becomes apparent. The teachers see an important connection between the tasks they give their students and the development of a learning environment that meets the CCSSM expectations. Hence, it should be noted that the success teachers had from implementing these five actions was done so as they applied all five together toward the same end; transitioning their instruction and students' learning to meet the mathematical expectations of the CCSSM.

Conclusion

In this paper, we have presented five actions teachers found to be sufficient in transitioning their instruction and students' learning from their current state standards to the expectations of the CCSSM. Through our work with these teachers and their attempts to overcome these obstacles in transitioning to the CCSSM we noticed that teachers who have a network of colleagues who are knowledgeable about the new standards and have spent time combing through mathematics education resources would be much more empowered than those who enact these five actions alone. We encourage districts to find ways to help teachers work collaboratively on enacting these five actions and provide professional development that gives teachers a deep and connected knowledge of the CCSSM.

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