

Notes from 3/27/14 Parallel Session 9C

Math Teacher Circles:

Brian Conrey (AIM), Matthias Beck (SF State), Kristin Umland (NM St), Brianna Donaldson (AIM—Math Teacher Circle)

Note: Kristin Umland is filling in for Diana White (on the schedule but couldn't come)

Brian:

Math Teacher Circles are all about professional development for inservice teachers. These can be part of the answer to : how can we get more mathematicians involved in teacher professional development? These are communities of mathematicians and middle school teachers (there are circles for other grades) to have monthly meetings to do cool math. Circles are a great investment because they are not resource intensive (just a few hours per month, low costs). And, they're fun—doing math together. There are about 60 such circles around the country. AIM funds 12 new ones each year (up until now) but now want to expand in a new way, by an order of magnitude: 600 circles with 10,000 teachers to reach 1,000,000 students. Every department ought to sponsor a math teacher circle, and have math faculty involved.

Matt: Talks about what's in it for the average math faculty member (to be involved in a math teacher circle)? The apparent benefits: keep math active with middle school teachers; bring recent interesting math to their attention; can try out non-traditional content with the group; can work out relevant solutions to problems and sometimes connect them to standards. For instance, graph coloring can be tied to middle grade standards. Challenging environments: inservice teachers in this informal environment is a very different audience than the standard math course for undergrads. The teachers tend to be more mature. They tend to be mathematically more diverse than undergrads. Less obvious: I get back things from the teachers. It is a nontrivial chance for me to listen to educators on the ground. Research mathematicians don't do enough of this. Teachers teach me how I might approach college students who want to be future teachers. This has been incredibly valuable in my career. There is a very concrete connection between middle school teachers and the "academy"—higher education. This is vertical integration at its best. Math teacher circles provide a very natural symbiosis.

Kristin: (presenting for Diana White): Impact of Math Teacher Circles

Kristin is part of the NSF grant investigating the impact of math teacher circles. Key questions: what do teachers believe they get out of participating in math teacher circles? What do teachers learn by participating in math teacher circles? Do teachers change the way that they teach after participating in math teacher circles? The group administered the MKT to summer immersion participants (150-200/year starting in 2010) and recruited 9 teachers to interview & video to be case studies (from the AIM, Denver and Albuquerque MTC). MKT increase 0.31 standard units in number & operations after the 4-5 day summer institute (240 teachers from 14 states). Still to be learned are the features of the summer workshops that are most correlated with these gains in MKT. The Math teacher circle participants tend to be highly engaged teachers, but still say they get learning out of circles that they don't get anywhere else. Some participants are already leaders; others report that participation lead them to develop leadership skills and see themselves more as leaders. Teachers seem to most appreciate both the community aspects and the mathematics in circles. Teachers report that their view of mathematics has changed: they value open-ended problems more; they appreciate the creative efforts required to do mathematics; see mathematics now as connected; value experiencing difficult mathematics, thereby gaining empathy for struggling students. Something that is more difficult is figuring out how to take math teacher circle problems and translate them to classroom lessons. Successful teachers often have

access to a math coach or other colleagues who can support them in this type of work. In one case, a teacher reported that math teacher circle participation provided her with a way to “put everything together”—she now had a model for how to push students to think deeply about mathematics. In another case, the teacher was a career-changer, but had a weak mathematical background. The math teacher circle gave her a place where she started off feeling very ignorant, but later gained confidence in doing mathematics. In a third case, the teacher was a “problem-solving skeptic” who had lots of energy but taught with gimmicks and tricks. He wasn’t sure how to get problem solving into his classroom, but the CCSS convinced him he needed to try. Future work will include trying to figure out the characteristics of math teacher circles that impact teacher attitudes and learning gains. Need to better understand the different types of math teacher circle enactments and structures. Also need to figure out how circles fit into the broader professional development landscape. Also, another big question is to study the impact on the mathematicians who participate.

Brianna Donaldson, director of special projects at AIM, including the MTC network
Maintains contact with the 60 circles, and works with logistics, especially to help the new circles. One question to understand is why departments might begin a math teacher circle? One is to maintain contact with alumni and local schools; another is to complement or extend other programs (MSP, GK12—this can be an inexpensive way to continue contact with teachers after funding ends for a large program); a third is institutional mission (STEM center or other outreach). In some cases, math teacher circles have started to collaborate—Ohio State, Ohio and Cincinnati—and have a state level of support for math teacher circle now. What do math teacher circles need: meeting space, refreshments, administrative support (advertising, PD credits), teachers, and mathematicians. If one to two people organize the circle overall, most mathematicians may only lead one session a year.

There is support (see slide near end with links)

NebraskaMATH: Professional Development Opportunities for Mathematics Teachers
Jim Lewis, Wendy Smith, Tom Marley, Tom Clark

NebraskaMATH partnership with K-12 school districts goes back to the early 1990s. It started mostly with Lincoln Public Schools (UNL is in Lincoln) but has grown to a statewide partnership.

Major grants included in NebraskaMATH are:

Math Matters (change how undergraduates are prepared to be elementary teachers)

Math in the Middle (middle school teachers, master’s degree program)

NebraskaMATH (K-3 mathematics specialist certificate [18 credit hours], Nebraska Algebra [9 credit hours for secondary algebra teachers], New Teacher Network [18+ credit hours for novice secondary teachers])

NebraskaNOYCE (Teaching Fellows and Master Teaching Fellows)

Data Connections (build better statistical models to estimate the impact of professional development)

These projects have developed a model for courses for teachers. Summer courses are one week or two courses paired over two weeks. Courses run 8am-5pm with 3-4 hours of homework per night and a 16-20 hour take-home final (called “end-of-course assignment”). Cohorts often have 35 teachers, with instructional teams of 5 to support this “boot camp” model. During the academic year, courses are either online, or blended in person (2-3 Saturdays) and online. UNL uses Blackboard and Adobe Connect/Google hangouts to facilitate online communication.

These projects have also built up the partnerships. While there are 4 core partners (4 of the 6 largest districts in the state including the 3 highest-need districts), over 100 districts have been involved. The partnership also includes 3 colleges and 5 departments at UNL, as well as UNL's other campuses (University of Nebraska at Omaha, University of Nebraska-Kearney, and University of Nebraska Medical Center).

Tom Marley expanded on Algebra for Algebra Teachers, a course that is the feature of Nebraska Algebra. Over the last few years, he has taught this about half the time to inservice teachers and half the time to post-baccalaureate preservice teachers. His textbook is comprised of 20 worksheets (2/day for 2 weeks). His method of instruction is about 1/3 each of lecture, small group work, and class discussion. Course objectives are both to learn abstract algebra and to understand algebra as a set of methods reasoned from principles, and not just a collection of algorithms. Topics include integers, divisibility, Fundamental Theorem of Arithmetic, modular arithmetic, rings, and polynomials.

Tom Clark discussed some of the highlights of his experiences as a graduate teaching and research assistant in NebraskaMATH. He was involved in creating and co-teaching Geometry for Geometry Teachers. He found the experience incredibly valuable as a future faculty member who will have to create courses/syllabi/assignments/assessments. The course focuses on the importance of axioms, problem solving, proof, and modeling good pedagogy. This course was mostly group work, discussions, and student-led presentations, with very little lecture. Tom also has worked on research, through observing and interviewing over a dozen teachers. He got to see K-12 teachers at work and experience the realities of the classrooms, while they got to benefit from his more advanced perspective of the mathematics they are teaching.

NebraskaMATH has made many steps toward sustainability. One is the Nebraska Math and Science Summer Institutes, in which the university discounts tuition for teachers, and courses are offered across the state. Other more local funds have been raised, including funds for fellowships for these summer courses, as well as the Omaha Public Schools Teacher Leader Academy (working with Omaha teachers—largest/highest-need district), Math Early On (extending work to preschool math teachers), Improving Teacher Quality grant to provide professional development to teachers in far western Nebraska, and a partnership with Lincoln Title I schools to provide professional development.

Research accompanies all of these grants. Overall, the findings are very positive. Teachers are learning more mathematics, have better attitudes toward math, more confidence & motivation, and less anxiety. For Primarily Math, there was also a control group, whose scores stay flat in all of these categories. UNL also partners with Northwestern University (Jim Spillane) to study the professional advice networks of teachers—over time in the presence of Primarily Math participants, these networks get denser (more math conversations are occurring). K-2 students individually tested show that starting in the 3rd year of the grant, students in Primarily Math classrooms started showing statistically significantly larger gains in math achievement from fall to spring than students in control group classes.