
Transformations Panel¹

Dana Pomykal Franz, Mississippi State University, df76@colled.msstate.edu

Marilyn E. Strutchens, Auburn University, strutme@auburn.edu

Margaret J. Mohr-Schroeder, University of Kentucky, m.mohr@uky.edu

Wendy M. Smith, University of Nebraska–Lincoln, wsmith5@unl.edu

W. Gary Martin, Auburn University (facilitator), martiwg@auburn.edu

Since its inception, the primary goal of the Mathematics Teacher Education Partnership (MTE-Partnership) has been the transformation of secondary mathematics teacher preparation. However, much of the initial work of the MTE-Partnership has focused on the work of Research Action Clusters (RACs) and Working Groups, which address particular problems of practice in alignment with the driver diagram developed as a part of its networked improvement community (NIC) design. See the introduction of these proceedings and Martin and Gobstein (2015) for more information about the overall design of the MTE-Partnership. One section of these proceedings describes the work of the RACs and Working Groups; many of the research reports also relate to this work.

As the work of the RACs has progressed, emphasis on supporting the work of local teams to use the emerging knowledge to transform their secondary mathematics teacher preparation programs has increased. A working group on program transformation was formed in 2016, which organized a new theme on program transformation at the 2016 MTE-Partnership Conference. That theme continued in the following conferences in 2017 and 2018, but reached a new level of emphasis in the 2019 MTE-Partnership Conference, where the case was made that the work of local teams to transform their secondary teacher preparation program must receive parallel billing with building solutions to particular problems of practice through the RACs. The transformations panel was the second in a sequence of four sessions across the 2019 conference focusing on program transformation.

The transformations panel session was organized by leaders of institutions participating in a project funded by the National Science Foundation (NSF) called NIC-Transform, which stands for Using Networked Improvement Communities to Design and Implement Program Transformation Tools for Secondary Mathematics Teacher Preparation (DUE-1834539 and DUE-1834551). The panelists described their progress in transforming their secondary mathematics teacher preparation programs. The institutions within the project operate as a NIC, focusing on coordinating efforts to support program transformation (Martin, Smith, & Mohr-Schroeder, in press); its driver diagram is shown in Figure 1. The conference itself was supported by the NIC-Transform project in response to the key change idea “convenings/communication across programs,” and RACs were encouraged to include address this change idea related to thinking about ways the resources they are developing can be effectively shared with other teams focusing on program transformation.

The final change idea is built on an additional premise of this project, that the NIC design can be adapted to support transformation efforts at the local level. Each institution participating in the NIC-Transform project has identified drivers related to transformation of its program and is conducting Plan-Do-Study-Act (PDSA) Cycles to address those drivers. The purpose of this session was to help local teams think about how they might use the NIC

¹ Work on this chapter was supported in part by a grant from the National Science Foundation Directorate for Education and Human Resources, Division of Undergraduate Education (DUE) – Improving Undergraduate STEM Education (IUSE), Exploration and Design: Institutional and Community Transformation, Grant ID #s 1834539 and 1834551. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

design to help organize their efforts at program transformation. Four of the NIC-Transform institutions included on the panel provided a short description of their efforts at program transformation—including their local aim, the primary drivers they posit will lead toward their aim, and examples of change ideas on which they were working—as a means to promote participants’ reflection on their own contexts. An overview of each institution’s presentation follows in the expectation that they will both serve as a record of what happened at the conference as well as the basis for other MTE-Partnership institutional teams to reflect on their efforts to promote program transformation.

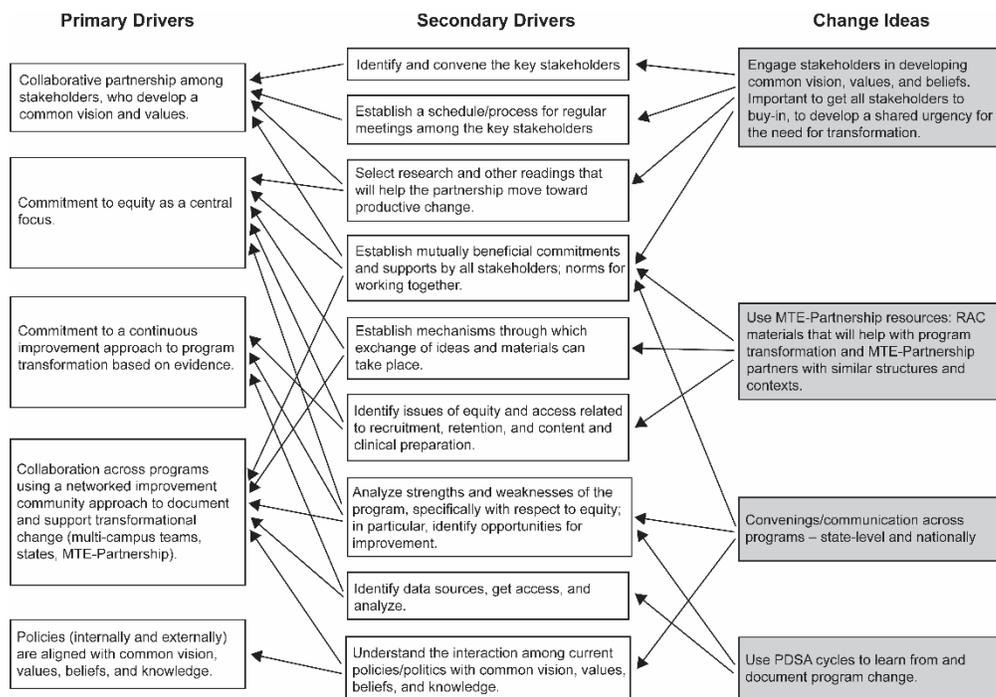


Figure 1. Driver diagram guiding the work of the NIC-Transform project.

Mississippi State University

Context

Mississippi State University is a land-grant institution with a distinction of being a global research institution. Mississippi State is designated “R1: Doctoral Universities – Very high research activity” and is the leading research institution in Mississippi. Student enrollment was 22,201 students for Fall 2019. The secondary mathematics program is housed in the Department of Curriculum, Instruction, and Special Education. Students earn a degree in secondary education with a concentration in mathematics, although the degree program is essentially a degree in mathematics. A Master of Arts in Teaching is also available through the department. The program graduates 10 to 15 students each year. The program has been continuously nationally accredited since the early 1970s. Mississippi State University educates a majority of teachers in the state and surrounding region.

The Mississippi State Partnership, as part of the MTE-Partnership, is hosted at Mississippi State with other partners being the Mississippi Association of Mathematics Teacher Educators and K–12 partners from Starkville Oktibbeha Consolidated School District and Golden Triangle Early College School. The Mississippi State University team consists of two mathematics educators, a science educator, and three mathematicians.

Aim and Primary Drivers

The aim of our work was to increase the number of students completing a degree in mathematics education and/or science education. Given the nature of our degree programs and the rural nature of our state, students could easily earn dual certification in mathematics and physics, chemistry, or general science. Our primary driver was to identify groups of students to target for recruitment. We need to understand how to effectively recruit incoming first year students, transfer students, and undeclared students. We have college recruiters that work effectively with incoming first year students, but we need to develop closer relationships with our partnering community college partners. Finally, we have a large number of undeclared students on campus. We need to understand how to reach out to these students.

Change Efforts

Our first PDSA Cycle concentrated on the undeclared students. We met with the director of undeclared students to learn about the characteristics of these students, effective communication with these students, and how many of these students already had interests in a STEM field. After study and discussion, we held a recruitment event for undeclared students. We had moderate success with our recruitment event. We plan to hold a similar recruitment event every year prior to the university's advising period. We will expand our recruitment advertisement to mathematics majors and other majors that have a heavy emphasis in mathematics.

Lessons Learned

We learned several valuable lessons. First, recruitment events need to be easily accessible to students. We will continue to hold these events in the student union during the primary lunch-time. Second, having students assist with the events is crucial. Students talking with other students serves to peak interest in what is being presented. Our students would initiate contact and then bring interested students to one of the professors/advisors working the event. Third, recruitment can be time-consuming and administrators, while they want more students, may not provide the resources or compensate your time for these events.

Next Steps

Through talking with students, we believe that students may be attracted to a double major in mathematics and mathematics education. Since the mathematics requirements for the two majors are similar, students could earn the double major easily. We currently are developing a prescribed dual degree that will be formalized for Fall 2019. We plan to have posters and flyers developed prior to the fall advising period.

Auburn University

Context

Auburn University is a comprehensive land, sea, and space grant institution – among the few that hold this distinction. Auburn's enrollment for the 2018–19 academic year was 30,440, which composes 24,628 undergraduate students and 4,706 graduate students. Auburn serves as the lead, and the public land-grant member, of the Central Alabama Mathematics Teacher Education Partnership (CAMTEP) of the MTE-Partnership. Other institutional partners of CAMTEP include Tuskegee University; Alabama State University; the Alabama Mathematics, Science, and Technology Initiative; Auburn City Schools; Tallassee City Schools; and Dadeville City Schools. The secondary mathematics program at Auburn University is housed in the Department of Curriculum and Teaching in the College of Education and has 12 to 20 bachelor's and/or alternative master's program completers each year. Each of these programs are initial certification programs and are Specialized Professional Association (NCTM, 2014) accredited with the Council for the Accreditation of Educator Preparation (CAEP). Thus, the programs have to meet specific standards for CAEP and the Alabama State Department of Education. Auburn

University also grants a doctoral degree, an educational specialist degree, and a master of education. Currently Auburn has 34 undergraduates at different points in their program and no alternative master degree students.

The programs are run by two nationally known mathematics teacher educators who strive to ensure that their teacher candidates receive the highest quality mathematics education that they can, based on research and innovative practices in the United States and the world. In addition, teacher candidates are provided with field experiences that are in alignment with their program goals and state and national standards.

Teacher candidates seeking initial certification at Auburn University take 42 hours of mathematics courses, which enable them to have a double major in mathematics and mathematics education. Other courses outside of mathematics education courses include foundation and core curriculum courses. Members of Auburn's local transformation team include mathematics teacher educators; mathematicians; mentor teachers; teacher candidates; the regional in-service director; the Alabama Mathematics, Science, and Technology Initiative director; the curriculum and teaching department chair; and members of the Office of Students Services of the College of Education.

Aim and Primary Drivers for Change

The aim of the team is to increase the engagement of stakeholders in secondary mathematics education program improvement. Our primary drivers for change are as follows. First, we would like to institutionalize the paired placement model for student teaching. We have university administrative support to do this but need to educate stakeholders. Second, we would like to increase engagement with clinical experiences for mentors in the methods courses. We communicate with mentor teachers but need to do more activities that ensure that mentor teachers' practices are in alignment with what is taught in methods courses. Third, we would like to redesign the math content sequence to become more aligned with the AMTE Standards (2017). We generally offer a capstone course, but this is an elective. Fourth, we would like to increase recruitment and retention of students. Our number of students has dropped to about 50% of what it was five years ago.

Change Efforts

Our first PDSA Cycle took place during initial stakeholder meetings. We planned to have meetings with stakeholders, such as the department chair of curriculum and teaching, the dean of the College of Education, representatives of the mathematics department, and the regional in-service center director. Overall the stakeholders were supportive of suggested program improvements and provided good advice on next steps. We will have a follow-up meeting with the mathematics department to further discuss suggested mathematics courses for teachers. Also, a mathematician attended the MODULE(S²) training during the 2019 MTE-Partnership Conference. We plan to meet with the regional district leaders in September or October 2019 about mutual concerns related to mathematics teacher shortages and preparing new teachers.

Lessons Learned

The initial lessons that we learned through this process are as follows. We learned that we need to act quickly due to rapidly changing circumstances, such as new policies, new administrators, and other unforeseen events. We also need to take advantage of opportunities that can be used to improve the program, such as departmental initiatives that increase research productivity and visibility. We need to capitalize on intersecting needs of the program and other stakeholders, such as the need for more mathematics teachers in the region.

Next Steps

Our next steps include continuing to work on replacing the traditional student teaching model with the paired placement model. In addition, we plan to convene a meeting with district leaders to discuss program changes and needs of the schools related to mathematics education. Continuing discussions with the mathematics

department about mathematics content related to teaching is also on our agenda. Finally, we are planning to develop a master's degree program to recruit and support career-changers.

University of Kentucky

Context

The University of Kentucky is a land-grant institution situated in the urban context of Lexington, but given its central location, it serves a large rural population across the Commonwealth. There are over 30,000 students at the university, which is home and leader to the Kentucky MTE-Partnership. While the Kentucky MTE-Partnership focuses on the improvement of secondary mathematics teacher preparation and retention, the programs at the University of Kentucky are housed within the Department of STEM Education in the College of Education. As the college's newest department (formed in 2011), it focuses on using a transdisciplinary framework to prepare mathematics and science teachers for the future STEM classrooms. There are two routes for initial secondary (Grades 8–12) teacher preparation in the department—a four-year, 120-credit-hour, undergraduate, double-major program, and a Master of Arts in Teaching program. While both program majors are called STEM Education, preservice teachers focus on their content area via a major in the area in which they wish to teach and is certifiable (e.g., mathematics). The programs, combined, graduate 10 to 15 students per year and are guided by program faculties that are made up of: STEM education and content faculty, K–12 teachers and administrators, the Kentucky Department of Education, and alumni. The Kentucky MTE-Partnership is active in the Program Recruitment and Retention (PR²) RAC, co-leads the Secondary Teacher Retention and Induction in Diverse Educational Settings (STRIDES) RAC, co-leads the Transformations Working Group, and is a piloter for the Mathematics of Doing, Understanding, Learning, and Educating for Secondary Schools (MODULE(S²)) RAC.

Aim and Primary Drivers for Change

The Kentucky MTE-Partnership is committed to producing STEM teachers who will function as professionals, lifelong learners, and leaders in their schools and communities. Candidates will gain hands-on experience in a variety of unique educational and research activities that will foster their interest, expertise, and enthusiasm for STEM education.

The primary drivers for change for Kentucky include: improving clinical experiences for students by creating and implementing more embedded course and clinical field experiences; be more intentional about infusing equity throughout all of our coursework and not only the methods experiences; understanding recruiting patterns of the students who apply and accept in order to increase the number of incoming students; expand programming opportunities for future teacher candidates so they can choose a program that fits their needs the best; and expand our partnerships, including schools, businesses, and industry.

Change Effort

Our former post-baccalaureate program was combined with another department, and there was little focus on STEM content, except within the one methods course, and little flexibility in the timeline for completion of the program. In order to give students more of a mathematics (and science, as applicable) focus and program flexibility, a new MAT program was created. Taking feedback from alumni, cooperating teachers, and other program faculty members, the new program was a complete transformation from the old one. For example, instead of traditional field experiences, candidates now get the opportunity to include informal learning experiences in their field experiences, as well as embedded methods courses at one of our school partnership sites. There are now full time and part time options available. Equity is a focal point, with strategies woven throughout all of the coursework, including practice and infusion of strategies for difficult and courageous

conversations. The use of storylines frames the content, and professional noticing is the framework infused throughout, which provides a lens for observation, reflection, and professional growth.

Lessons Learned

The process took six months to plan and nine months to get through the university's approval processes. Throughout the process, the challenges and roadblocks were mainly from faculty rather than from partnership processes or an obligation to adhere to particular standards; change is difficult. The Kentucky MTE-Partnership uses a shared leadership model, especially in leading the programs, but we learned along the way that you still need someone to be *the* point person. While we used networked improvement communities (NICs) as a foundation group for our work, not everyone liked the idea of a NIC. Finally, even with a fancy, new, gold-standard-infused program, negative images of teachers still exist that can make recruiting a challenge.

Next Steps

Our next steps will focus on major recruitment and retention efforts. Universities are getting creative with the recruitment of students into the university, but we need to capitalize on this to promote teaching as a viable major and career choice. We are starting with the Educators Rising Partnership with high schools across Kentucky and partnering with our Educators Rising Collegiate group. We are looking at dual credit models and also unique admissions scenarios that help to take away barriers to students going into the teacher education program. We know our retention in our mathematics courses is not the greatest, especially in Calculus II. Already an active learning class, we are exploring additional ways that we can provide our students with the support and resources they need to successfully complete Calculus II.

University of Nebraska–Lincoln

Context

The NebraskaMATH Secondary Teacher Education Partnership (NebraskaMATH STEP) includes the University of Nebraska system campuses in Lincoln (which is the flagship), Omaha and Kearney, and the public school districts located in those same cities. The state of Nebraska only has 16 colleges and universities that prepare teachers; nearly all mathematics and mathematics education faculty have PK–12 responsibilities for preparing teachers. Thus, the focus of NebraskaMATH STEP has broadened to PK–12, rather than only secondary mathematics, and also involves others who prepare teachers of mathematics, such as special education and English Language Learners (ELL). Members of NebraskaMATH STEP include mathematicians, mathematics educators, special educators, district mathematics, special education (SpEd), and ELL coordinators, and other school, district, and regional PK–12 administrators. Members of NebraskaMATH STEP are quite active in the MTE-Partnership, including involvement in the Active Learning Mathematics Research Action Cluster (ALM RAC); Mathematics of Doing, Understanding, Learning, and Educating for Secondary Schools (MODULE(S²) RAC), Equity and Social Justice Working Group (ESJWG), and Secondary Teacher Retention and Induction in Diverse Educational Settings (STRIDES RAC).

For this panel presentation, the focus is on efforts in Lincoln (at the University of Nebraska–Lincoln [UNL] and Lincoln Public Schools [LPS]). Lincoln is the second largest city in Nebraska, with about 26,000 students at UNL and over 40,000 students in LPS. UNL has two overlapping teacher preparation programs: a traditional undergraduate program and an 18-month master's level program for those with substantial undergraduate mathematics coursework. Recently, across both programs, UNL graduates about 25 new secondary mathematics teachers per year.

Aim and Primary Drivers for Change

The aim of Nebraska's efforts is that all programs for preparing teachers of mathematics (PK–20, including SpEd and ELL) will work to align their programs to meet the AMTE Standards (2017), including (a) a deep and integrated focus on equity, (b) foundation for career-long learning, (c) focus on mathematics, (d) shared responsibility across stakeholders, and (e) commitment to improving effectiveness

The primary drivers for change include (a) understanding mathematical dispositions of students (engagement, anxiety, etc.); (b) understanding teacher prep programs statewide; (c) improve clinical experiences; (d) focus on cooperating teachers; (e) strengthen school-university partnerships; and (f) transform programs with a focus on equity.

Selected Efforts: Infusing Equity

Although the NebraskaMATH STEP team is working on all of the drivers, for the transformations panel presentation at the 2019 MTE-Partnership Conference, we highlighted the efforts toward *infusing equity*. In partnership with the ESJWG, UNL and LPS worked together to revamp the mathematics methods courses for future secondary teachers to focus on the AMTE Standards (2017). This course redesign has an explicit and central focus on equity. At UNL, the Department of Teaching, Learning and Teacher Education engaged in department-wide efforts to infuse a focus on equity throughout secondary teacher preparation. It was recognized that the responsibilities for equity infusion cannot solely be on the methods instructors; equity infusion needs to be part of all other education courses future teachers take at UNL. At the same time, LPS ended the low math track for K–8 students. All students are now in either on grade level or above grade level in mathematics courses. Students who struggle to be successful in on grade level mathematics courses are provided additional support through mathematics intervention time daily.

Lessons Learned

Across the Nebraska partnership, we learned that higher education faculty and PK–12 personnel have a genuine desire to collaborate, despite official competition among some of the institutions. However, keeping all those engaged in the work focused across all partners is hard. Transformation efforts are an add-on to most people's current responsibilities, so it can be hard to make time for the work. We realize we need better ways to share progress across sites and partner locations as well as a more explicit focus on PDSA Cycles as part of our NIC.

Next Steps

One next step for the Nebraska partnership is to share the UNL/LPS equity work across the rest of the partner institutions. In related work, UNL and two Nebraska community colleges recently received an NSF S-STEM award for funding undergraduate scholarships for STEM majors; this project will help to bring community colleges into the partnership efforts. Finally, we will supplement online and email communication by continuing to meet in person at least once per year, during our state meeting (Nebraska Association of Teachers of Mathematics) in the fall.

References

- Martin, W. G., & Gobstein, H. (2015). Generating a networked improvement community to improve secondary mathematics teacher preparation: Network leadership, organization, and operation. *Journal of Teacher Education*, 66(5), 482–493.
- Martin, W. G., Smith, W. M., & Mohr-Schroder, M. J. (in press). Transforming secondary mathematics teacher preparation programs. In W. G. Martin, B. R. Lawler, A. E. Lischka, & W. M. Smith (Eds.), *The Mathematics Teacher Education Partnership: The power of a networked improvement community to transform secondary mathematics teacher preparation*. Charlotte, NC: Information Age Publishing.