

RESPONDING TO CHALLENGES IN RECRUITING SECONDARY MATHEMATICS TEACHER CANDIDATES¹

W. Gary Martin, Marilyn E. Strutchens, Wendy M. Smith

Auburn University, Auburn University, University of Nebraska-Lincoln

A networked improvement community (NIC) of 46 secondary mathematics teacher programs working to better align their practices with non-compulsory national standards has seen a significant drop in the number of students completing their programs over the past years. In accordance with the NIC model, programs are designing a wide range of strategies to address this problem using Plan-Do-Study-Act cycles to guide their work. The NIC is also building opportunities for collaborations among the teams to learn from each others' work in order to better understand what may or may not work in various settings and contexts. Although the ultimate success of these efforts will not be seen for several years, as we continue to track the number of candidates produced, we are finding the NIC model useful in guiding these improvement efforts.

Many countries globally, including the U.S., face a significant shortage of well-prepared secondary mathematics teachers, particularly in the highest-need districts, and particularly in subjects like mathematics (e.g., Ingersoll & Tran, 2023; Smet, 2022). The field has long known that well-prepared mathematics teachers are a necessary foundation to improving student mathematics outcomes and thus broadening participation in STEM. As stated in the National Mathematics Advisory Panel Report (2008), "Teachers are crucial to students' opportunities to learn mathematics, and substantial differences in the mathematics achievement of students are attributable to differences among teachers" (p. 35). Thus, an adequate supply of well-prepared mathematics teachers is essential, particularly in high-need districts. Meanwhile, undergraduate enrollment in education programs nationwide is down dramatically (Grawe, 2023), and enrollments in secondary mathematics education are half what they were a decade ago.

The Mathematics Teacher Education Partnership (MTEP) is a collaboration of secondary mathematics teacher preparation programs across the U.S. that was formed in 2012 to address this and other issues facing secondary mathematics teacher preparation (Martin & Gobstein, 2015). MTEP is currently focused on growing the network and supporting programs to better align their practices with non-compulsory national standards (Association of Mathematics Teacher Educators [AMTE], 2017) to produce more well-prepared novice mathematics teachers, building on the networked improvement community (NIC) design described by Bryk et al. (2015). The NIC design is enacted at multiple levels of the project, from its use to guide improvement efforts at the local program level to organizing collaborations across programs. MTEP currently consists of 46 local secondary mathematics teacher preparation programs organized into 20 teams that may encompass a single program or multiple programs in a region or state. Teams also include secondary school partners and others with whom they collaborate to prepare future secondary mathematics teachers.

The NIC design includes several key features that guide the work of the MTEP teams (Bryk et al., 2015). NICs must have a clearly-defined aim which focuses their work. NICs must have a theory of action that guides work towards the attainment of their aim. This theory of action is frequently represented in a driver diagram, showing primary and secondary drivers (change levers) posited to be possible improvements that will make progress toward the aim. NICs also engage in iterative cycles following principles of improvement science; MTEP uses the specific structure of

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Plan-Do-Study-Act (PDSA) cycles to guide this iterative process. Finally, NICs are networked, facilitating communication across participants and encouraging local adaptations of change strategies based on each other's learning.

METHODOLOGY

This study investigates the research question: How do networked improvement communities focused on transforming secondary mathematics teacher preparation programs address the challenges associated with recruiting candidates to their programs? This question falls under the overarching MTEP question: How can a collaborative structure of networked improvement communities support, accelerate, and sustain secondary mathematics teacher preparation program transformation efforts locally, regionally, and nationally toward a goal of achieving more inclusive and equity-oriented programs? MTEP collects annual documentation from the team NICs: the number of candidates graduated by each program within the team, a self-assessment of the progress of the team in alignment with the AMTE (2017) Standards, and documentation for each NIC's change efforts, including a statement of current team members, a current driver diagram, at least one PDSA cycle, and plans for future work.

ANALYSIS OF THE PROBLEM

The data indicate that recruitment of candidates is a central problem for many teams. A summary of the graduates produced shows that the median number of graduates produced by the MTEP programs has dramatically decreased over the past five years (see Figure 1). A linear regression with time as a predictor, grouped by program, demonstrated that this is a highly significant decline (adj. $R^2=0.90$, $F=29.02$, $df=175$, $P<<0.001$). As a result, programs are facing serious questions about whether they are viable or will be discontinued.

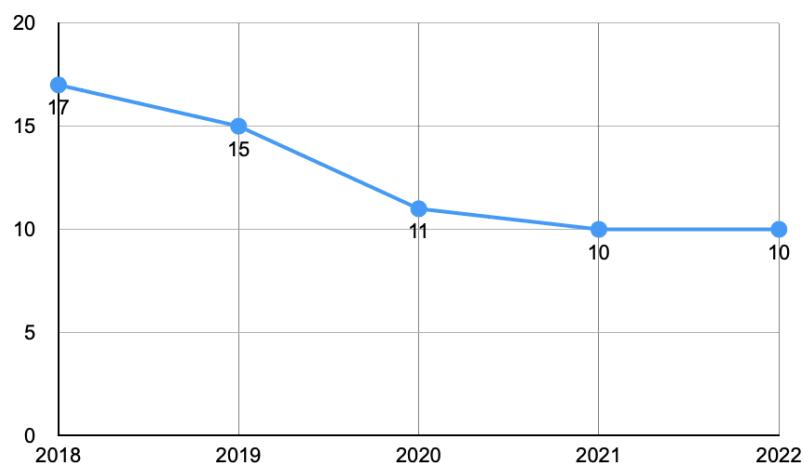


Figure 1: Median Number of Completers Reported by MTEP Programs (N=28)

The self-assessment data reinforces the immediacy of the need to reexamine recruiting practices. Only 25% of the MTEP programs reported making substantial progress on the AMTE standard related to candidate recruitment, and nearly 40% identified this as an area of high priority. As one team responded, "We desperately need to focus on this area!" Further, over 40% of MTEP programs identified addressing the diverse needs of the communities they serve as a high priority. This is consistent with the findings of Sears, Jessup, and Matthews (2021), who cite data suggesting that the percentages of Black and Latinx teachers in the U.S. are less than half of the percentages of the Black and Latinx students they may teach.

STRATEGIES TO IMPROVE RECRUITMENT

In this section, we examine specific strategies that teams are employing to address this issue. In 2020, 10 out of 21 of the team NICs reported plans for conducting PDSA cycles related to recruitment and retention. Their change plans for recruitment and retention ranged from establishing mechanisms for recruiting students into teaching mathematics in grades 6-12 and post-secondary institutions to seeing if regular check-in meetings with prospective students increases the number of students who remain math education concentrations (in the math undergraduate program) who complete the concentration and complete the Masters in Teaching math program.

For the 2021-2022 academic year, 10 out of 23 of the team NICs reported plans for conducting PDSA cycles related to recruitment and retention. Some of the change plans for recruitment and retention included building support for a “Grow Your Own” effort in which programs partner with schools to recruit candidates from their community; implementing effective methods to recruit incoming freshman, transfer students, undeclared students, post-bachelor’s students, and career changers; analyzing admittance data; establishing recruitment programs among university students targeting undeclared students and students in early STEM classes; and identifying resources used in recruitment of teacher candidates.

Even though NICs have been conducting PDSA cycles related to recruitment and retention in previous years, a review of their plans for the 2023-2024 year collected for a MTEP-wide convening focused on increasing networking across the teams and providing opportunities for them to learn from each other revealed that nine of the participating teams focused on recruitment efforts. During the workshop five teams discussed recruitment strategies, such as focusing on recruiting undergraduate learning assistants from disciplinary programs like mathematics, statistics, and physics, and sharing teaching approaches that might spark the undergraduate learning assistants’ interest in mathematics teaching as a career; targeting high school “Grow Your Own” programs and recruitment fairs to talk to students about mathematics teaching; sitting in high school cafeterias with high school students to talk about mathematics teaching; and attending mathematics courses to talk to undergraduates about mathematics teaching. We are looking forward to following up with these participants in the coming year to see what progress they have made toward increasing enrollments in their programs.

Examining the planned PDSA cycles of the NICs showed that recruitment and retention is and will be an on-going effort for many teams and that they are diligently working to increase the number of highly qualified secondary mathematics teachers going into the field.

CONCLUSIONS AND NEXT STEPS

Recruitment of candidates is a high priority for many of the teams involved in the MTEP, and they are developing, testing, and refining a wide range of strategies to address it, following the NIC model. While these strategies are necessarily designed to address the local context, the networking aspect of the NIC model provides opportunities for teams to learn from each others’ work to better understand what may or may not work in various settings and contexts. This reinforced the following claim from the call to action in the conclusion to the AMTE (2017) Standards: “Faculty in programs preparing teachers of mathematics must build collaborations with faculty in other programs preparing teachers of mathematics. Learning from and with colleagues from other institutions and providers can accelerate progress in their improvement efforts, with faculty benefitting from experiences and results of each site” (p. 166). Moreover, the shared knowledge so generated may be of value beyond the network, as MTEP members are writing about what they are learning to help advance the field more broadly (cf. Martin et al., 2020). Over the coming years, MTEP will hold additional convenings at which the NICs can share the work they are doing to promote mutual

learning. We will also encourage the formation of more formal “NIC of NICs” structures for teams working on similar strategies to coordinate their work.

The ultimate success of these efforts will not be seen for several years, as we continue to track the number of candidates the MTEP programs produce. However, we are finding the NIC model useful in guiding the work. We are engaging in more intensive data collection and analysis, including interviews of members of a purposive sample of 10 teams representing different stages of development, to better understand how the NIC model is informing their work.

References

Association of Mathematics Teacher Educators. (2017). *Standards for the preparation of teachers of mathematics*. <https://amte.net/standards>

Bryk, A. S., Gomez, L., Grunow, A., & LeMahieu, P. (2015). *Learning to improve: How America's schools can get better at getting better*. Harvard Education Publishing.

Grawe, N. (2023). *The agile college*. Johns Hopkins University Press.

Ingersoll, R. M., & Tran, H. (2023). Teacher shortages and turnover in rural schools in the U.S.: An organizational analysis. *Educational Administration Quarterly*.
<https://doi.org/10.1177/0013161X231159922>

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. <https://doi.org/10.1177/0022487115602312>

Martin, W. G., Lawler, B. R., Lischka, A. E., & Smith, W. M. (Eds.). (2020). *The Mathematics Teacher Education Partnership: The power of a networked improvement community to transform secondary mathematics teacher preparation*. Volume 4 in B. Benken (Ed.), Association of Mathematics Teacher Educators Professional Book Series. Information Age Publishing.

National Mathematics Advisory Panel. (2008). Foundations for success: The final report of the National Mathematics Advisory Panel. U.S. Department of Education.

Sears, R., Jessup, N., & Matthew, L. (2021). *Reimagining the STEM education pipeline for teachers of color: Advancing Research & Innovation in the STEM Education of Preservice Teachers in High-Need School Districts (ARISE)*. American Association for the Advancement of Science.

Smet, M. (2022). Professional development and teacher job satisfaction: Evidence from a multilevel model. *Mathematics*, 10, 51. <https://doi.org/10.3390/math10010051>