Challenges to STEM Teacher Recruitment and Preparation

Five years into the ten-year effort, 100Kin10 has much to celebrate as the network of 280+ partners makes collective progress toward the goal to recruit, train, support, and retain 100,000 excellent science, technology, engineering, and math (STEM) teachers for our nation’s schools by 2021.

By fall 2015, four years into the effort, 100Kin10 partners have together prepared more than 30,000 new STEM teachers, while supporting tens of thousands more to access meaningful opportunities for professional learning and growth, enabling them to improve their skills and stay in the classroom longer. Most recently, 100Kin10 has secured the commitments from partners to train the full 100,000 STEM teachers, achieving a major milestone in the ambitious goal laid out by President Obama five years ago.

Despite these and other accomplishments, 100Kin10 and its partners still have significant work to do to fulfill these ambitious commitments over the coming years, and, more importantly, to overcome the big, system-level barriers that make this work so difficult. 100Kin10 has developed a draft set of grand challenges (http://file.100kin10.org/grand-challenges-v2.swf) that articulate the largest barriers and their root causes, based on data and evidence provided by hundreds of STEM teachers, principals, 100Kin10 partners, and other stakeholders since early 2015. At this critical midpoint juncture, and as 100Kin10 transitions into the next five years of the work, the network has committed to collectively confront these barriers.

In support of this effort to understand the systems-level challenges, 100Kin10 recently asked two key questions of our approximately 80 partners working to recruit and prepare new STEM teachers. (We received responses from 55 partners whose names are listed below.) These questions honed in on challenges pertinent to recruitment and preparation—the early stages of the STEM teacher pipeline:

1) What are the top challenges your program is confronting (not including access to additional private philanthropy)?
2) What would it take for your program, working in concert with state flagships and other high-quality providers as you determine them, to fully staff the vacancies of the districts with which your partner or to increase the number of excellent STEM teachers you prepare by x2? What changes in the operating environment in which your program exists would make that possible?

While the supply of excellent STEM teachers is just one piece of the larger pipeline challenge, it is a critical component and one that has implications for STEM teacher retention and success in the classroom. The investment in newly trained STEM teachers pays off when those teachers improve over time, stay in the profession, and accelerate student achievement.1

1 The work is by its nature cyclical and interrelated; greater understanding of how to support and retain teachers already in the classroom informs more targeted recruitment and improved preparation. Attending
Our network of partners identified the following as the biggest challenges to increasing the supply of high-quality, diverse STEM teachers and shared their key insights into impediments particular to attracting STEM teacher candidates in the states in which they work. They did this against the backdrop of declining enrollment in teacher preparation programs overall.

1. Teaching Not Perceived as a Top Career Choice

   Teaching lacks prestige and is not widely perceived as a top career choice for STEM college graduates. STEM teachers are often drawn from cohorts of science, math, and engineering students who have other career options that are often better paying and in fields that have greater prestige. Newly minted STEM college graduates often face repayment of student loans and/or live in high-cost areas and feel forced to consider jobs that offer more competitive salaries. Several program respondents noted that there is limited federal funding (loan forgiveness, stipends, etc.) to incentivize student enrollment in STEM teaching programs. According to partners’ responses, some students may be intimidated by the task of completing within four years both teacher preparation coursework and a rigorous STEM curriculum sequence in order to earn STEM teaching certification—and, given teacher salaries, the prospect of extending to a fifth year of education for the teaching certificate, and as a result increasing student loans, is an additional deterrent.

   One program respondent commented on the need to acknowledge the wide range of competencies teachers develop that are applicable to other jobs, such as strong time management, communication, and project management skills. Finding a way to recognize those important skills might help students majoring in STEM subject areas see teaching experience as a skill enhancer, rather than a dead end.

2. Potential Candidates Not Encouraged to Teach

   Unfortunately, many STEM students are discouraged from pursuing teaching by parents, teachers themselves, and university professors who direct talented students towards research/PhD tracks instead. Higher education institutional structures can also act as a barrier by not exposing students to available teaching tracks or structured opportunities to explore the teaching profession as they simultaneously earn a STEM content degree. Even seemingly small issues like federal reporting requirements that give colleges credit for the number of students pursuing STEM careers, but not for students pursuing STEM teaching, can act as impediments, deterring college professors from pointing STEM students toward teaching.

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to STEM teacher professional learning and growth at all stages of the career continuum is therefore imperative to reaching our goal. That said, this report is particularly focused on challenges in recruitment and preparation. Ingersoll, R., Merrill, L., & May, H. (2014). *What are the effects of teacher education and preparation on beginning teacher attrition?* CPRE Research Report #RR-82. Philadelphia: Consortium for Policy Research in Education.
3. Lack of Aligned Partnerships Between Districts and Teacher Preparation Programs

100Kin10 partners noted a general lack of communication and coordination between school districts and preparation providers. Several suggested that school districts, as the primary consumer of STEM teacher talent, could be powerful partners to training programs in solving the supply challenge. For instance, districts and programs could jointly recruit and select teacher candidates. They could also work together to design curriculum to ensure that aspiring teachers graduate with the content and pedagogical skills they need to be successful in local schools and drive school reform and improvement.²

4. Difficult to Develop Both Deep Content Knowledge and Strong Pedagogy

Partners noted the challenge of simultaneously preparing STEM teachers to have deep content knowledge and strong content-based pedagogy, alongside the need for understanding child development and how to effectively reach culturally, linguistically, ethnically, racially, and socioeconomically diverse learners. One respondent commented that this is a particular challenge for elementary/multiple-subject teacher candidates, as many do not have bachelor’s degrees in the STEM disciplines.

5. Intensive Clinical Training (e.g., Residency) Expensive and Time-Consuming

Several partners pointed out the power of residencies or other intensive clinical training opportunities, which give aspiring teachers relevant, classroom-based teaching experiences under the guidance of a practiced mentor. Yet, this is an expensive and complex programmatic element, requiring close coordination with district partners and the identification of excellent mentor teachers. It is also costly for students, in terms of the time commitment and tuition, especially for career changers who may be leaving well-paying jobs. For many students, the upfront financial investment in high-quality clinical- or residency-based preparation programs may not be perceived as equivalent to the reward.

6. Cumbersome Licensure Requirements Not Correlated with Teacher Ability

STEM teaching certification requirements vary drastically by state and district, which can be confusing. Current state licensure rules pose a significant barrier to entry for many prospective teachers, and many of the requirements, such as minimum GPA or credit hours earned, do not seem to correlate with teaching effectiveness. These regulations may keep potentially strong teachers out of the classroom, particularly career changers who bring real-world experiences and content expertise but are several years removed from college. In addition, some partners questioned the efficacy of licensure examinations. Several programs noted that teacher examinations have become more difficult, demonstrated by lower first-time pass rates, which may discourage new applicants. This particularly affects prospective teachers from diverse backgrounds, who remain under-represented in the teaching workforce generally and in STEM subjects, in particular.

² It is worth noting that these recommendations came from institutions of higher education and other teacher-preparation programs, which are asking to partner more closely with school districts.
7. **Challenging District Hiring Processes**
District hiring processes are, at best, frustrating for STEM teachers; in many cases, the challenges teachers face in navigating the hiring process deter many ambitious and talented individuals from reaching our students most in need of excellent teaching. Available positions are often unknown until late in the school year, or even the summer, due to district and school budget uncertainties and other policies that keep districts from advertising open roles and searching for the best-prepared candidates to fill them. New teachers also tend to be assigned to the least desirable courses. The lack of control in the hiring process and school placement decisions may deter qualified candidates from pursuing teaching jobs.

8. **Poor Working Conditions in the Schools**
100Kin10 partners report that STEM teacher candidates have concerns about working conditions in schools and believe the environment can be both unfriendly and stressful, and that this deters strong potential teachers from considering STEM teaching as a career. A number of perceived challenges were mentioned, including a heavy workload, lack of administrative support, inflexible hours, rundown facilities, large class sizes, polarizing union-district politics, and unpredictable funding. The specter of lay-offs, a result of the economic downturn, has also contributed to this perception.

9. **Active Teaching of STEM Subjects Discouraged**
Given the current high-stakes testing culture and emphasis on test prep, prospective STEM teachers believe they would have limited opportunities to employ creative teaching approaches, particularly those that utilize active or project-based learning strategies. General perceptions about lack of funding and a dearth of high-quality materials exacerbates this concern, as prospective STEM teachers worry that they would not have the necessary instructional supplies to teach in creative or active ways, especially for lab courses.

In general, STEM teaching is not often viewed as a STEM profession, especially one with the power to help students integrate what they are learning in school with real-world STEM opportunities. One respondent suggested further engaging businesses and corporations to provide STEM teachers with professional learning in authentic settings through experiences such as employer shadowing programs or internships.

10. **Lack of Leadership Opportunities and Career Pathways**
A lack of career pathways within the teaching profession also serves as a deterrent to entry. Potential STEM teachers see minimal opportunities to change roles and grow over the course of their careers. There is a perception that you walk into the classroom at 25 and walk out at 65, having done the same thing for the intervening 40 years. There are few incentives or rewards for excellent teaching and lock-step pay increases accumulate slowly. The lack of opportunity for professional growth or acknowledgement of expertise over time deters ambitious students.
11. Absence of Innovative Staffing Models

At least one partner noted that the inflexibility around defining the role of the teacher serves as a barrier for many experienced candidates who might otherwise be persuaded to teach in K-12 schools, if not necessarily to become full-time STEM teachers. The traditional school day model hampers a creative approach to bringing in non-certified content experts (such as adjunct college professors or professionals in STEM related fields) on a part-time basis. This points to a larger school organization challenge that also impacts teacher satisfaction and retention.

By highlighting these and other challenges impeding progress in recruiting and training strong STEM teachers, 100Kin10 intends to identify system-level barriers and mobilize partners and others working across the STEM teaching field to design, test, and share solutions and strategies that accelerate the collective progress against them.

Fifty-five 100Kin10 partners recruiting and preparing new STEM teachers contributed data to the analysis in this report:

Academy for Urban School Leadership  
Boston Teacher Residency  
Capital Teaching Residency  
Center for Mathematics Education, University of Maryland, College Park  
Center for Science Teaching and Learning, Northern Arizona University  
Colorado School of Mines/University of Northern Colorado STEM Teacher Preparation Program  
Denver Teacher Residency  
Drexel University School of Education  
EnCorps STEM Teachers Program  
Fresno Unified School District  
Graduate Programs in Science and Mathematics, Morgan State University  
Guilford County Schools  
Harvard Graduate School of Education  
High Tech High  
The Ingenuity Center – UT Tyler  
Jacksonville Teacher Residency  
Loyola University Chicago  
Mary Lou Fulton Teachers College at Arizona State University  
Merrimack College  
Michigan State University  
Noble Network of Charter Schools  
North Carolina New Schools  
Project Inspire  
Project Tomorrow  
Purdue University  
Relay Graduate School of Education  
Rider University  
San Francisco Teacher Residency  
Spelman College  
Stanford Teacher Education Program  
Teach For America  
Technology Access Foundation  
Texas A&M University  
The Algebra Project, Inc.  
The Long Beach Educational Partnership  
TNTP  
Twin Cities Teacher Collaborative  
University of California, Santa Barbara  
University of Houston-Clear Lake  
University of California, Berkeley  
University of California, Irvine, Cal Teach Science and Mathematics Program  
University of California, Merced  
University of California, San Diego  
University of Indianapolis  
University of Missouri  
University of Northern Colorado  
University of South Carolina  
University of Virginia  
University of Washington College of Education  
University System of California  
Urban Teachers  
USC Rossier School of Education  
The UTeach Institute  
Virginia Commonwealth University – Richmond Teacher Residency  
The Woodrow Wilson National Fellowship Foundation