

DEAR MR. PRESIDENT:

We applaud your announcement of a STEM Teacher Corps that will recognize the nation's top STEM teachers. We are delighted to see that the Teacher Corps is among the 2013 State of the Union proposals released in your blueprint for a strong America.

We believe that the Teacher Corps creates an important opportunity to improve STEM education in the United States, to attract and reward talent in STEM teaching, and to create a community of practice among teachers that broadly advances learning.

We are a group of wide-ranging individuals and organizations from the education, philanthropic, corporate, and academic sectors. We are pleased to stand together and voice our support for the concept of a STEM Teacher Corps.

In order to help advance and support your Administration's work to build a successful Teacher Corps, we all served as advisers in the development of the attached white paper, authored by a team representing Math for America, Google, and the Broad Institute. The white paper reflects more than a year of dialogue among various stakeholders, including leaders from the Department of Education and the White House. It builds upon the recommendation made by your President's Council of Advisors for Science and Technology (PCAST) in the 2010 report Prepare and Inspire. The paper offers a potential path to a Teacher Corps, and we hope it will catalyze further collaboration across the private and public sectors with the common aim of making the STEM Teacher Corps a success.

Respectfully,

**Academy for Urban
School Leadership**

**The Achievement
Network**

**Alex Reeves, Clinton
Global Initiative**

**American Association of
Physics Teachers**

**American Institute of
Physics**

**American Modeling
Teachers Association**

**American Physical
Society**

**Anne Sung, Physics and
Math Teacher, Houston**

**Aspire Public Charter
Schools**

**Association for
Computing Machinery**

**Betty Carvellas, retired
Biology Teacher,
Vermont**

**Bill Kurtz, CEO, DSST
Public Schools, Denver,
Colorado**

CA Technologies

**Charity Fesler, STEM
Integration Manager,
District of Columbia
Public Schools**

**Chattanooga-Hamilton
County Public
Education Foundation**

**Computer Science
Teachers Association**

**Dennis M. Walcott,
Chancellor, New York
City Department of
Education**

**Donna Gerardi Riordan,
Education Consultant**

DonorsChoose.org

**Ellen Moir, Founder
& CEO, New Teacher
Center**

**Evan Glazer, Thomas
Jefferson High School**

**Eyal Wallenberg, Math
Teacher, New York City**

**Francis (Skip) Fennell,
McDaniel College,
Project Director
Elementary Mathematics
Specialists and Teacher
Leaders Project**

**Gay & Lesbian Fund for
Colorado, a program of
the Gill Foundation**

Google

**Howard Gobstein,
Executive Vice President
of Association of
Public and Land-Grant
Universities**

**Industry Initiatives
for Science and Math
Education**

**Internationals Network
for Public Schools**

**James Brown, Executive
Director, STEM
Education Coalition**

**Janet English, Science
Teacher and Presidential
Awardee for Excellence
in Math & Science
Teaching, El Toro High
School, California**

**Jay Labov, National
Research Council***

**Jennifer Bruckner,
Executive Director,
Industry Initiatives
for Science and Math
Education (IISME)**

Jhumki Basu Foundation

**Judith Opert Sandler,
Senior Policy Adviser,
Education Development
Center, Inc.**

Lehman College

**Mary Ann Rankin,
Provost at the University
of Maryland and
Founder, UTeach**

**Mary M. Brabeck, Gale
and Ira Drukier Dean of
the Steinhardt School of
Culture, Education and
Human Development at
New York University**

Math for America

Merrimack College

**Michael Lach, Director
of STEM Policy and
Strategic Initiatives,
University of Chicago
Urban Education
Institute**

**Michelle Cahill and
Talia Milgrom-Elcott,
Carnegie Corporation of
New York**

**Museum of Science,
Boston**

* The signing of this letter does not necessarily reflect the views of the NRC, and the NRC has not reviewed the attached white paper.

Mytonomy	Suzanne Wilson, University Distinguished Professor and Chair of the Department of Teacher Education, Michigan State University	Tom Luce, Chairman of the Board of the National Math and Science Initiative
National Commission on Teaching and America's Future		
National Council of Teachers of Mathematics	TC2	Tom Stritikus, Professor and Dean, The University of Washington College of Education
National Science Teachers Association	Teaching Institute for Excellence in STEM	
NC New Schools	Teach Plus	Tom Torkelson, Founder and CEO of IDEA Public Schools
New York Hall of Science	The Broad Institute	Tom Vander Ark, Getting Smart
New Leaders	The Leona M. and Harry B. Helmsley Charitable Trust	Urban Teacher Center
Oana Pascu, Math Teacher, New York City		Uri Treisman, Executive Director of the Charles A. Dana Center at the University of Texas at Austin
Public Impact	The School of Education at Loyola Marymount University	
Relay Graduate School of Education	The Woodrow Wilson National Fellowship Foundation	WNET New York Public Media
Richard M. Ingersoll, Board of Overseers Professor of Education and Sociology at the University of Pennsylvania	TNTP	Young People's Project
		Zach Levine, Executive Director, ElevatED

A PATH TOWARD A
STEM
TEACHER CORPS

White Paper | April 2013

This White Paper was authored by:

Jordan Lloyd Bookey
Google

Bina Venkataraman
Broad Institute

John Ewing
Math for America

with input from more than 80 organizations and individuals from the public, private, philanthropic, and nonprofit sectors.

SUMMARY

The STEM Teacher Corps is a bold initiative to advance STEM teaching and learning across the United States by recognizing the nation's top K-12 STEM teachers. In order to attract and retain the best STEM teachers, we must significantly reward excellence in STEM teaching, elevate the status of the profession, and create paths within the profession to which all STEM teachers can aspire. We also have an opportunity to create a cadre of the nation's most accomplished teachers who will broadly advance education and education policy.¹ The need for such a Corps was outlined in a September 2010 report to President Obama from his Council of Advisors on Science and Technology (PCAST). The President announced his Administration's plans to launch a Teacher Corps in July 2012.

A national STEM Teacher Corps² would recognize a larger percentage of teachers than any existing recognition program, create an interactive professional community of teachers empowered to make broad improvements to STEM education, and provide significant stipends to reward teachers and their schools. It would also provide a growth trajectory for teachers to develop within the profession and avenues for them to engage in improving STEM teaching and learning beyond their classrooms. The Corps is a coherent cadre of teachers with national visibility, and with linked national, regional, state, and local networks of teachers who help improve each other's practice and professionalize STEM teaching.

¹ Although there are significant reasons for launching and piloting a Teacher Corps for STEM teachers specifically, ideally, a Teacher Corps would eventually extend to K-12 teachers across disciplines.

² Heretofore referred to interchangeably as "the Corps."

WHY DO WE NEED A STEM TEACHER CORPS?

Preparing outstanding STEM teachers is not enough.

The STEM teaching profession faces shortages in key subject areas and geographic areas, and suffers significant turnover rates.³ Too many teachers lack the resources, support, recognition, and time to feel empowered to prepare and inspire the next generation to use STEM⁴ in their lives and in their careers. The result is unacceptable: We are failing to empower teachers to improve student learning, motivate their students to study STEM and pursue STEM-related careers, and to close the achievement gap among students in STEM subjects.

Teaching must become a valued profession that attracts and retains talent.

K-12 schools struggle to attract highly-prepared, talented, and committed people to teach young Americans science, math, technology, and engineering. Students who major in STEM fields face the opportunity cost of becoming a teacher, with careers of greater stature, higher pay, and better working conditions offered in other STEM fields. It is also critical to ensure that great teachers get to the schools that need them most and stay in those classrooms. Achieving this requires us to recognize and reward excellent STEM teachers — in a much more significant way and on a broader scale than we have to date.

A program to recognize and reward these teachers will highlight models for excellence in STEM teaching and create career paths within teaching.

The Teacher Corps recognizes those who attain high standards of excellence, in the interest of highlighting models of excellent teaching and elevating the aspirations of all teachers. The program also creates paths for growth in teaching careers, without requiring teachers to leave the classroom to progress on a career ladder. This approach has the potential to attract great teachers into the profession and encourage them to stay in STEM teaching. It empowers and recognizes the best STEM teachers in the nation to make a larger impact on the profession and on STEM education.

Existing efforts towards teacher recognition and reward are insufficient.

Current and historical programs have admirably provided awards to some teachers. However, those awards have been narrow in scope and scale. Furthermore, past awards have not set a clear and high standard defining excellence in STEM teaching. Programs for board certifying teachers have been broader, but have not elevated teachers in the public eye. Importantly, no program has used social networking to meaningfully connect teachers, nor harnessed the use of technology to leverage the best STEM teachers for broader impact. We need to learn what works to attract and retain excellent STEM teachers; the Teacher Corps provides an opportunity to develop and evaluate rigorous incentives.

³ About 25,000 math and science teachers leave the profession annually, less than a third of whom retire. R. Ingersoll and D. Perda (2010). Is the Supply of Mathematics Teachers Sufficient? *American Education Research Journal* 47(3): 563-594.

⁴ “STEM” should be understood to include traditional subjects of science and mathematics, such as physics, chemistry, and algebra, but it should also include computer science, engineering and other subjects not historically the focus of science and math in schools. In the future, we hope a broadly agreed upon definition of STEM will emerge that will make this clear. A committee of the National Academies of Sciences is working to further define STEM in a forthcoming report due in the summer of 2013.

PURPOSE OF THIS DOCUMENT

In this white paper, we outline some key features a Teacher Corps will require to be effective in retaining excellent STEM teachers, improving STEM teaching practice, and enhancing STEM learning. We also make specific recommendations for how a national program can accomplish these aims. To reach these conclusions, we consulted nearly 80 advisers including education leaders, teachers, academics, government officials, philanthropists, and entrepreneurs. We hope that this paper will undergird a national conversation to design a high-quality program to recognize excellence in STEM teaching.

GOALS OF A NATIONAL STEM TEACHER CORPS

- **Attract excellent STEM teachers to the profession**
- **Retain the best teachers, extending their careers and enhancing their impact on student learning and inspiration in STEM**
- **Make it possible for the best STEM teachers to have a significant impact on the profession, policies, and students**
- **Reward and recognize the best teachers, showing them they are valued**
- **Elevate the STEM teaching profession in the public eye**

KEY DESIGN PRINCIPLES OF A STEM TEACHER CORPS

The concept of a STEM Teacher Corps, as outlined in the President's Council of Advisors report to the President in 2010, includes several key features. Below, we expand on these to outline principles for an effective Teacher Corps.

Broad in Scope and Scale

The Teacher Corps could eventually strive to recognize the top 20 percent of STEM teachers.⁵ An initial, near-term goal is to recognize a significant number of K-12 STEM teachers in regional pockets across the country. The Corps should represent a range of grades and subject areas, as well as the diverse nature of STEM teachers and schools in which they teach. The White House has announced its proposal for an initial Corps of 10,000 teachers, which is a significant first step toward building a large-scale Corps.

Reflect Excellence of Outstanding Professionals

There are many excellent STEM teachers in K-12 classrooms today. The Corps requires a selection process that will identify teachers who are preparing and inspiring students in STEM subjects. Teachers should be selected in a competitive process based on their ability to help students learn and to motivate students to pursue STEM subjects. Excellence should be defined to reflect teachers' demonstrated abilities and their performance. A framework for selection should evaluate teachers' STEM content knowledge specific to their discipline, knowledge of STEM pedagogy specific to their discipline, student learning, and demonstrated commitment to ongoing professional growth. The framework should be developed with deep consultation with outstanding STEM teachers. The selection process should give particular consideration to teachers whose service in high-needs schools further demonstrates their excellence as STEM teachers. Teachers' leadership in improving the profession, their schools, and education more broadly should also be taken into account.

Give Respect and Recognition to People and the Profession

Members of the STEM Teacher Corps should be recognized and respected as a professional elite. The recognition should aim to increase demand for excellent teachers on the part of schools, school districts, and parents. The Corps will be a national network of teachers who will serve as mentors, leaders, and liaisons to the public and policymakers. Teachers should have a voice in STEM education policies and serve as advocates for STEM in their schools, school districts, communities, and beyond; the Corps will afford them this possibility. The program will expand teachers' opportunities for professional growth, while aiming to keep them in teaching by giving them leadership status within their schools and beyond.

⁵ A definition of STEM teachers should include those who are characterized as STEM teachers at the middle and high school level, and also teachers in elementary school who demonstrate excellence teaching STEM subjects. We recognize that identifying, recruiting and selecting such teachers at the elementary level will pose unique challenges.

Build a Community

Teachers will engage in Corps activities throughout their terms. These will include professional meetings and other events with fellow Corps members, centrally organized workshops and online forums, mentoring of other teachers, and leading the implementation of innovations such as the Common Core Standards for math, the Next Generation Science Standards, and the CSTA K-12 Computer Science Standards.⁶ These activities not only serve their stated purpose, but also help build an esprit de corps, engendering a long-term commitment to the organization and to the field of teaching. A virtual community of excellent STEM teachers spanning geographic regions should be connected by social media, to encourage the sharing of materials and practices. That sharing should also extend beyond the Corps to STEM teachers who can benefit from the practices of the Corps.

Award Teachers Significant Stipends

Members of the Corps should receive significant stipends both to add prestige to their membership and to reflect the significant additional responsibilities asked of members of the Corps. A stipend of \$15,000 per year will accomplish these purposes, although it may be adjusted upward in future years. In addition to the stipend, these teachers should receive some resources to use at their discretion in their schools, and possibly for other professional expenses (such as travel to meetings and conferences).

⁶ This should include recognized state or national standards for elective courses.

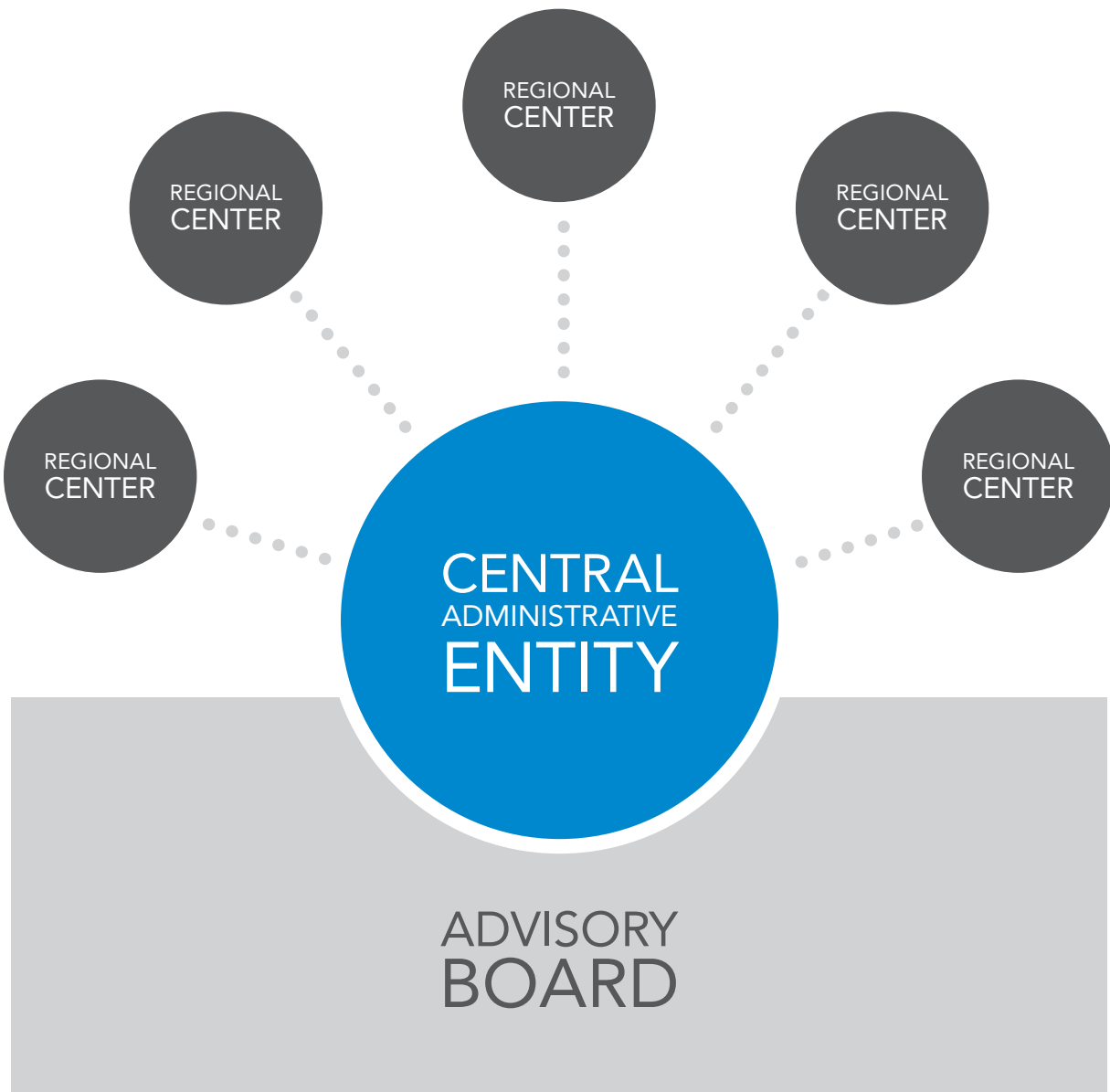
ORGANIZATIONAL STRUCTURE OF A STEM TEACHER CORPS

The STEM Teacher Corps has been proposed by President Obama as a federally-funded national program. It is important to recognize that the Teacher Corps is not an awards program. It is a large-scale and intensive program to identify, recognize, connect, leverage, and raise the profile of tens of thousands of high-quality teachers. It therefore will require crucial administrative functions that cannot be readily taken on by a government agency alone and cannot be handled by a centralized entity alone. It also requires greater coordination than a distributed network could achieve. An organizational structure that balances central coordination with regional/local nodes and innovation will be ideal. A networked approach to running the Corps with a central hub can also ensure cost-effectiveness, while encouraging a spirit of innovation, creativity, and collaboration.

A Corps governance and organizational structure will be required to carry out the following activities:

- Development of selection criteria for teachers and a rubric for ongoing evaluation of the overall program
- A large-scale recruitment, application, and selection process for tens of thousands of teachers to be conducted annually
- A central infrastructure for connecting networks of teachers using technology
- Oversight and coordination of regional sites
- National and regional convenings, and network activities for thousands of teachers
- Ongoing development of opportunities for engagement and learning of STEM teachers and their professional colleagues
- Facilitation of input from leaders in education, philanthropy, government, business, and academia on all aspects of the Teacher Corps as it evolves over time
- Branding and promotion support to elevate the Corps in the public eye

ORGANIZING STRUCTURE DETAIL



Other functions of the Teacher Corps organizational structure are described throughout this document. It is worth noting that some activities of administering and convening teachers can be enabled or enhanced by the use of technological tools. (We address this in more detail in the section below on Technology.) Nevertheless, tacit knowledge exchange and in-person interactions are important, as evidenced by other successful teacher and principal recognition and cultivation programs, such as Math for America and New Leaders.

KEY CHALLENGES

To be effective at driving retention of excellent STEM teachers and at raising the status of the STEM teaching profession, the Teacher Corps program must coherently bring together a high-caliber, connected cadre of excellent teachers. The Corps program should promote consistency and integrity across the nation in bringing teachers into the Corps, provide consistent opportunities and rewards to its teachers, and serve as a model of excellence and achievement to which other teachers will aspire. Similar metrics must be employed across different locations for the Corps to signal a consistent level of excellence; otherwise the process will merely reinforce existing, diverse approaches around the country that differentiate teachers.⁷

Administering and implementing the Teacher Corps program will require regional and local organizations, as well as the expertise of multiple entities. Organizations capable of recruiting applicants, screening and interviewing them, and applying a rubric for selection reflecting teacher excellence are needed. Regional and local organizations that have the knowledge and responsibility for developing rigorous teacher leadership, engagement, mentoring, and professional development opportunities are required in order to avoid creating a Corps with diffuse impact. The Corps must also find a way to effectively connect teachers in person and virtually to have a greater impact than existing recognition programs.

In addition, the STEM Teacher Corps will require ongoing engagement with and guidance from the public and private sectors to effectively adapt to new knowledge, chart new directions, and interact with the broader public. Businesses, philanthropies, universities, governments at all levels, teacher preparation programs, scientists and engineers who can help connect teachers with the practice of STEM, and schools should be formally involved in an ongoing basis with the Corps as it evolves over time. A cross-sector governing board or steering committee that helps guide the Corps on an ongoing basis may be required.

⁷ Nevertheless, it is important that selection of Corps members reflect the diverse contexts in which teachers work, and encourage great STEM teachers to teach in high-needs settings. We deal with this question in the section on selection.

It is also critical that the STEM Teacher Corps create a formal avenue for providing teachers an ongoing voice in the development and direction of the Corps.

In short, there is a need for robust local/regional involvement as well as a consistent national strategy and vision for the Corps, informed by ongoing guidance and interaction with teachers, and other experts from the private and public sectors. The central challenge is organizing this complex structure.

We recommend that the Teacher Corps be structured as follows:

A **Central Administrative Entity** should serve as the national convener of the STEM Teacher Corps, and as standard-bearer and evaluator of regional and local entities and networks that operate and administer the Corps' functions. The entity should be responsible for:

- Administering the overall Corps
- Creating a process and rubric for selection (using guidelines from the Advisory Board described below)
- Building an infrastructure to support Corps functions and interactions (including an online network)
- Promoting the Corps and its activities to a national audience
- Evaluating the operation and effectiveness of the Regional Centers (see below)
- Evaluating the overall and long-term success of the overall Teacher Corps

The entity should have a dedicated Director and staff responsible for the Corps. The central entity should be selected in a competitive process run by the Federal agency responsible for supporting the Teacher Corps. Eligible organizations should include existing nonprofits, partnerships among entities, and new nonprofits. The central administrative entity needs to have the autonomy and flexibility to drive decision-making, formulate strategy, and implement the Corps.

An **Advisory Board** should guide and advise the central organizing entity. It should be a prestigious board made up of leading figures including STEM researchers, STEM practitioners, STEM educators and education researchers from higher education, business leaders, and K-12 STEM teachers.⁸ The Board will help govern the entire program and will act as a board of directors to the entity. The Advisory Board may create committees, drawing on outside members, to provide expertise on various aspects of the program. In particular, the Board should create a Steering Committee, comprised of a majority of STEM teachers and other state and local education leaders, which can help shape the program in its initial phases. The Board will provide a direct connection to the existing scientific research and education communities, ensuring that the program is consistent with the realities and aspirations of both.

Regional Centers (approximately 10 in number) based at organizations such as colleges or universities, consortia, education non-profits, cross-sector STEM organizations, state commissions for education, or businesses. These will be selected in a competitive process carried out by the central administrative entity. The Regional Centers will engage local partners, which may be other institutions of higher education or education non-profits that have existing networks. The Regional Centers will:

- Recruit teacher applicants, in coordination with the central organizing entity
- Screen, interview, and select Corps members following procedures and rubrics provided by the central organizing entity
- Coordinate the network that supports all Corps members in the region
- Convene occasional meetings of Corps members in a region, either for specific purposes (to work on a particular issue) or for the general good

⁸ The Board should also include some people with expertise in educator development, who have run successful evidence-based teacher preparation or development programs.

The Regional Centers should have the following attributes:

- Respect and prestige among STEM teachers, practitioners, and schools, signifying the high level of stature of the Corps
- Capacity to execute on the functions above, including expertise in STEM disciplines, teacher selection, recruitment, and partnership building
- Ability to work across disciplines and organizations to bring together the expertise and resources of various sectors, to include businesses, education organizations, philanthropies, academia, K-12 education systems, and teacher preparation programs
- Orientation and experience of working within a networked group of organizations to achieve common aims across the national education landscape

In conjunction with their local partners, the Regional Centers will:

- Develop and coordinate the community of Corps members within the region, using local partners to carry out the day-to-day activities
- Conduct workshops and other professional activities (many of them organized and led by Corps members themselves)
- Connect Corps members with existing pre- and in-service programs for teachers and coordinate their involvement as cooperating teachers or mentors
- Seek opportunities for involvement of teachers outside the Corps to interact with Corps activities and for alumni Corps members to remain engaged after their active service period in the Corps has ended
- Build partnerships with existing education organizations, schools, and districts that have programs relevant to the Corps and its activities

A subset of STEM Teacher Corps members in a given region should work closely with the Regional Centers, as leaders helping to shape Corps operations. We discuss the specific opportunities for leadership in the section below on Building a Community.

We note that it will be important for the central, regional and local entities to develop partnerships with school, district, and state education authorities and leaders in order to build the Teacher Corps. Districts should be able to nominate teachers for participation in the Corps. It may also be useful to pilot and evaluate whether providing incentives to school and district leaders to give teachers in the Corps additional flexibility and support improves the desired outcomes of the Corps including retention of talent and empowering of teachers for broader impact. We further discuss the role of state, district, and school partnerships below in the section on Building a Community.

RECRUITING AND SELECTING STEM TEACHERS

A STEM Teacher Corps that defines excellence for the profession, drives retention, attracts great talent into STEM teaching, and leverages talented STEM teachers for broad impact will require rigorous standards and processes for recruiting and selecting teachers. Ensuring the integrity and consistency of selection while upholding a high standard for excellence will send a signal to teachers and ultimately elevate the status of STEM teaching in the public eye. The Corps should also strive to build communities of practice in the STEM teaching profession that can help teachers grapple with common challenges, adapt to new STEM knowledge, and improve collective and individual teaching practice.

Creating cohorts with critical masses of teachers across different STEM teaching contexts may be necessary. Within geographical areas, teachers should be able to exchange tacit knowledge, through regional convenings. Critical masses of teachers within subject areas and grade levels should ensure STEM teachers have the opportunity to improve their practice through active engagement in a relevant and comparable community. It is also important that a STEM Teacher Corps cultivate, retain, and celebrate teachers who work in a variety of contexts, including schools with the highest rates of turnover.

KEY CHALLENGES

A major goal of the Teacher Corps is to retain excellent teachers — in the teaching profession as a whole and especially in schools where they are most needed. Recognizing the nation's best STEM teachers (regardless of their context, grade, subject, or location) must be balanced with creating densities of excellent teachers in geographic areas, and with achieving communities of practice among a range of cohorts of STEM teachers. If targets are not developed, the program might merely recognize a set of dispersed, dissimilar, and poorly-linked teachers rather than create a coherent STEM Teacher Corps with members who exchange useful information. On the other hand, a Teacher Corps that merely seeks to fulfill quotas for STEM teachers will compromise its standard of excellence, its credibility, and its ability to drive teacher retention and aspiration.

A central challenge is creating a Corps that has sufficient scale to build the desired communities. Each community will include teachers from elementary, middle, and high school, as well as from a range of STEM fields. The Corps will bring together disparate groups of accomplished teachers, say elementary specialists in science with high school science teachers, and this will allow them to interact and understand the full range of K-12 science education. This has the potential to be of great value. Yet the communities must be sufficiently large to ensure that each has subgroups of teachers with similar interests and experience, for example, subgroups of secondary biology

teachers or elementary mathematics teachers. Those subgroups will engage in much of the day-to-day sharing within the community.

In urban areas, communities of teachers may regularly conduct face-to-face workshops and small conferences. In rural areas, much of the interaction may be online, using technology to connect teachers across large regions. The ways in which communities work together, both across groups and within regions, will vary according to the density and distribution of teachers.

Eventually a STEM Teacher Corps should stretch across the nation, with teachers recognized in each Congressional district. By setting a minimum number of teachers, around 5 per Congressional district, there is the possibility of ensuring representation nationwide while allowing for recognition of areas with a commitment to hiring and developing excellent STEM teachers.

In the short term, a Teacher Corps can be piloted in regions of the country with resources and commitment to actively participate in the Corps, develop its structure and processes, and learn about the attributes of teacher communities that are most successful at increasing retention. Balancing the need for wide representation against the need for vibrant local communities will require careful attention, especially while the Corps is initially growing. The Advisory Board and central administering entity will need to make difficult decisions, focusing on building communities on-the-ground and virtually in order to achieve effective wide distribution of Corps membership. They should also experiment with different arrangements that combine in-person network interactions with virtual tools for connecting teachers online, and discover the best way to build communities in urban, suburban, and rural settings. This will have to be an evolving process, but the lessons learned will be valuable far beyond the Corps itself, providing ideas for better engaging all teachers in professional communities.

The following program features can help address these challenges:

- Rigorous selection criteria
- Replicable selection process
- Flexible targets for the composition of the Teacher Corps that create critical masses or cadres of teachers at school types, subject areas, and grade levels

Ensuring consistency in selecting teachers while creating cohorts of teachers at the scale of a national program involving thousands of teachers will be especially challenging. It is important to draw on the emerging body of knowledge of how to identify excellent teachers in STEM at various grade levels, and to develop criteria and a selection process that will reflect the diverse contexts where STEM teachers serve. The selection criteria and process, as well as the targets, should evolve as new knowledge emerges about teacher excellence. The approach to defining excellence and selecting teachers should be strongly guided by the voice and perspectives of teachers on the steering committee and Board of the Teacher Corps.

RECOMMENDATIONS

The central convening entity of the STEM Teacher Corps, should, with guidance from its governing board and steering committee (and particularly the teachers in these councils), lay out the criteria for teacher selection, as well as goals and basic guidelines for the application and selection processes. The central entity should use these criteria and guidelines to put out a request for proposals and to encourage organizations to develop a high-quality selection rubric weighting various teacher criteria. The chosen selection rubric will be used by regional entities as they select teachers for the Corps.

The central entity should evaluate the selection criteria and process on an ongoing basis, as well as evaluate the implementation by regional entities. We recommend that the following considerations guide the development of a selection rubric and the application, recruitment, and selection process:

Defining Excellence:

The STEM Teacher Corps should signify excellence in STEM teaching, gauged along a variety of criteria. Upholding a high standard for excellence is critical to ensuring that the Teacher Corps becomes aspirational, helping to attract talent and retain great teachers in the profession. The criteria used to define excellence should capture a STEM teacher's capacity to help students learn, engage, and become inspired in a variety of contexts, from high-needs schools to those with greater resources. The criteria should reflect that excellent teachers often demonstrate leadership in their schools and beyond. In short, the selection process should aim to capture a teacher's impact and ability through factors including: deep knowledge of content and pedagogy in STEM; student learning, interest, and engagement; passion and dedication to STEM teaching and students; commitment to upholding high standards for students to prepare them for college and careers; activities outside the class; leadership activities; and reflectiveness and innovation in teaching practice. (See appendix for additional considerations in setting teacher selection criteria.)

Reflecting the STEM teaching profession:

Teachers in the Corps should reflect the best of the nation's K-12 STEM teachers. It is also important that the selection of those teachers demonstrate that STEM teachers can be excellent in a variety of contexts, subjects, school types and regions. In order to create cohorts of teachers with critical mass so that teachers can benefit from each other's knowledge in comparable contexts, the Teacher Corps may initially require minimum target percentages of teachers of certain kinds. For example, it may be desirable to stipulate that some percentage of teachers ought to be in the physical sciences, computer science, engineering, the life sciences, mathematics, and that some percentage ought to be middle school or elementary teachers.⁹ It may also be important to have a minimum percentage of teachers who are serving in the nation's high-needs schools. These targets might be selected to reflect the current diversity of the profession. Such targets for creating critical masses of teachers (densities of particular teacher types) should be flexible over time to the changing landscape of the STEM teaching profession, and should be flexible enough to allow excellence of STEM teachers to take precedence.

Stage of Career:

The STEM Teacher Corps should set out to help define the aspirations of the profession and the level of excellence achieved by teachers with experience. It should also create paths for career progression for teachers that keep them in the classroom. We therefore suggest teachers should be in their fourth year or later of teaching to apply for the STEM Teacher Corps. Nevertheless, we acknowledge that in years 3-5, K-12 teacher retention is a particular challenge, and that the Corps should have a vehicle for cultivating and retaining excellent teachers in that cohort. We also acknowledge that teachers with 10 or fewer years of teaching now make up more than half the profession. STEM teachers in years 1-3 could formally benefit from the Corps by applying or being nominated to serve as "STEM Teacher Fellows." These fellows could participate in local and regional events, receive some level of stipend (perhaps one-half that of more senior teachers), and receive mentorship from other teachers.

Recruitment, Nomination, and Application:

All qualifying teachers in K-12 who teach STEM should be eligible to apply for the STEM Teacher Corps. A process of nomination and recruitment should be established to both find and attract teachers in diverse contexts, and encourage them to apply. Deep partnerships with states, schools, and education organizations will be required to recruit in a targeted manner. Current and former Corps teachers, as well as colleagues, supervisors, school leaders, district leaders, parents, and students should be able to nominate teachers and support their applications. Current Teacher Corps members should also be responsible for promoting and cultivating applicants to the Corps in order to build regional and local density in their respective areas. An online application process whereby STEM teachers enumerate their qualifications to join the Corps should be developed by the central entity. It will be important to balance the level of difficulty of the application with the need to recruit and attract excellent teachers.

⁹ We note that more thought needs to be given to the selection of elementary school teachers of STEM subjects, and to the role played by STEM specialists. As the research evolves on this, so should the Corps and its selection. We discuss this in the Appendix.

Interview and Selection Process:

A rigorous selection process administered by regional entities (see Organizational Structure section) with capacity and expertise for online screening, in-person interviews, and in-person observation of teachers should be implemented. Exemplary teacher selection processes should form the basis of the recommended process. Separately, we have attached details of one example of a teacher selection process used by Math for America.

The essential selection criteria should include evidence of:

- Content knowledge, both depth and breadth¹⁰
- Pedagogical mastery specific to their subjects
- Student learning, interest, and engagement
- Passion for the STEM subject
- Dedication to STEM teaching
- Commitment to upholding high standards and high expectations for students
- Activities outside the classroom, including leadership
- Reflective understanding of and possible innovations to teaching practice

¹⁰ In the appendix, we discuss specific considerations for elementary school teachers, whose STEM-specific content knowledge often differs from secondary teachers.

There is a growing body of literature that defines excellence in teaching, and the selection process should rely upon that work. Indeed, over time, the STEM Teacher Corps will add to that literature and ultimately may help to define excellence.

A selection process should include:

- A screening exam to test appropriate content knowledge and pedagogical skills for teaching subjects

- A rigorous application with many components that provide evidence of the criteria above

- A comprehensive interview process for selected candidates that consists of multiple settings in which candidates demonstrate both their facility with and attitudes towards their subject, as well as their abilities as teachers

(See appendix for additional considerations for the teacher selection criteria and process.)

Length of Term:

We suggest that in an initial iteration of the Corps, teachers serve in 4 year terms. After this time, they should be given the chance to reapply in a competitive process, and careful consideration should be given to how the Teacher Corps can address the needs and opportunities of teachers as they progress on the career ladder. Alumni and current members of the STEM Teacher Corps who have served 2 years should serve as Ambassadors to districts, schools, and regions to recruit additional teachers to refresh the pipeline of STEM Teacher Corps.

BUILDING A TEACHER CORPS COMMUNITY

Retaining and attracting the most talented STEM teachers to the profession requires creating avenues for them to grow professionally, engage in leadership and community-building activities, and extend their impact, while continuing to thrive in the classroom. The Corps should provide these opportunities as a reward while creating an expectation and sending a message to the public that the teachers in the Corps will engage in broader service to K-12 STEM teaching. The Corps should offer ample opportunity to further professionalize STEM teaching through targeted opportunities that allow teachers to enhance their content expertise and pedagogical skills specific to their discipline, leadership skills, and ability to extend their reach without relinquishing their work with students. This vision for a STEM teacher community aligns with the Department of Education's RESPECT Project, which seeks to empower teachers, create career progressions within teaching, and distribute their leadership in schools, districts, and beyond.

Building a Teacher Corps community relies upon creating strong networks for interaction with other teachers, cultivating connections to ongoing STEM research and practice, and creating avenues for engagement of Corps members.

“Strands” — or community-building components in the Teacher Corps experience — can help achieve the latter of these objectives. Strands have three aims: (1) To create effective opportunities for the best STEM teachers to have an impact beyond their classrooms through coaching, design and curation of tools for instruction and professional development, and leadership; (2) To provide opportunities for teachers to enrich their content knowledge and professional growth by connecting to STEM fields and practice; and (3) To create multiple pathways for excellent STEM teachers to grow professionally (based on their talents and interests) while staying in the classroom, as a reward for serving in the Corps.

The Strands should draw on the distinctive strengths demonstrated by the individual teachers while providing them resources to be effective in engaging in activities beyond their classrooms. Strands should include activities to improve STEM teaching such as coaching, developing pedagogical tools, designing and delivering high-quality professional development; activities to allow teachers to serve as leaders in a variety of contexts; and activities to magnify the impact of the Corps such as serving as ambassadors and disseminating effective teaching models using technology.

Teachers should ideally choose a Strand that amplifies their impact and helps them benefit professionally through a commitment to service and participation. Through these Strands, we expect to see teachers further hone their skills as leaders, ultimately taking on or improving upon a variety of critical roles in districts. These might include serving as industry liaisons, STEM content masters, mentors, teacher prep program mentors, or STEM education social media experts. In places like Oakland, Denver, and other cities across the US, districts and schools are leveraging and growing the exceptionally talented STEM teachers at their schools. Strands will serve as a mechanism to do this at scale. Eventually, such roles for teachers that allow for progression within

the profession may help inform broader efforts to refine teacher roles.

The Strands will also allow teachers to connect with other teachers and leaders regionally and nationally. Strands will leverage the efforts of the nation's best STEM teachers to achieve a broader impact on the teaching profession and on student learning. Finally, they allow teachers, the stewards of their profession, to serve as role models in their schools, communities, and in the public eye.

KEY CHALLENGES

Opportunities for engaging and cultivating teachers must provide value to Teacher Corps members directly, as well as more broadly to the K-12 education community and students. Excellent teachers share common characteristics, but may also differ in important ways. For example, some teachers will have the interest and aptitude for local, teacher-focused engagement such as coaching other teachers. Others will have an interest in engaging in adopting or developing technology-based innovations for education. In addition, some teachers in the Corps may already be effective at vetting new curriculum or creating high-quality professional development for other teachers, while others will require coaching to more effectively engage in such activities, or will gravitate toward Strands that reflect their strengths. A cohort of thousands of teachers necessarily implies a dramatic range of aptitudes, interests, and needs. To that end, it will require care, differentiation, and coordination from regional entities and the central organizing body of the Corps to ensure that all teachers are successfully engaged in at least one of several Strands. This will mean creating avenues for a set of interests and needs, from abstract areas that impact policy to more hands-on areas such as coaching.

Time is another challenge that faces all programs aiming to engage teachers outside of the classroom. Teachers are busy, especially teachers who are already leaders in their communities and schools. Strands in the Teacher Corps provide an opportunity to recognize and cultivate the extra work teachers are already doing outside of their classrooms. They also provide the opportunity to help such teachers amplify their impact. The rewards of the Corps to teachers, however, must be commensurate with the expectations for service and respect the many demands on teachers' time. In addition, teachers in the Corps may require flexibility in how they engage in the Strands. (For example, some might participate most actively in the summers while others may participate most actively during the school year.) Finally, it may be worth using some Corps resources to reduce teaching loads or free up a portion of teachers' time, though such efforts must be balanced with the need to keep excellent teachers in front of students who benefit from their presence.

RECOMMENDATIONS

Create opportunities for STEM teachers to connect with the world of professional STEM research and practice. This will ensure an underlying commitment to helping Corps members remember to “put on their own oxygen masks first,” even as they engage in activities of the Corps. All such Corps activities require teachers to remain knowledgeable about their fields and plugged into new discoveries and techniques. Supplemental activities that connect teachers with STEM practitioners and experts, linking real-world problems and trends to the work happening within the Corps, will help address this need. Partners (including businesses and Federal partners such as the NSF, NASA, NOAA, DOE, NIH, NIST, EPA) that fund research and opportunities to engage with other STEM professionals, can help keep Corps members’ engagement in their fields up-to-date as they participate in Strands (described in detail below).

Build into the Teacher Corps program capacity and opportunities for all STEM Teacher Corps teachers to participate in networking opportunities within and across districts and regions. The Corps should create social gatherings and live events, as well as frequent use of video, social media, and other virtual mediums to bring together communities of teachers. This would imply reserving some funds to support informal “meet-ups” (through Ambassadors, as described below) as well as more formal gatherings that help to build relationships and informal knowledge-sharing among teachers.

Forge partnerships with organizations to create Strands — avenues for professional engagement and growth, coaching, educational tool development and other community activities. Once teachers join the Corps, they should select Strands or subgroups for action and engagement. Many excellent teachers are already leaders in their schools and communities. The Corps will provide an opportunity to more deeply engage and to leverage a national network of leaders to magnify their impact. Moreover, the Corps will provide outlets for teachers to improve and cultivate these community-building activities and skills, and to share their skills with communities of like-minded professionals within and across district lines. These partnerships should in particular be forged with state and local education authorities as well as school leaders in order to create opportunities for the teachers to most effectively engage in Corps activities and in improving STEM teaching and learning as a whole.

Below are three broad categories of Strands, along with examples of the kinds of activities that fall within each.

(A) Professional Activities to Improve STEM Teaching as a Whole

These are activities that reward and cultivate the excellent teachers in the Corps to improve STEM teaching and content overall. Strands within this area focus on STEM teaching and curricular tools available to Corps members, and more broadly to teachers across the profession.

We suggest that Strands and corresponding partnerships be developed for teachers in the Corps to:

Serve as coaches:

Teachers serve as coaches to other STEM teachers in their schools, districts, and beyond, and receive coaching themselves to become more effective in this capacity. Corps teachers will likely act as coaches to teachers in the same discipline and grade level who are not members of the Corps during their time of service. Ideally, the central organizing body could utilize or build upon an existing web-based matching platform to create a pool of potential teachers who are seeking coaching and an easy-to-use mechanism to be matched with STEM Teacher Corps members. In addition, teachers may serve as cooperating teachers in teacher preparation programs throughout the country, coordinating their work in teacher preparation with other Corps members. It is critical that teachers be supported on an ongoing basis with programs and coaching that allows them to be effective coaches for others.¹¹

Develop pedagogical tools, adapt and co-develop curricula, and refine instructional approaches:

Teachers with an aptitude and inclination for this Strand can lead efforts to develop best practices in STEM pedagogy that can be shared on the STEM Teacher Corps technology platform (see Technology section below). They can also work in collaboration with interdisciplinary teams to develop content-rich curricula or help align existing curricula to the Common Core Standards for math, Next Generation Science Standards, and CSTA K-12 Computer Science Standards. Additionally, teachers can modify, curate and rate existing curricula and instructional approaches and learn about the development of new elements of curricula like apps and online games. Teachers would partner with organizations to release innovative curricula and practices developed and approved by the STEM Teacher Corps for use in all STEM classrooms.¹²

¹¹ Examples of partners here include: Online mentoring organizations including Tutor.com, New Teacher Center, The New Teacher Project, NBPTS, American Association of Physics Teachers, National Council of Teachers of Mathematics, National Science Teachers' Association, Computer Science Teacher Association, National Association of Biology Teachers, National Association of Geoscience Teachers, International Technology Education Association, Physics Teacher Education Coalition, International Society for Technology in Education, American Chemical Society, EdTech, Professional Development/CUE, Uncommon Schools, Mastery Charter schools, Rice University School Mathematics Project, Teach for America online communities, technology-based platforms such as National Lab Day Network, teacher education programs at colleges and universities, Relay School of Education.

¹² Examples of potential partners here include: Open-source content platforms, educational publishers, curricula design expert/training organization(s), Center for the Study of Mathematics Curriculum, ComPADRE, SERC, Eisenhower Clearinghouse for Mathematics and Science, NASA Education, IISME Community Website, Teach for Engineering, Intel Engage, Khan Academy, LearnZillion, Better Lesson, American Federation of Teachers, America Achieves, the Core.org, Share My Lesson, Shared Learning Infrastructure, My Group Genius/Literary Design Collaborative.

Reimagine, design and deliver a new generation of content-rich, pedagogically-sound professional development:

Teachers in this Strand design, develop, and deliver content-rich professional development (PD) that is of a much higher caliber than the standard PD offered to STEM teachers today,¹³ including for early-career STEM teachers in their regions and districts. They curate and rate existing PD that is rich in STEM content. Teachers test and iterate with one another at gatherings and in smaller cohort groups, present at conferences, and create video recordings to amplify their impact. Teachers can spread use of PD beyond Corps members by presenting at national education and STEM conferences, such as the NSTA national and regional annual conferences.¹⁴

(B) Activities to Grow as Leaders and Improve STEM Education

These are activities that cultivate the nation's best teachers to serve as leaders and changemakers in their profession and beyond. They provide professional growth opportunities that keep teachers in classrooms while engaging them for broader impact, and lend the voice of teachers in the Corps to the shaping of policies. We recommend that teachers in the Corps be given the opportunity to participate in activities that allow them to:

Serve as Leaders:

Excellent STEM teachers should be given the opportunity to lead and influence within a range of professional contexts. This Strand should develop their capacity to lead within schools, as well as within partnerships and communities outside of schools. Teachers in this Strand receive leadership training and development throughout the duration of the program. This gives Corps members the opportunity to effectively spread what they learn from the Corps (new skills, innovative models, curricula) within their own schools and districts, indeed leading instructional change within their own buildings, and beyond. Regional organizing bodies will provide access to virtual and in-person leadership trainings and also connect Corps members to opportunities to serve as regional subject-area experts and to present at STEM and general education conferences.¹⁵

¹³ We note that in particular there is a need for high-quality discipline-specific professional development.

¹⁴ Examples of potential partners here include: Education Development Corporation, New Teacher Center and other existing PD providers, Achieve, UTeach, Complex Instruction, The New Teacher Project, Teaching Channel, National Science Foundation, ACSD, AMTE, school districts, university education programs including Stanford's Center to Support Excellence in Teaching, informal science education institutions and museums such as the Exploratorium and New York Hall of Science, teacher associations (NSTA, NCTM, CSTA, ISTE, AAPT).

¹⁵ Examples of potential partners here include: Schools and districts, state and local boards of education, Leading Educators, New Leaders, America Achieves Teacher and Principal Fellowship program, Hope Street Group, Educators for Excellence, ASCD, NCSM, the New Teacher Project Fishman fellows, professional STEM teacher organizations, Association of Public and Land Grant Universities, CCSSO, NGA, CalTAC, Einstein Fellows/Triangle Coalition, AAAS, Teach Plus, LEE, VIVA, Students First, Students for Education Reform, 50CAN, NASBE, Alliance for Excellent Education, education think tanks, PhysTec, ChemTec, businesses in communities, universities and business schools to deliver leadership development trainings.

(C) Activities to Magnify the Impact of the Corps

These activities allow the STEM Teacher Corps to become more visible in schools, communities, and the public eye. They also provide opportunities for STEM teachers to organize, innovate, and spread the word about STEM education models and successes:

Serve as Corps Ambassadors:

Teachers who choose to be Corps Ambassadors serve as organizers and public emissaries of the Corps. They serve as local and regional points of contact who organize informal gatherings of Corps members to encourage social interaction and relationship-building. (An example of this includes the “Bring Your Own Math” convenings organized by Math for America teachers.) These Corps members will also receive coaching in writing and public speaking to help them effectively serve as the face of the Corps at conferences and for media outlets. They might present best practices that emerge from Corps members at national conferences and other public venues. Ambassadors might also help recruit to replenish the pipeline of excellent STEM teachers to join the Corps in future years, as well as bring early-career teachers with promise in contact with opportunities to benefit from teacher activities. They could also help recruit high school and college students into STEM teaching careers. This Strand may be targeted specifically at teachers who have already served a year to two years in the Corps.¹⁶

Innovate and Disseminate New Models Using Technology:

Teachers in this Strand serve as a cadre who test and implement a variety of innovative models and modes for expanding the STEM Teacher Corps’ reach. For example, these teachers might have the opportunity to test and evaluate new approaches such as blended learning or the restructuring of elementary content-focused teaching models. Teachers could be responsible for testing, iterating, and sharing learning and innovations with their fellow Teacher Corps members through trainings and more informal connection points. Ultimately, participants in this Strand would also share learnings with the broader community of STEM teachers and the public. This group would have the option to receive additional training (as referenced in the Technology section below) to create effective content-rich videos to be shared more widely with the public. These teachers, through partnerships and use of video platforms, would create and broadcast videos introducing the American public to the Teacher Corps. Moreover, these teachers can serve as trusted partners for educational video content on the web.¹⁷

¹⁶ Examples of potential partners include: State and local STEM education councils and groups, social networking platforms, chambers of commerce, schools of education at universities, state legislatures, Congress, state offices of education, universities, Meetup to organize local STEM teacher and parent meetings; Toastmasters and public speaking development organizations.

¹⁷ Examples of potential partners include: Public Impact, The Teaching Channel, LearnZillion, open video platforms (YouTube/Teachers.tv, e.g.), Learning Registry, VITAL (Video in Teaching and Learning)/PBS LearningMedia, ISTE, Edmodo, Edge, @TERC, Gates Foundation, New Teacher Network, Bloomboard, Teachscape, Uncommon Schools, Relay Graduate School of education, PTRA, TED and TEDx, ComPADRE, and others investing in education technology and expert/curated content creation.

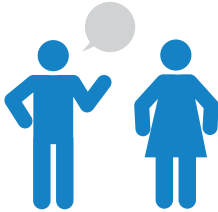
TEACHERS



SERVE AS COACHES

SERVE AS LEADERS

SERVE AS CORPS
AMBASSADORS



TEACHER CORPS COMMUNITY



STEM TEACHING ON THE CUTTING EDGE: THE ROLE OF TECHNOLOGY

Technological tools provide an opportunity to more effectively connect STEM teachers to each other, creating a lively, interactive professional cadre of teachers across the nation. Technology also has a role in expanding the reach and impact of a STEM Teacher Corps. Technology, while still inaccessible for many and not a panacea for challenges in schools, is already helping more students gain access to excellent STEM teaching and content, and helping more teachers to benefit from each other's practice and knowledge. A national Teacher Corps will recognize excellent STEM teachers as individual contributors in physical classrooms, and will celebrate teachers and bring them together for in-person gatherings. Yet there are also great opportunities afforded by technology to dramatically extend the impact of a Teacher Corps by creating wide-ranging and cohesive networks, by spreading and broadcasting the work of excellent STEM teachers, and by expanding and personalizing opportunities for professional growth at different stages of teachers' careers.

KEY CHALLENGES

The marketplace for education technology, including related social media networks, curricular, and video platform sites is increasingly crowded. Creating a new platform to connect teachers in the Corps runs the risk of adding to the cacophony. In addition, with so many tools and platforms available to teachers today, it is challenging for many time-pressured teachers to determine what materials and tools will actually make teaching easier and more effective. Quality is the critical factor in technology-based tools for teaching and learning STEM and for connecting teachers to each other.

With any decision around technology, there must also be consideration for access to broadband and hardware infrastructure. We believe that the Corps should plan for increased access over the long-term. That said, at launch, there will be issues around virtually connecting teachers who do not have high-speed internet connectivity or adequate hardware.

RECOMMENDATIONS

Cultivate a Teacher Corps social network that crosses district lines, ideally by harnessing existing platforms or networks to establish a community of practice within the Corps. The central administering body should oversee an extensive virtual network for all current and alumni Teacher Corps to form virtual communities of practice. Given the state-of-the-art social networking platforms already available today — some of them specifically educator-focused — we recommend that the central organizing body develop a strategic partnership with one or more of these organizations to build a custom network or layer for STEM Teacher Corps teachers. On this platform, teachers will have the opportunity to participate in virtual professional development, to bolster in-person conversations, and to make connections and share information with excellent teachers in all regions. This may be particularly valuable to teachers who are in isolated regions.

Creating this social community, filled with useful content and conversations, will add even more value to the experience for participating teachers. While this is intended to be an elite, internally-facing layer of a teacher social network for Corps members, the network should also have an additional, externally-facing layer to share themes, vetted lessons, and other useful content with the broader education community on a regular basis. (Below we discuss other opportunities for technology to help teachers communicate more broadly with STEM teachers outside the Corps.)

Over the long term, create or connect to resources to help STEM teachers sort through the clutter of technology-based materials and tools. We recommend that the Teacher Corps' technology platform be developed to contain a layer that serves as a curation hub for education technology and tools.¹⁸ Teachers in the related Strand (or other teachers in the Corps) can, by virtue of what technology-based tools and curricula they use, be called upon to rate and share information about their experiences with these tools. (The best way to do this would be through an automated function that sorts through and highlights content and tools that Teacher Corps teachers have deemed worthwhile.) Teacher Corps teachers and other teachers external to the Corps should be able to see information and data on the tools through this infrastructure.

Use technological tools to disseminate best practices and materials of teachers, especially new approaches to STEM learning. While all teachers in the Corps would engage via the social platform, we envision a subset of teachers signing on to participate in a Strand (see section above on Building a Community) that would utilize a variety of platforms to externally share existing Corps members' lessons and other projects as well as to develop content to be shared online on behalf of the Corps.

¹⁸ Digital Promise is already doing work in this area and would be one potential partner for this work.

Teachers in this Strand would focus on the following areas:

- Improving the quality and availability of online courses and content in STEM subjects, especially those not available in all schools.
- Creating excellent videos that can serve as stand-alone modules or as supplements to enhance STEM learning and teaching in and out of classrooms (in partnership with existing organizations that do this work). These videos should include demonstrations of best practices in pedagogical approaches to teaching STEM to be used by other teachers, as well as specific modules to teach STEM subjects to learners.¹⁹
- Partnering with innovators in education technology to produce and curate content and to develop new ideas and iterations on existing programs/products.
- Serve as early adopters and validators of new technology approaches to STEM learning.

Here we envision the STEM Teacher Corps members engaging in the development of educational technology tools and content to be shared widely with the STEM teaching profession, including for the benefit of those teachers not yet in the Corps. There are existing libraries of videos and lessons in STEM, but having Corps members as contributors and curators provides the imprimatur of quality and expertise. It is critical that the program provides teachers with necessary tools to train and transform them from being consumers of technologies to top-notch content producers. In doing this, the program will make these teachers more discoverable online, and leverage their expertise to reach thousands of students beyond their classrooms. This can enhance the influence and prestige of teachers and the Corps as a whole.

STEM Teacher Corps members should be drawn upon to contribute and curate videos that demonstrate the teaching of particular areas of content, but also model excellent teaching practices. These are two distinct ways that excellent STEM teachers can transmit best practices and content to the broader teaching profession.

In addition to video, there are a number of platforms today that are reaching hundreds of thousands of students through massive online open courses (MOOCs), which can be used to help spread effective teaching practices and curricula. Although these are primarily for use with university-level courses, there is great potential for the Teacher Corps to partner with organizations to conduct MOOC pilots at the K-12 level.

¹⁹ Partnerships for this video content might include: The Office of Education Technology, Gates Foundation, LearnZillion, and YouTube.

Use technological tools to celebrate STEM teachers and elevate the role of the STEM teaching profession. We recommend developing partnerships with video and social media platforms, web-based media outlets, and traditional broadcast outlets to create and disseminate stories of teachers' work in schools, communities, and the policy arena. Teacher-generated videos, blogs, and other media providing their voice and perspective are an important element of the content that could be broadly shared to raise the profile of the profession publicly.

Overall, it is critical that we ensure that our STEM teachers are given resources to remain on the cutting edge of education technology. Armed with this knowledge and skills, they can share and spread their perspectives as thought leaders and content experts.

SPREADING THE WORD: PROMOTING THE CORPS AND ELEVATING STEM TEACHING

Celebrating the nation's best STEM teachers and elevating the status of the profession in the public eye will provide opportunity to attract and keep talented teachers in the profession. Creating a visible, prestigious program will also provide an opportunity to create the community-level support and political momentum needed to make the Corps successful and sustainable. Yet teacher recognition programs and teacher evaluation systems have had little success to date in elevating the status of excellent STEM teachers.

KEY CHALLENGES

To have a major impact on the public perception of STEM teaching, the Teacher Corps must effectively elevate the status of teaching in a more significant way than previous efforts have done. This alone is a great challenge. The promotion of the Corps should be a nationwide effort; we must create a sense of pride, ownership, and investment in the success of the Corps in communities throughout the country. We must raise the national profile of the profession, while adequately “localizing” the Corps so that parents, students, school leaders, and community members will understand and embrace the Corps idea.

Additional challenges include:

- There is no clear, current brand on which to build this initiative, especially because we want it to be a fresh take on retaining and celebrating excellence. STEM is becoming a more understood concept in the American lexicon, although there continues to be confusion around this acronym.
- There is a need to rally the public around the brand of a Corps, a strategy that inspires widespread excitement around STEM teaching as a profession.
- Many current education reform efforts focus on fixing things that don't work, and the public is not used to giving its attention and trust to the best teachers. This is a shift in perception and conversation that is required.

RECOMMENDATIONS

The central organizing body of the Corps, in partnership with education organizations and with guidance from its Board and Steering Committee, should develop a brand that is aspirational and elite, but perceived to be attainable by STEM teachers. The audience for such a brand is diverse, including educators, parents, students, policymakers, and the mass market. Design elements for the brand should be distinct and stand alone, and able to be localized but consistent overall.

One key to making the Corps serve these purposes is to select an appropriate name to brand the Corps. We have used the placeholder “STEM Teacher Corps” throughout this document, largely because it is descriptive. The Corps should have a name that communicates its excitement and vitality, while at the same time conferring prestige on its members. There are several possibilities; one of the first tasks in creating this program is to determine the best name.

A fanbase/movement generation strategy should be designed and launched, using networked partners to build support from the ground up. Partners should include K-12 organizations and systems, and should range from national teacher associations such as NSTA, NCTM, CSTA, and AAPT, to successful network-builders such as 100Kin10, to national, state, and local organizations.

The central and regional entities of the Corps should collaborate to design and launch a promotion and communications strategy. Media (traditional and new) and technology should form the underlying backbone of a compelling campaign to build brand recognition and support for the Corps. The Corps should also take advantage of the national spotlight as a White House-launched program. Prominent celebrities at the national and local level should be engaged to reach wide audiences with messages championing the Corps and educating citizens. Members of Congress should be engaged to highlight the teachers in their districts and states. STEM professional societies of academics and practitioners should also be called upon to carry forth the message and mission of a STEM National Teacher Corps.

It’s critical that campaigns to elevate and create excitement for the Teacher Corps feature students and teachers – highlighting great stories as well as data — to inspire a movement to support and reward excellence in STEM teaching.

A PATH TOWARD A STEM TEACHER CORPS: PILOTING AND SCALING

We know far too little today about what factors will keep excellent STEM teachers in classrooms where they are needed most. While some education research suggests reasons why STEM teachers leave the profession and promising methods retaining them, there is a profound need to understand what attracts, drives, and keeps talented teachers so incentives can be aligned with their motivations. It is also important to understand the potential differences among groups of teachers to understand what incentives and programs are best targeted to which groups – and particular how to attract and keep the most talented and high-potential teachers in various settings. The STEM Teacher Corps provides an opportunity to learn about these questions, and should be designed as a program that pilots and evaluates what works to keep great teachers in their crucial role of advancing student learning in STEM.

Building a program of the reach, impact, scale, and complexity of a national STEM Teacher Corps will require several years. A pilot or plan for phasing-in the Corps should build a foundational structure and process for an initiative that can eventually recognize and reward tens of thousands of top STEM teachers across the nation in a given year. The structure and process should be built to evolve as experience, data, and knowledge is gained in early stages. Exceptional teachers can help to prototype and develop the program during the scale up process.

Initially, the goal should be to pilot the Corps at sufficient scale and local/regional density to develop, learn, and prototype the best methods to do the following: (1) recruit and select teachers with a rubric and process that defines outstanding teachers with integrity and that includes top teachers working in a variety of contexts; (2) reward and incentivize teachers to retain outstanding STEM teachers in classrooms; connect teachers and leverage their talent via technology; raise the profile and brand of STEM teaching; and create opportunities for teachers to have a broader impact on the profession and educational policy.

A possible strategy for phasing in the program extends over 4 years:

- Year 1: Establish Central Entity + Advisory Board + 2 Regional Centers

- Year 2: Add 3 additional Regional Centers (total 5)

- Year 3: Add 5 additional Regional Centers (total 10)

- Year 4: Regional Centers at steady-state, as numbers of teachers grow

In Year 1, the critical first step is establishing an Advisory Board and Central Entity (see section on Organizational Structure).

In this phase, the following activities and processes must be built and put into place in their first iteration:

- Initial plan and protocol for recruitment of teachers, application/nomination process, selection process to be run by Regional Centers
- Rubric for Regional Centers to use in selecting teachers
- Opportunities for engagement of Teacher Corps in Strands or growth opportunities with partners at local/regional/national level
- Partnerships with schools, districts, states, and national teacher organizations
- An online platform for networking of teachers in professional groups and branding of teachers through technology
- A branding, media, and outreach strategy

As the pilot launches, the program will recognize and reward an initial set of teachers with stipends, funds to dedicate to classroom resources or student projects in STEM, and avenues to support their effective participation in networking and professional growth opportunities aimed at elevating those teachers and the profession.

Also in Year 1, Regional Centers that will implement the Corps by running the recruitment, selection, and partnership development process in two areas of the country to be selected within six months. By choosing the first two Regional Centers carefully, one can gain experience and also create models for the other sites as they are added. The choice of the initial sites should balance many factors—for example, one might be primarily urban, the other primarily rural; one might be coastal, the other in the middle of the country; one might rely on predominantly colleges and universities as partners or Regional Centers, the other could include educational non-profits. The experience of the first year of operation will be invaluable in adapting the selection of future Regional Centers and operations.

Estimated Costs: While it is too early to budget with precision, approximate costs for the pilot and phase-in process can be estimated by dividing costs into fixed and variable, since much of the administrative cost (including selection) depends directly on the number of teachers in the Corps.

Estimates of phase-in costs are approximately as follows:

- Year 1: \$10M fixed + \$25K x 1000 (teachers) variable = \$35M

- Year 2: \$15M fixed + \$25K x 5000 (teachers) variable = \$140M

- Year 3: \$25M fixed + \$25K x 10000 (teachers) variable = \$275M

- Year 4: \$25M fixed + \$25K x 15000 (teachers) variable = \$400M

The total expenditure over the four-year period would be \$850M. It is possible that some additional expense will be incurred during the first year, if setting up the initial administration and evaluation (see below) requires additional support.

Evaluation:

Another major responsibility of the central entity and Advisory Board in the first two years will be to create a structure for evaluation and review. The evaluation of a STEM Teacher Corps will differ from other evaluations for several reasons. This is not a program primarily designed to make teachers better, as these are already accomplished teachers, and their performance is already exceptional.

Rather, it is a program that should be evaluated based on its ability to retain excellent teachers in the profession, attract great talent into teaching, and elevate the status of teachers and STEM in the public eye so as to advance the overall state of STEM education in K-12. It should also be evaluated based on its ability to deploy outstanding teachers to make a broader impact on STEM education. The primary goal is to show that the Corps and its members are having significant effects on STEM teaching and teachers, that learning in its broadest sense is improving over time, and that attitudes about STEM are changing, both for students and for the public. These are all long-term effects, and they will require years to measure adequately.

In order to properly evaluate the program, a structure for tracking teachers and students will have to be put in place during the first two years. For example, a system to track teachers who are not only in the Corps but who interact with the Corps should be created; consistent and pervasive attitude surveys should be administered to all students of Corps members; studies of course-taking patterns for students in the classes of Corps members should be initiated. These are projects that require both infrastructure and planning (for example, to obtain tracking information). They will require a separate effort.

The best and most informative evaluation, however, will be undertaken dynamically as the program evolves. Broad-scale programs like this one can have unintended benefits (and, sometimes, unexpected drawbacks). This should be an area that is overseen with care by the governing board.

A critical component of evaluation of the Teacher Corps should be answering the broader question of what motivates excellent teachers to stay in the teaching profession, and what factors and incentives drive retention of STEM teachers who are the most successful at advancing student learning and inspiration. The answer may vary for different subsets of the teaching profession, and parsing out those subsets and the relevant incentives that should be aligned with them could be a powerful insight provided by the Teacher Corps.

THE POTENTIAL OF A STEM TEACHER CORPS

The STEM Teacher Corps is a bold initiative to significantly recognize, reward, and connect excellent teachers. It aims to cultivate and attract great teachers who will stay in the nation's classrooms, while having an impact far beyond their classrooms. The Corps presents an opportunity to deeply understand what works to retain excellent teachers in schools.

The Corps also has the potential to reshape the national conversation about teaching, allowing us to seize the opportunity offered by the nation's best K-12 STEM teachers to make positive change. Through the Corps, we can bring together and empower our best teachers to have a far-reaching and lasting impact on how science, technology, engineering, and mathematics are taught to young Americans. The teachers in this Corps can become the creators, adopters, and disseminators of needed innovations in K-12 schools and the leaders of efforts to improve STEM teaching practices, curriculum, coaching, professional development, and education policy. Ultimately, the Teacher Corps will serve to create leaders committed and empowered to improve STEM education for students across the country. If implemented with vision and care, we believe this will be a transformative initiative.

Bina Venkataraman

Broad Institute

Jordan Lloyd Bookey

Google

John Ewing

Math for America

APPENDIX: OPEN QUESTIONS

This white paper attempts to lay out a credible path toward a STEM Teacher Corps, and to address some of the major considerations in designing a Corps. We consulted many thoughtful experts throughout this process. We were ultimately unable to resolve all potential issues, and a number of open questions remain in addition to those described in the main white paper. We briefly describe some of those issues here:

Advisory Board member selection. It is important to be thoughtful about who selects members of the Governing/Advisory Board and to find a credible process to appoint members from a wide range of expertise and from the public and private sectors. We recommend a rapid review of board structures from other Federally funded programs to determine how best to approach this to ensure the credibility, prestige, and expertise of the Teacher Corps board.

Criteria for teacher selection. There is a growing body of work that studies excellence in teaching. The work is ongoing and there are no definitive answers, but there is a growing consensus. We have tried to provide a framework for selection that can adapt to this emerging knowledge over time. Indeed, the Corps program and evaluation process will likely contribute to a better answer to the key question: “What is excellence in STEM teaching?”

Elementary STEM Teacher selection. A significant challenge in the selection of teachers across grade levels is that teachers are prepared very differently for STEM teaching at the elementary level, where many teachers lack content-specific training in STEM and STEM specialists play a strong role in certain contexts. As knowledge emerges on what constitutes and signals excellence in teaching at the elementary level, the Corps should adapt to that knowledge.

Regional Centers. A number of kinds of entities might serve as the optimal entities for Regional Centers – universities, education organizations, STEM councils, businesses, state commissions of education could all play a role in partnership or alone as Regional Centers in the organizational structure of a STEM Teacher Corps. It is important that any entity that serves as a regional center have great relationships and the ability to work with K-12 schools and systems. It may be worthwhile to pilot different kinds of entities, and adopt the most effective kind of regional center.

Evidence basis for Teacher Corps: As we note in the section on piloting and evaluation, too little is known today about what drives retention of great STEM teachers, and how that differs by groups and contexts. The STEM Teacher Corps, if designed to learn how best to improve retention of excellence, can contribute to the knowledge base. We urge that the Corps evaluate on an ongoing basis the incentives that increase retention of excellent STEM teachers and adapt the program to align those incentives where they are needed.

In-person vs. Virtual Interaction: Programs that successfully create cadres of teachers and other professionals often utilize face-to-face interaction to build community, improve knowledge exchange, and create a sense of professionalization. Technology offers promising opportunities to efficiently create such communities without requiring as much travel or resources and offers the ability for such communities to transcend geographical constraints. Nevertheless, we still do not understand to what extent communities and cohorts of teachers will be cultivated across distances versus in close proximity. We recommend that the STEM Teacher Corps be designed to learn what is necessary, by creating closely proximate groups of teachers that interact regularly, as well as experimenting with technology to create more disparate communities of teachers. It will be important to evaluate how the program features differ in their results for teacher retention and recognition.

Qualifying Time in Profession and Term Limits: Some have suggested that teachers in their third year of teaching might benefit from being able to apply to the Teacher Corps and that the retention issues in STEM teaching may be particularly acute in years 3-5. It is an open question whether eligibility ought to begin in the third year of teaching. Similarly, the term of service and its renewability might be something that needs to be evaluated to see what has the greatest impact on teachers. Some of those who have given us input have suggested a term of 3 years; we suggest initially evaluating a 4-year term.

Demands on Teacher Time: A STEM Teacher Corps intends to recognize and reward teachers, and also to create avenues for them to grow professionally and deepen or broaden their impact on STEM education. We acknowledge that STEM teachers have limited time, and that they may require additional time to be freed up for activities of a Teacher Corps. However, the point of the Teacher Corps is to keep great teachers in the classroom, not reduce their time with students. It is important to balance rewarding excellent teachers for their leadership and service outside of the classroom (much of which is already taking place, but is not being rewarded or recognized sufficiently) with not burdening the teachers selected to join the Corps. It is possible that accommodations and resources will ultimately be deemed necessary for Teacher Corps participation, and it is worth piloting, evaluating, and adapting the program accordingly. More crucially, it is important through partnerships and a movement to create the support system from communities, schools, and districts needed to make this a true reward and recognition program for teachers, as opposed to extra work.

Technology, Opportunities for Blended Learning Models, and Reach: In the next decade, many schools will adopt some level of blended approach to learning powered by technology. The STEM Teacher Corps members have the potential to be innovators as well as to improve upon and shape this movement. Additionally, models that use technology and new modes of thinking increasingly allow excellent teachers to take responsibility for more students. It is important to design a Teacher Corps that can adapt to future models for education. It will require ongoing engagement of experts and advisors to determine how teachers in the Corps can best influence and adopt future innovations in STEM teaching.