

Science and Mathematics Teacher Imperative

Memorandum

To: NASULGC Presidents and Provosts

Cc: Governmental Affairs
Research Vice Presidents
Public Affairs

From: Peter McPherson

Date: June 2, 2008

Re: Science and Mathematics Teacher Imperative Paper

We are pleased to share the attached discussion paper about preparation of science and mathematics teachers. The paper argues that NASULGC presidents/chancellors and their institutions should make a commitment to the preparation of additional science and mathematics teachers. Such commitments would be in connection with the efforts of others in the particular state. However, the overall conclusion and specifics of the paper are and must be very much open for debate and modification by you. Of course we know many of you are already seriously engaged in teacher preparation, and there are many state and national efforts underway. However NASULGC may be able to add significant and unique value by linking such efforts and to that end we need your feedback on the paper. Again the attached paper takes a clear position but it is intended to get the views of you and your institution.

As you know, addressing the nation's critical need for STEM teachers has been one of NASULGC's major initiatives over the past 18 months with the leadership of Chancellor Herman of the University of Illinois Urbana-Champaign and a commission on the Science and Mathematics Teacher Imperative. Acting on a request from Richard last February, the NASULGC Board created a special ad hoc committee of presidents and provosts chaired by President Lee Todd of the University of Kentucky, specifically to consider whether presidents and chancellors ought to be asked to make some form of commitment.

President Todd's committee endorses the attached proposal and recommends serious consideration by presidents and chancellors at their June 10 meeting and by provosts at their NASULGC summer meeting. We hope that you and your campus will continue to be engaged on this matter into the summer and early fall. We will compile your feedback to this paper, and with the assistance of Richard Herman, Lee Todd and his committee, we will revise this paper for consideration. If appropriate we will then make a recommendation for action by the NASULGC Board at the annual meeting in November.

We invite your questions, comments, proposed revisions and of course disagreement. We welcome all communications, and would appreciate if you would also share copies of any feedback with our co-director of the Science and Mathematics Teacher Imperative Charles Coble (ccoble2@nc.rr.com).

Weighing Our Commitment to the Science and Mathematics Teacher Imperative

This paper proposes that presidents and chancellors of NASULGC institutions commit to:

1. *Substantially increase the number and diversity of high quality mathematics and science teachers they prepare;*
2. *Identify the need— both immediate and longer term -- for science and math teachers in their states, working with appropriate state agencies and other universities;*
3. *Build partnerships among universities, school systems, state government and others to collectively address their state needs on a sustained basis.*

In "Rising Above the Gathering Storm," the National Academies' first recommendation is a call for an annual increase of 10,000 mathematics and science teachers in order to maintain U.S. economic standing in a world growing rapidly more competitive. With the shortage of qualified math and science teachers approaching crisis proportions in many states, a commitment by a significant number of NASULGC institutions to address the needs of their states would demonstrate critical leadership and could stimulate other sectors in turn to ramp up their efforts.

As discussed over the past 18 months with both the Council of Presidents and the Council on Academic Affairs, NASULGC, in collaboration with its 218 members and other organizations, has undertaken this initiative to increase significantly the number and diversity of high quality science and mathematics teachers prepared and inducted into teaching. To guide our efforts, NASULGC established a prominent commission of university, industry and education leaders chaired by Richard Herman, Chancellor, University of Illinois at Urbana-Champaign <http://www.nasulgc.org/NetCommunity/Page.aspx?pid=592&srcid=584>. NASULGC augmented its staff with a small expert group and received a planning grant from the Carnegie Corporation of New York in October 2007. In March, 2008, the initiative received a grant from the National Science Foundation to assess the specific state-level needs for science and mathematics teachers. Two other proposals have been submitted. The staff has consulted extensively, surveyed the provosts of NASULGC institutions, and began promising collaborations with other education, business, and science societies.

A Special Committee on the Commitment to the Teacher Imperative*, named by the NASULGC Board, endorses a proposal that presidents and chancellors commit their institutions to preparing and developing science and math teachers. The committee recommends for serious consideration by the NASULGC Council of Presidents and the Council of Academic Affairs this discussion paper describing the potential commitment. The Special Committee was formed during the February 2008 NASULGC Board meeting in response to a request by Richard Herman, Chair of the NASULGC Commission for the *Science and Mathematics Teacher Imperative*. The Special Committee consists of 13 presidents and provosts to provide guidance on how NASULGC might stimulate member universities to increase significantly the number and quality of math and science teachers they prepare. Based on feedback from university leaders this summer, we will forward recommendations as appropriate to the NASULGC Board for action during the annual meeting in November.

* Presidents: Lee Todd, Chair, University of Kentucky; Erskine Bowles, University of North Carolina System; Robert Bruininks, University of Minnesota; Beverly Edmond, Alabama A&M University; Milton Gordon, California State University, Fullerton; John Simpson, University at Buffalo; Larry Penley, Colorado State University; Nancy Zimpher, University of Cincinnati; Richard Herman, ex-officio, University of Illinois, Urbana Champaign, and Chair of the Commission for the *Science and Mathematics Teacher Imperative*; and Provosts: Barbara Couture, University of Nebraska, Lincoln; Michael Gottfredson, University of California, Irvine; Doris Helms, Clemson University; and John Frederick, University of Texas, San Antonio

The Rationale for a Statement of Commitment

We estimate 150 or more NASULGC institutions undertake some 500 discernible math and science teacher preparation efforts in response to over 25 years of national concern over the decline in U.S. student achievement in pre-college education relative to international competitors. Yet, it does not appear that these efforts are a sufficient response to the nation's critical challenge in providing enough teachers of appropriate quality. (See attachment.) A shared commitment, endorsed by a large number of institutional leaders, would encourage individual institutions and their university systems to take bolder actions and draw strength from the nation-wide momentum. The shared statement could galvanize universities, spurring them to stretch in their objectives recognizing that to increase the number and diversity of high quality math and science teachers will require enhancing partnerships with other sectors in education as well as further attention to undergraduate science and math education. Only the shared commitment endorsed by many leaders could generate sufficient interest and drive from which to consider changes in faculty rewards and incentives for participation in teacher preparation.

Shining such a favorable light on leading state universities emphasizing education at all grade levels could stimulate a complementary higher priority to science and math teacher recruitment, preparation, induction, development and retention by critical partners in state governments, school districts and the private sector. The shared commitment could grant a more potent voice with state and district education leaders in drawing attention to another important issue that is out of direct university control - appropriately compensating teachers.

Business and philanthropic foundations, some already engaged in somewhat disparate efforts in teacher preparation, development and compensation, might be further stimulated by the coherence of a national commitment. Perhaps we could use such a commitment to stimulate the development of broader national efforts with these key partners.

Finally, if we are successful in garnering pledges of concerted and measurable action by a sufficiently broad and large array of leading universities, we would work to translate this into attention and further support of federal agencies, as they develop programs during the early months of the next Presidential administration.

In his request for the formation of this committee, Chancellor Herman noted members of his Commission proposed the idea of a shared statement of university commitment - a "pledge" as one university system Chancellor suggested at the NASULGC Council of Presidents meeting in November, 2007.

Potential Elements of a Commitment

The Commission suggested key strands of a potential commitment by university and system leaders might include:

1. Substantially increase the number and diversity of high quality mathematics and science teachers they prepare;
2. Determine the need – both immediate and longer term -- for science and math teachers in their states, working with appropriate state agencies and other universities;
3. Build partnerships among universities, school systems, state government and others to collectively address their state needs on a sustained basis.

An institutional commitment embodying these three strands would capture many critical characteristics:

- Acknowledge that the situation is a crisis or approaching one in most states, and thus necessitating immediate action;
- Emphasize the number and quality of teachers needed by each state and district;
- Stimulate collaboration among universities, education systems and state governments to assess the need for math and science teachers recognizing it's a shared problem requiring shared solutions to match supply and demand in their own state;
- Incorporate ongoing efforts by institutions/systems and respect the variety of initiatives, funding, and approaches already underway;
- Stimulate the formation of stronger partnerships with local school districts, community colleges and other educational institutions and community entities;
- Allow for a multi-faceted approach to satisfying the demand for math and science teachers, including rigorous non-traditional routes to teacher certification;
- Extend the universities' role and responsibilities in teacher preparation to include the induction and mentoring of new teachers and the ongoing development of experienced teachers
- Dedicate sustained resources – money, people and time -- to the efforts to improve and intensify math and science teacher preparation;
- Include metrics --specific quantifiable goals -- to enable us to demonstrate progress and to stretch institutions and the education community to move beyond their present practices -- significantly increase the number, quality and diversity of teachers they prepare and show results over many years

Challenges to Implementing a Shared Commitment

There are important questions and issues that need to be resolved in the process of defining and implementing a potential statement of institutional commitment. Earlier this decade, institutional leaders made pledges to teacher preparation under the auspices of AAU and ACE. AAU retrieved archived files in order for NASULGC to learn

from and build upon the AAU work. Based in part on discussions with individuals engaged in the AAU effort, NASULGC recognizes that challenges include:

- Sustaining top level institutional attention to an effort sufficiently long to achieve measurable results
- Getting enough institutions to sign on to attract meaningful attention
- Developing and employing a suitable metric such that both individual and aggregate progress can be measured over time
- Commanding sufficient resources from within each institution to make programmatic changes, particularly in difficult economic times
- Enhancing science and math faculty rewards and incentives for teacher preparation, which require some change to very deeply entrenched faculty and institutional cultural norms on the priority of research to scholarship
- Determining how to distinguish and establish the value-added of such an “over-arching” initiative, given how much is already underway
- Leveraging political and financial support from local and state decision makers to sustain the work

Meanwhile, the issue has been amplified by national and state reports citing a continued and growing need for high quality math and science teachers.

Implementation of the Proposed Commitment: a Five-Pronged Strategy

Our implementation would be sustained over many years and we will create a NASULGC entity, such as a new commission, to serve as a hub and convener for these important programs across NASULGC institutions. Our efforts would be organized around five components:

1. Galvanize higher education leadership to make STEM teacher preparation a higher priority among peers,
2. Determine how to assess the need for secondary science and math teachers, recognizing that supply and demand differs from state to state,
3. Facilitate state fiscal and policy support and increased cooperation between state policymakers and education leaders,
4. Develop the means for institutions to learn from one another's approaches -- an analytical framework which incorporates key components of the most promising practices in science-math teacher recruitment, preparation, mentoring and induction, partnership, and teacher development across universities, and
5. Team up with selected national and regional university, science, mathematics, and education groups.

Should an institutional commitment be adopted, by galvanizing higher education leadership it would become the foundation of our implementation of the teacher imperative, as denoted in the **first prong of our strategy**. The notion of a commitment by several dozen (over a hundred?) major public institutions would draw the attention of potential collaborating sectors, and hopefully with that, prospects for

additional resources for universities attempting to bolster their programs and collaborations. NASULGC would work to build and sustain visibility by:

- keeping track publicly of institutions (and in what states) that sign on;
- marking the progress of committed institutions with aggregate metrics; and
- portraying examples and case studies of programs that are achieving their goals and creating effective state or regional partnerships.

Our **second prong** addresses the challenge facing states to assess their current and projected needs for science and math teachers and the teacher recruitment-preparation-retention pipeline. National estimates of the need for "10,000 additional science and mathematics teachers annually" are rough approximations meant as calls for national action, but they give no guidance for individual states. Similarly, the commitments by a number of universities to double or triple their production of science and mathematics teachers are a strong step in the right direction, but often are not based on true assessments of needs that would ensure these efforts are ultimately on target. In response to this problem, NASULGC has received a grant from the National Science Foundation to devise a resource to help state policymakers and university leaders more accurately determine their science and mathematics teacher demand and supply picture. The resource is intended to include a protocol, based on a review of relevant literature and prior efforts, to help officials frame the appropriate questions and give them guidance in undertaking the kinds of analysis that will afford the most accurate and useful projections of teacher supply and need.

Third, we are developing a project with the Education Commission of the States (ECS) to collaborate with state government and education leaders to identify and develop further leading state models of specific strategies and sustained resources to address needs for science and math teachers.

Fourth, we will develop the means for institutions to learn from one another's approaches to the preparation of math and science teacher preparation. During our anticipated effort, we will:

- compile an analytical framework for viewing and assessing the most promising practices in science-math teacher recruitment, preparation, mentoring and induction, partnership, and teacher development across universities, and
- undertake robust communications among NASULGC and other institutions through meetings and websites to share experiences, approaches and challenges in addressing programs and policies.

Fifth, we will collaborate with selected national and regional university, science and education groups. We have begun to:

- reach out to organizations representing other key sectors, such as the chief state school officers (CCSSO), the Education Commission of the States and the National Governor's Association, to leverage our state university commitments with comparable commitments by their members;
- collaborate with science professional societies in physics, chemistry and math to provide robust opportunities for faculty involved in teacher preparation to learn

from one another and develop ways to deal with institutional and cultural constraints to their further engagement;

- seek foundation and private funding for university programs through collaborations with appropriate funding organizations such as the National Math and Science Initiative (NMSI), Math for America, and the Woodrow Wilson National Fellowship Foundation; and
- seek state and federal funding through enhanced visibility among state and federal government leaders and programs targeting university teacher partnerships.

DRAFT

ATTACHMENT

Context For The NASULGC Teacher Imperative

Not since the launch of Sputnik, and the fear that the Soviet Union was outperforming the U.S. in science and technology, has the call for America to step up its commitment to mathematics and science education been as loud and persistent as today. Beginning in 1983 with the National Commission on Excellence in Education report, *A Nation at Risk*, and continuing through the turn of the century with the 2000 National Commission on Mathematics and Science Teaching for the 21st Century (“Glenn Commission”) report, *Before It’s Too Late*, a variety of reports warned that America continues to lose ground in the global competition for scientific and engineering human resources. And it is clear from the international TIMSS and PISA assessments of student learning that U.S. students in general are far behind students in many other countries in having the knowledge of science and mathematics and the critical thinking skills that are the ticket to success for individuals and for the nation’s economy now and in the future.

Significantly, most of these studies note the essential role K-12 teachers play in improving their students’ math and science competency and, thus, the critical need to ensure that all children have teachers who are sufficiently well-prepared to accomplish the task. The NAS’ seminal 2006 report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, cites the intense global economic competition of today’s information age and America’s declining ability to keep pace. The report notes: “By far the highest leverage to be found in our education system resides with teachers, if for no other reason than that they influence such a large number of future workers.” However the NAS cited significant shortages, noting that many school districts hired uncertified or under-qualified teachers. According to the report, a U.S. high school student had only a 40% chance of studying chemistry with a teacher who was a chemistry major and even less in physics. Furthermore, about 2/3 of the nation’s teachers are expected to retire in the coming decade, with about 200,000 of them secondary science and math teachers – potentially making matters even worse.

The first of the NAS report’s four recommendations— “the 10,000 new teachers for 10 million minds” to significantly improve K–12 science and mathematics education reflected the singular importance of preparing teachers. The report committee presented this recommendation as a higher priority than its advocacy for research funding, graduate education or the environment for innovation.

This first recommendation is the focus of the NASULGC ***Science and Mathematics Teacher Imperative***. As the leading public universities in every state, NASULGC institutions educate, by far, the largest –and probably best prepared -- cohort of undergraduate science and engineering students, on research-intensive campuses that house arguably the most influential colleges of education in each state. NASULGC is the best positioned group of institutions to respond to this NAS call by leading the increase in the number and diversity of high quality secondary school mathematics and science teachers prepared by our nation’s universities.

Universities Respond – but its not enough

There has been a growing effort among colleges and universities to respond to the shortage by increasing their output of K-12 science and mathematics teachers. A number of individual universities and systems have established ambitious goals in response to their state needs. Among them are the California State system – committing to double the number of science and math teachers prepared, to 1500 annually by 2010; the University of California system – quadruple, to 1000 by 2010; the University of Maryland system, triple by 2013; and similar serious commitments by other universities in North Carolina, Georgia, Arizona, New York, Texas, Louisiana and Florida. The leading UTeach program at the University of Texas Austin, begun about a decade ago in part with an NSF grant, now prepares over 70 math and science teachers annually with some 500 undergraduate students presently in training.

NASULGC institutions are the in the lead in most programs. According to our estimates, based in part on tallies from provosts, more than 150 NASULGC universities participate in more than 500 discernible science and math teacher preparation projects combined, from the National Science Foundation (NSF), Department of Education, National Math and Science Initiative, Woodrow Wilson National Fellowship Foundation, Carnegie Teachers for a New Era, Math for America and/or the Physics Teacher Education Coalition. More than 40 NASULGC universities participate in NSF Math and Science Partnership (MSP) projects. Of special note is the new National Math and Science Initiative (NMSI), funded in large part by ExxonMobil, that has announced funding of some 13 institutions, beginning in 2007, for 5 year commitments to replicate the UTeach program on their campuses. NASULGC institutions dominated the ranks of the winning proposals, as they did the over 50 institutions that applied for NMSI matching funds.

Important as these various efforts are, they do not come close to meeting the need for more and better-prepared science and mathematics teachers. For example, *California's Math and Science Teachers: A Critical Path Analysis* by the California Council on Science and Technology and the Center for the Future of Teaching and Learning reported that in California alone “the demand for new science and mathematics teachers in the next ten years is expected to be over 33,000.” (2007) A CSU president involved in this analysis noted that it meant that even if CSU and UC achieved their ambitious commitments to significantly increase the math and science teachers prepared, the state would still fall further behind every year. The 11-campus University System of Maryland, which produces hundreds of science, mathematics, and engineering graduates annually, last year produced only 46 secondary math and science teachers and only one physics teacher. A recent Georgia newspaper article discussing a new effort in that state to recruit science and mathematics teachers noted:

In Georgia, out of 25,000 public college graduates in 2006, just three became high school physics teachers. Nine accepted jobs as chemistry teachers. It's a situation that will worsen in time. By 2010, Georgia will need more than 4,500 middle and high school math and science teachers, according to the University System of Georgia (“Teacher Recruitment Paying Off,” *The Brunswick News*, March 13, 2008).

The immense challenge amidst this plethora of current initiatives is that even the most promising are not yet of sufficient scale to make a very significant impact. Although some institutions are making significant progress in addressing the needs of their states, most individual institutional responses remain somewhat tenuous. Universities, each acting alone, face daunting challenges in making the necessary institutional changes, and, as a community, have yet to develop the focus or drive to sustain a higher priority for preparing and developing science and math teachers. For faculty, it is difficult to learn from and build upon the initiatives at other institutions. For administrators, it is hard to address fundamental structural constraints—serious reforms in incentive and reward systems that would sustain a higher priority for teacher preparation and education partnerships, thus building them into the fabric of institutional culture. And overall, university efforts do not have sufficient visibility or credibility to prompt leaders from other sectors to create the necessary significant collaborations to make very major changes.

Working together, under the umbrella of this national initiative, we are a broad and engaged community of leading research institutions with unusual capacity and leverage to provide national leadership. We can build across and significantly empower the many ongoing fine efforts, and prompt collaborating attention by other key education, public and industrial sectors. Knitting together the drive and creativity of individual institutions responding to regional needs will stimulate the sustained institutional change necessary to make a significant and longstanding national difference.