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# Education and Human Resources in the FY 2009 Budget: Supporting the STEM Pathway

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## INTRODUCTION

"The national goal of maintaining and invigorating a science and engineering workforce demands policy efforts on three fronts . . . First, capable young people must be welcomed throughout the educational process. Second, their talents must be nurtured by elementary and secondary schools and institutions of higher education. Third, they must perceive employment opportunities that utilize their talents by providing fulfilling work."

What has changed in the 20 years since these words appeared in an Office of Technology Assessment (OTA) report?[1] A lot has changed, and in a peculiar way, very little. We still lament "society's gender, race, and class biases in its talent selection," as OTA put it, and how these biases affect "recruitment and retention." But it is also clear that "American schools, colleges, and universities have the capacity to provide enough qualified scientists and engineers to meet the Nation's needs." Of course, today the Nation's demographics are more compelling, the capacity is global, and U.S. institutions vie for the talent, especially at the graduate level, that has made science, technology, engineering, and mathematics (STEM) a more competitive enterprise.

Today we recognize that the STEM pathway extends from preschool through workforce entry and beyond. It is a system neither well-organized nor well-coordinated that rewards students by ZIP code and curtails educational opportunity for many who cannot afford the cost of higher learning. Yet it is a meritocracy.

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[1] U.S. Congress, Office of Technology Assessment, *Educating Scientists and Engineers—Grade School to Grad School*. Washington, DC: U.S. Government Printing Office, June 1988, this quote and those below from p. 20.

Into this landscape the federal government, through a panoply of research and development (R&D) agencies, interjects programs at every level of education to support the STEM pathway (the front end of which is otherwise heavily directed from state and local resources). These programs are intended to advance department and agency missions while sustaining national needs. The people who are trained in these pursuits, a mere 5 percent of the Nation's workforce, play a disproportionate role in ensuring future U.S. productivity and leadership.

The pressure remains on the federal government to craft and implement policies that support both the institutions that educate and the individuals who emerge as the next generation of STEM professionals. This chapter examines, by agency, a budget proposal by an outgoing Administration. It is not our role to determine its fate, but to examine its main components. As investments in STEM, how does it contribute to the ongoing national needs described above? And in the aggregate, is it sufficient to ensure that the talent will be present and appropriately prepared to address the Nation's needs?

## MECHANISMS OF SUPPORT

The federal financing of STEM education has a storied history, beginning with the National Defense Education Act of 1958 (P.L. 85-864) passed in the wake of the Sputnik launch. Different mechanisms of support tend to dominate various segments along the pathway to the workforce. Formula funding, keyed to population concentration, is the chief mechanism at K-12. Individual scholarships are awarded to college-going students. But the post-Sputnik focus on funding for graduate education directed toward students has been eclipsed by competitive project-based funding, granted in the name of the "principal investigator" (PIs) or the institution as the favored graduate and postdoctoral mode of support, now coupled to the fate of the PI.

As these types of support have evolved at the graduate level over the last 40 years, three mechanisms have been identified with the federal role in STEM education. The ascendant type, *research assistantships* awarded to PIs of research grants, imposes no restriction on who can be supported. *Fellowships*, in contrast, are portable grants awarded directly to students pursuing graduate study at the institution of their choice. *Traineeships* are awarded to institutions, or more precisely, to units within them, to build training capacity in a discipline or set of

disciplines. The mix in type of support helps shape the composition of any particular research unit.

In contrast to the direct support of graduate education as portable fellowships or funding tied to researchers, the federal strategy for K-12 education is focused on leveraging the resources it distributes in ways that affect how states and localities spend their education dollars. Whether via the *formula funding* of the Department of Education or the *competitive grants* programs of the National Science Foundation, districts receive resources directed toward furthering national goals, including those related to improving STEM education.

**DEPARTMENT OF EDUCATION**

The President proposes a flat $59.2 billion for the Department of Education in FY 2009 (see Table II-18). The cornerstone of the Administration's K-12 education agenda is **No Child Left Behind (NCLB).** During the second session of the 110th Congress, expect a clash between Congress and the Administration as they duel over competing proposals to reauthorize the Act, which has been criticized both for insufficient funds since its inception in 2001 and for fostering a testing mania.

The **American Competitiveness Initiative (ACI),** while focusing on physical sciences research, also continues to be a key component of the President's pre-college education vision. The **Math Now** initiative which was split between two separate programs in the FY 2008 request (at $125 million each) would be rejoined again at a request of $95 million. The **Advanced Placement (AP) and International Baccalaureate Programs (IB)** would increase $26.5 million to $70 million. The goal of the program is to train educators to teach math and science courses with an emphasis on training teachers in high-need schools.

Other elements of ACI include the **Adjunct Teacher Corps**, requested at $10 million, to provide competitive grants to schools that partner with public or private institutions. The goal is to create programs that give professionals with expertise in mathematics and science the opportunity to teach in secondary schools. The **Mathematics and Science Partnerships Program** would remain flat at $179 million. For higher education, the ACI efforts would include a $960 million request for Academic Competitiveness and SMART Grants.

**Title I Grants to Local Educational Agencies** would grow 2.9 percent in FY 2009 to $14.2 billion. The **Title I School Improvements Grants Program**, a new program introduced in 2006 to ameliorate the number of schools failing to meet adequate yearly progress (AYP), would receive flat funding at $491.3 million after tripling last year. The special education formula grants funded through the **Grants to States** program, as authorized by the **Individuals with Disabilities Education Act (IDEA)**, would increase slightly to $11 million in FY 2009.

**Reading First** would receive an enormous boost growing to $1 billion in FY 2009, a 154 percent increase over the FY 2008 allocation of $393 million. The renamed **21st Century Learning Opportunities** program (formerly 21st Century Community Learning Centers) would receive $800 million. Finally, the Administration proposes the creation of a new Pell Grant K-12 scholarship program that would provide $300 million for low-income students to transfer to local private schools or out-of-district schools. The program appears to be similar to the Promise Scholarships.

***Higher Education Programs***. A major highlight of the FY 2009 budget request impacting higher education is a proposal to increase the maximum **Pell Grant** award to $4,900 next year. The total request is $18.9 billion for FY 2009, an increase of $2.6 billion above FY 2008. However, the increases provided for Pell Grants result in significant decreases in the **Federal Family Education Loans** ($2.4 billion, a decrease of $2.1 billion) and the **Federal Direct Student Loans** ($329 million, a decrease of $5.2 billion). The Department also states that savings would be found by recalling **Perkins Loans**.

The Administration would request $24 million for an **Advancing America Through Foreign Languages Partnerships** program, a new start authorized through the America COMPETES Act of 2007. The FY 2009 budget request also includes $110 million for the **International Education and Foreign Languages Studies** (IEFLS) programs.

Title III funding for **Aid for Institutional Development** programs would receive $451.7 million in FY 2009, providing flat funding or decreases for programs under its jurisdiction: Strengthening HBCUs ($238.1 million), Strengthening Historically Black Graduate Institutions ($56.9 million) and Developing Hispanic-serving Institutions ($74.4 million).

Finally, the Administration would significantly boost funding for the **Institute of Education Sciences (IES)** to $658.2 million in FY 2009, an

increase of over 20 percent. The majority of the increase would go to support increases in the National Assessment program ($130 million) and National Assessment Governing Board ($8.7 million). Statewide Data Systems would more than double in FY 2009 to $100 million.

## NATIONAL SCIENCE FOUNDATION (NSF)

NSF is the principal federal agency charged, under the NSF Act of 1950, with science and engineering education. Today this translates largely as building "the science, technology, engineering, and mathematics (STEM) workforce of the 21st century." The NSF Education and Human Resources (EHR) budget, where the core education portfolio resides, would increase 9 percent to $790 million in FY 2009 (see Table II-7).

At the programmatic level, NSF's education initiatives are organized under four divisions: Research on Learning in Formal and Informal Settings (DRL), Undergraduate Education (DUE), Graduate Education (DGE) and Human Resource Development (HRD).

The budget request for **Research on Learning in Formal and Informal Settings (DRL)** would grow 5.8 percent to $226.5 million in FY 2009. The majority of the increase would go to the Discovery Research K-12 program ($108.5 million).

**Undergraduate Education (DUE**) programs would increase $8.8 million to $220 million, including $11.6 million for the Robert Noyce Teacher Scholarship program, $51 million for the Math and Science Partnership, $51.6 million for Advanced Technological Education, $39.2 million for Course, Curriculum and Laboratory Improvement, and $29.7 million for the STEM Talent Expansion Program.

NSF's **Graduate Education (DGE)** programs would grow $30.6 million in FY 2009, a significant growth of 19 percent for a total budget of $190.7 million. Almost all of the increase ($28.6 million) would go to support the Graduate Research Fellowships for a total of $116.7 million. In other areas the budget request includes flat funding for the Integrative Graduate Education and Research Traineeships (IGERT) at $25 million and a slight increase of $2 million for the Graduate Teaching Fellows in K-12 Education (GK-12) for a total of $49 million in FY 2009.

Finally, the **Human Resource Development (HRD)** programs would increase almost $13 million in FY 2009 to $153.4 million. Almost all of

the requested growth would go to support Research and Education Infrastructure ($47.3 million, up 17.2 percent) and Opportunities for Women and Persons with Disabilities ($19.3 million, up 15 percent). Although it accounts for more than half of the total budget, the Undergraduate and Graduate Student Support program would receive just a slight increase of 4 percent to $86.9 million.

**OTHER AGENCIES THAT SUPPORT SCIENCE EDUCATION**

***Department of Energy (DOE):*** DOE education activities are administered through the Office of Science, and would increase 7 percent to $13.6 million in FY 2009. DOE's Workforce Development for Teachers and Scientists manages three programmatic elements: **Educator Programs** ($7.5 million), **Student Programs** ($4.6 million) and **Program Administration and Evaluation** ($1.1 million).

DOE's Educator Program FY 2009 budget request includes $6.4 million for the Academies Creating Teacher Scientists (DOE ACTS) to train 227 new and 114 existing K-12 teachers. The Faculty and Student Teams (FaST) program would provide $0.3 million for university and national laboratory research collaboration opportunities, and DOE's Einstein Fellowships would receive $0.8 million in FY 2009.

The agency's Student Programs include $3.2 million for its Science Undergraduate Laboratory Internship (SULI), Community College Institute (CCI), and Pre-Service Teachers (PST) programs. In addition it requests $1.4 million for the annual National Science Bowls conducted at middle and high schools.

Finally, DOE is ramping up an Evaluation and Workforce Study with a request of $1.1 million in FY 2009 as part of its Program Administration and Evaluation theme.

***National Institutes of Standards and Technology (NIST)****:* The FY 2009 NIST request includes $13 million towards expanding a research and training institute (JILA) for graduate students and postdoctoral fellows run jointly by NIST and the University of Colorado at Boulder.

***National Aeronautics and Space Administration (NASA):*** The President's FY 2009 request for NASA's Education programs would provide $115.6 million, a 21 percent cut. However, the decrease includes

$26.3 million in congressionally designated FY 2008 projects that are not carried over into the FY 2009 request. When comparing the FY 2009 budget against the FY 2008 enacted budget without earmarks NASA's Education programs would fall $4.9 million or 4 percent.

NASA's activities cover a broad portfolio of activities geared to three main "outcomes" across elementary, secondary, and higher education: attracting students to STEM disciplines, developing and strengthening the STEM workforce, and building strategic partnerships to promote STEM literacy and awareness of the NASA mission.

The three biggest "program commitments" in the request account for three-fourths of the total education request: the **National Space Grant College and Fellowship Project** ($28.7 million), the **Minority University Research and Education Project** ($28.1 million), and the **Elementary and Secondary Education** Project ($32.1 million). Other programs supported by NASA include **EPSCoR** ($8.3 million), Higher Education ($9.5 million), Informal Education ($2 million) and E-Education ($6.8 million).

***Department of Defense (DOD):*** DOD also supports education initiatives through its **National Defense Education Program (NDEP)** within its "6.1" basic research account. The FY 2009 budget request is $69 million, an increase of $25 million (56.8 percent) over FY 2008. DOD's education initiative falls under two categories: pre-college and undergraduate, graduate and post-graduate.

The majority of the military's education efforts go to award **Science, Mathematics and Research for Transformation (SMART)** scholarships ($35 million) to undergraduate and graduate students in physical science, engineering and mathematic fields. In addition, the agency would provide $11.4 million for the **National Security Science and Engineering Faculty Fellowships** (NSSEFF) program. This is a new start in FY 2009 to provide $600,000 five-year awards to a maximum of 50 graduate and post-doctoral students.

DOD's pre-college programs include the **Material World Modules** ($13 million), a teacher training program that links teachers with DOD laboratory scientists and a new start for a Pre-Engineering Partnerships Program ($10 million) that will hands-on, inquiry-based curriculum materials for middle and high school students.

## CONCLUDING REFLECTIONS

The numbers presented in this chapter likely represent an "underestimation" of the funding directed toward STEM education. For example, individual NASA missions include required activities related to education and public outreach. NSF Centers grants often include education and outreach efforts associated with proposers' responses to the "broader impacts" criterion. And nowhere is there an estimate of the level of graduate and post-doctoral support tied to research grants. Sadly, there seems to be a less-than-coherent picture and little in the way of a comprehensive strategy for the investment of federal resources toward developing and maintaining a STEM workforce.

Although desirable, it is not possible to analyze federal support directed to different components of STEM education pathways. While agencies have a vested interest in ensuring the adequacy of the talent base in the fields of interest of each, most lack the authority to act on this need. In other cases the people who emerge as "by-products of research" find a dearth of opportunities for continuing on this pathway with a shrinking pool of research support Additionally, graduate education in many STEM fields important to innovation, sustainability and national security are attracting diminishing numbers of US citizens.

The multiple challenges posed above are joined to the larger ones of ensuring an adequate supply of highly qualified young people from the demographically more diverse pool of K-12 students. Concerns of the "dumbing down" of curricula and standards at state levels to ensure that requirements are met under NCLB are joined to those related to the long-term adequacy and capacity of the science and mathematics teaching workforce.

Meanwhile, a disjointed picture of federal support for education and human resources is what we have. And clearly the size of the investment does not reflect the magnitude of the problem. We are reminded of the coordinating role played by the Office of Science and Technology Policy (OSTP) in rationalizing federal initiatives across agencies, programs, and points along the STEM pathway. Leadership matters.

The new Administration inherits a cacophony that must be harmonized with State and local investments to support education and workforce development for the 21st century along the entire STEM pathway.