

To: Dennis McDonough, White House Chief of Staff
Cristin Dorgelo, Office of Science and Technology Policy Chief of Staff

From: Alisha Nikita Dua

Re: Efficient Transfer of Educationally Useful STEM Equipment from Federally Funded Universities to Public Schools

Date: 3rd April, 2016

Recommendation

In order to promote equal science, technology, engineering and math (STEM) education opportunities for public school students across the United States, it is recommended that an executive order be made to the Department of Education to require the direct transfer of useful STEM equipment, such as, but not limited to, microscopes or pipets, to public schools by federally funded universities no longer in need of such equipment. Using the language below, this executive order will work in cooperation with other STEM initiatives of the White House Office of Science and Technology Policy to advance US STEM education and competency for a better and more equitable American future.

Proposed Language:

Efficient Transfer of Educationally Useful STEM Equipment from Federally Funded Universities to Schools

(a) To the extent permitted by law, all federally funded universities shall give highest preference to schools in the transfer, through gift or donation, of educationally useful university STEM equipment.

(b) Universities shall attempt to give particular preference to schools located in the Federal enterprise communities and empowerment zones established in the Omnibus Reconciliation Act of 1993, Public Law 103-66.

(c) Each agency shall, to the extent permitted by law and where appropriate, identify educationally useful university STEM equipment that it no longer needs and transfer it to a school by:

(1) conveying research equipment directly to the school 15 U.S.C. 3710(i); or

(2) reporting excess equipment to the General Services Administration (GSA) for donation when declared surplus in accordance with section 203(j) of the Federal Property and Administrative Services Act of 1949, as amended, 40 U.S.C. 484(j). Agencies shall report such equipment as far as possible 17228 Federal Register / Vol. 61, No. 77/ Friday, April 19, 1996 / Presidential Documents in advance of the date the equipment becomes excess, so that GSA may attempt to arrange direct transfers from the donating agency to recipients eligible under this order.

(d) In transfers made pursuant to paragraph (c)(1) of this section, title shall transfer directly from the university to the schools as required by 15 U.S.C. 3710(i). All such transfers shall be reported to the GSA. At the direction of the recipient institution, and if appropriate, transferred equipment may be conveyed initially to a nonprofit reuse or recycling program that will upgrade it before transfer to the school holding title.

(e) All transfers to schools, whether made directly or through GSA, shall be made at the lowest cost to the school permitted by law.

(f) The availability of educationally useful federally funded university STEM equipment shall be made known to eligible recipients under this order by all practicable means, including newspaper, community announcements, and the Internet.

(g) The regional Federal Executive Boards shall help facilitate the transfer of educationally useful Federal equipment from the agencies they represent to recipients eligible under this order.

Brief Statement of problem (Abstract)

The United States is facing a severe deficit in STEM professionals. If this deficit is not solved, research suggests there will be severe economic, security and social implications for the US as our world becomes increasingly technological. Public education in the US does not provide the tools necessary for students to maintain and interest in STEM subjects. Even those students who are interested often face bias or are unable to successfully complete STEM degrees in higher education. Research has proven that there is an immense benefit to hands-on learning in STEM subjects. However, the equipment necessary to experience science through active learning methods are not available to most public schools students. Old, but still usable, STEM equipment is often forgotten, trashed, or sold for parts by research universities. Mandating the transfer of this equipment from federally funded universities to public schools can provide the opportunity for public school students to deeply engage with STEM subjects. Increased access to STEM equipment will help improve student interest in STEM subjects and current problems with university retention in STEM subjects. This is a vital first step to increasing the number of STEM professionals and improving the prospects of America's future in a STEM-driven world.

Rationale for Policy Recommendation

Our mission is to promote student achievement and preparation for global competitiveness by fostering educational excellence and ensuring equal access. – US Department of Education

An equal education that provides the tools to prosper in life is a right, not a privilege. With an individual's success becoming more and more dependent on their proficiency in STEM subjects, the United States has an obligation to ensure that all students have been given the tools and education to succeed in our increasingly technological world. Access to STEM tools is especially important given that research has shown that active, hands-on lessons improve learning in STEM subjects—a fact even the White House has acknowledged.

The current education system places public school students at a disadvantage. This is not to say that the government must provide the same opportunities as a private school; this obviously cannot be achieved. But, in US public schools, simple technologies such as microscopes or even the Internet is a privilege. The fact that the microscope was invented in the early 1600s, and many students still don't have access to this equipment, is simply astonishing. The US government is failing its commitment to prepare its students for global competitiveness in our STEM driven world.

The question then becomes: what should the government do? In the highly partisan and contentious atmosphere that now defines politics, getting more money from the national budget for microscopes, let alone other science equipment, would not be an easy sell. Realistically, current successful systems or programs targeted at increasing access to STEM technologies must be drawn upon to change the tides in STEM education. President Bill

Clinton released Executive Order 12999 in 1996, which mandated that all federal agencies transfer useful equipment no longer needed by the agency to schools or non-profit organizations. This order provides the perfect precedence to mandate similar actions be taken by federally funded universities. Possibly more important than the legislative precedence set by this order are the successful outcomes seen as a result of President Clinton's action. In 2008, the NIH donated over \$13 million worth of useable equipment—7,500 individual items—mostly to local schools. Montgomery Community College's Rockville campus was able to set up a new laboratory entirely from NIH donations that would have otherwise cost the school millions of dollars.

The burden placed on universities by requiring equipment donations to public schools is minimal. The General Services Administration (GSA) acts as a proxy for government agencies and small business contract partners that want to donate equipment but don't want to handle the transfer or required small repairs. Providing GSA services to federally funded universities, as stipulation of the proposed executive order, would alleviate administrative burdens that may initially seem limiting. Even without GSA service, however, many universities have donation systems in place that adopt a direct transfer method of donation. One program at Northwestern University is addressing problems of public school STEM technology deficits by encouraging laboratory equipment donations of outdated or unused technology. The program was able to provide a thermocycler to a local high school, which allowed students to run a PCR (one of the most used and important science research techniques).

The Northwestern donation program also highlights issues of research waste. The website acknowledges that at the university level, "lab equipment is still usable, but is replaced by newer technology or upgrades in standards". My personal experience at Georgetown can confirm that equipment, minimally broken or simply old, can sit under lab benches or on shelves for years. With no current system or mandate in place for donations, this technology is often trashed or sold for parts. STEM professionals, especially, should be highly aware of the impact such waste can have on the environment and health. As the producers and users of this equipment, STEM professionals have an ethical obligation to reduce the impact of this technology waste. The proposed executive order provides the guidelines for the STEM community to fulfill this ethical obligation, while helping support the success of future generation of STEM professionals.

The clear ethical, social, and economic benefits to STEM equipment re-use and recycling provides strong justification for the implementation of the proposed executive order.

Legislative Context and Background Policy Information

Executive Order 12999 mandated the donation of educationally useful equipment to schools and non-profits by federal agencies. This executive order built upon the Federal Technology Transfer Act of 1986 and the Stevenson-Wydler Technology Innovation Act of 1980, which aimed to improve the access and use of technology in America. Thus, there is a strong historical precedence for mandating technology donations by an executive order and, more generally, for political actions targeted at improving STEM outcomes through policies on STEM tools and technologies.

Also of importance is the Obama administrations' clear commitment to improving STEM outcomes and access. The Office of Science and Technology Policy (OSTP) as implemented many programs and initiatives specifically targeted at changing the face of STEM education such as 'Nation of Makers' and 'Educate to Innovates'. In fact, increasing access to learning tools to

improve interest and encourage innovation in STEM fields is a specific goal of the Nation of Makers program. The proposed executive order would be effective avenue for achieving the goals set forth by these OSTP initiatives and is clearly aligned with the Obama administrations' work on STEM education.

Background of Problem

The United States produces 300,000 STEM graduates with a bachelor's or associates degree each year. At this rate, the US will be 1 million STEM graduates short of meeting the projected requirements to maintain its international preeminence in science and technology over the next decade. The impacts of this deficit are expansive. Science and technology advances were responsible for over half of the US's seven-fold growth in average per capita income in the 20th century. In light of current projections, our STEM workforce will be unable to maintain this rate of economic progress. Additionally, in our increasingly technological world, national security will need skilled STEM professionals to tackle issues in cyber security and bio-warfare. The economic stability and general welfare of the American state is dependent on increasing the number of STEM graduates.

There are many factors causing this short fall in educated STEM professionals, ranging from issues with STEM subject retention at the university level to limited access to the tools necessary for STEM education to failing curricula and unqualified teachers. One of the many significant problems is the lack of interest in STEM subject areas by American students. This lack of interest is a direct product of an unequal, unfit, and inefficient STEM education system in the US. A 2012 report from The President's Council of Advisors on Science and Technology (PCAST) summarizes:

... even schools that are generally successful ... often lack teachers who know how to teach science and mathematics effectively—and who know and love their subject well enough to inspire their students. Teachers lack adequate support, including appropriate professional development as well as interesting and intriguing curricula. School systems lack tools for assessing progress and rewarding success. The nation lacks clear, shared standards for science and math that would help all actors in the system set and achieve goals. *As a result, too many American students conclude early in their education that STEM subjects are boring, too difficult, or unwelcoming¹*, leaving them ill-prepared to meet the challenges that will face their generation, their country, and the world.

Unfortunately, though not surprisingly, the gap between interest in STEM subjects and completion of STEM degree is highest among minority students and women. The PCAST report also found that students of color reported experiencing an unwelcoming environment in STEM classrooms. Minority students also have the least opportunity to explore and experience a high quality science education, with statistically fewer AP classes, more uncertified teachers, and limited to no access to even basic learning tools such as the Internet. As a result, of today's graduates, "only 2.2 percent of Latinos, 2.7 percent of African Americans, and 3.3 percent of Native Americans and Alaska Natives have earned a first university degree in the natural sciences or engineering by age 24." Similarly female students often face systematic bias in STEM fields, which has led to only 20% of female students graduating with a STEM degree even though women are the majority of all college students in the US.

These disparities in STEM education are deeply engrained in the American system. The appearance of achievement gaps—for both minorities and women—in math and science have been documented in primary education and even kindergarten. These early and persistent

¹ emphasis added

inequalities in education are leaving minority students and women unprepared to succeed in STEM subjects at the university level. With minority students now comprising over half of all primary school student in the US, a majority of prospective STEM professionals will face bias and/or lack a quality STEM education that will hinder their ability to successfully achieve a STEM degree.

Leaving our current STEM education system unchanged system will undoubtedly have detrimental impacts for our Nation's future as a global leader. We must look for cost effective means to address these education issues and close achievement gaps if we want to ensure a prosperous and stable future for all American people. The proposed executive order is an effective action for addressing these issues.

Relevant Stakeholders

President Obama/ Executive Office of the President, Department of Education, Office of Science and Technology Policy, General Services Administration, Public schools (students, teachers, administration), Federally funded universities (administration, STEM professors/researchers, STEM departments)

Sources

"A Nation of Makers." The White House.

"Advancing Equity through More and Better STEM Learning." The Leadership Conference Education Fund. (2015).

"Educate to Innovate." The White House.

Exec. Order No. 12999, 3 C.F.R. 17227 (1996).

Faust, Julie. "New Report Details Critical Disparities in STEM Education." *The Leadership Conference on Civil and Human Rights*. (2015).

Fryer, Roland G., Jr., and Steven D. Levitt. "An Empirical Analysis of the Gender Gap in Mathematics." *American Economic Journal: Applied Economics*. (2010);2 (2).

"NIH Property Donation Program Succeeds." *NIH Record* LX1.21 (2009).

"OSEP Equipment Donations." *OSEP Equipment Donations: Procurement and Payment Services*. Northwestern University.

"OSTP Initiatives." *Office of Science and Technology Policy*. The White House.

"Report To The President, Engage To Excel: Producing One Million Additional College Graduates With Degrees In Science, Technology, Engineering, And Mathematics." *President's Council of Advisors on Science and Technology*. Executive Office of the President. (2012).

"Report To The President, Prepare And Inspire: K-12 Education In Science, Technology, Engineering, And Math (STEM) For America's Future" *President's Council of Advisors on Science and Technology*. Executive Office of the President. (2012).