



Report

America COMPETES Act's effect on NASA's Education and Public Outreach Programs



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ABSTRACT

NASA's Education and Public Outreach program performances have historically been poorly evaluated. The programs are fragmented and difficult to track which contributes to the difficulties faced by the United States' struggling education system. In response, the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science Reauthorization Act of 2010 (America COMPETES) was passed in an effort to streamline federal efforts in Science, Technology, Engineering, and Math education (STEM) and keep the American technical workforce competitive in the global market.

America COMPETES' impact on NASA's role in STEM education made little positive changes. The Act's requirements perpetuate misguided STEM education evaluation methods. Funds appropriation marginalize NASA from meaningful K-12 education interactions. Portions of the implementation steps are counter-productive to NASA's public image.

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1. Introduction

The United States wants to maintain its status as a world leader in technology development. This aspiration is the driver behind the current attention to strengthening a direct education pipeline for the science, technology, engineering, and math (STEM) industries. The United States is investing in STEM education (STEM-ed) to provide the skills, knowledge, and training to create a sustainable and robust workforce [1]. The productivity of the country depends on a strong workforce that can produce technological innovations in the coming decades. STEM education is a front-end investment aimed at building the multi-generational workforce.

Since the creation of the National Aeronautics and Space Administration (NASA) in 1958, the organization has been a high-profile representative carrying out national policies on science and technology. NASA is a publically recognized agent that inspires the past, current, and future generations' interest in science and technology development. Legacies such as the Apollo program to the Moon, the Space Shuttle, and the International Space Station (ISS) are significant demonstrations of the United States' ability to produce groundbreaking advanced technologies. These programs also served as symbols of prestige and the public image of the

nation. Over the last 60 years, technological superiority through the demonstration of space exploration became part of the United States' identity. Space, particularly human spaceflight, represents a mythical and culturally significant ideal for the American public as a national destiny [2].

Within the larger context of the United States' technology demonstration objectives, STEM education is a domestic policy program that is receiving current attention. As part of that policy, NASA's Education and Public Outreach (EPO) programs represent a high-profile component. Space activities embody an appeal in science that is unique when compared to work from other the federal agencies.

2. America COMPETES Acts

The federal STEM-ed reform effort is guided by a Congressional act passed in 2007 and reauthorized in 2010 to cultivate a larger STEM workforce. The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act (COMPETES) will reorganize 14 federal agencies' Education and Public Outreach Programs with the intent to form a cohesive effort and increase their efficiency [3]. America COMPETES' goal is to increase STEM research funds and to produce a sustainable domestic education pipeline of STEM graduates to maintain competitiveness in technology on the global scene.

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COMPETES 2007 was remarkable in being a single legislative act that combined funding authorization for a broad range of science and technology agencies. It was also prominent as a bipartisan legislative achievement [4]. The reauthorization in 2010, while still a bipartisan effort, received less support compared to the enthusiasm behind COMPETES 2007.

Preceding both COMPETES Acts were bipartisan inquiries for action items the federal policymakers should take to maintain the nation's competitiveness. The National Academies of Science, the National Academy of Engineering, and the Institute of Medicine jointly published a report in 2005 titled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, followed by a 2010 revision. More commonly referred to as the "Gathering Storm" report and headed by former Undersecretary of the Army and retired CEO of Lockheed Martin, Norman Augustine, this report advanced the formation of COMPETES 2007 [4]. Similar to Augustine's findings in the 2004 National Innovation Initiative Summit, the Gathering Storm report pointed to the continuing inability of the United States to supply the technical workforce necessary to remain competitive globally [4]. Both Gathering Storm reports and both COMPETES Acts all focus on efforts to increase support on research and scientifically literate educators and graduates. The 2005 Gathering Storm's recommendation to increase STEM education and research funding gained strong support in the next two years in Congress [4]. The policy direction were further substantiated when President George W. Bush used recommendations from the Gathering Storm report in his 2006 State of the Union Address and announcement of his American Competitiveness Initiative [4].

A "revisit" edition of Gathering Storm was published in 2010 to build momentum behind the COMPETES 2010 reauthorization efforts. The Obama Administration incorporated the Gathering Storm 2010 report into the Innovation Strategy [4]. The 2010 report was written by a team of 17 experts. Mr. Augustine's 2010 team was heavily composed of leaders in technology industry and academics. Only one member of the team represented the kindergarten to 12th grade (K-12) precollege education sector [5]. This imbalance suggested the proposed education reform report featured disproportionately small educator inputs.

The COMPETES Acts differed from previous technology policies such as International Traffic in Arms Regulations (ITAR) which is a defensive "keep out" export control. Under the fear of American innovations leaking to other nations, ITAR is a policy focused on protecting American technical knowledge. Whereas the current STEM education method is focused on developing domestic human resources and building research capabilities within the country. The approaches are different, but both are based on fear of foreign nations. Economist Jerry Marschke of State University of New York at Albany, criticized that the Gathering Storm report team for "The way they wrap up their policy recommendations, they're trying to scare people" [6].

The Gathering Storm reports raised fears on the dire conditions of America's failing education system as the cause that the US is lagging behind in global competitiveness, particularly compared to China's booming development [5]. The sinophobic overtone of the 2010 report painted a polarizing view and recommended increasing STEM workforce size and doubling research and development funding. The recommendation was to produce more qualified STEM K-12 educators and by extension more student interest in STEM career paths. Public policy expert Ron Hira at Rochester Institute of Technology in New York points out that "Just increasing the number of engineers seems like a really simplistic approach" [6]. The reports and COMPETES Acts assume a direct correlation between larger technology workforce and innovation. Such assumptions and simplifications may not

provide the long-term results in a complex social disparity problem.

3. What does America COMPETES 2010 do to NASA?

Initial implementation studies of NASA's Education and Public Outreach Programs highlighted decentralization and organizational siloing as a continuing problem [7]. The New Public Administration reform of the 1990s introduced new requirements to promote transparency and accountability [8]. However those changes were not cemented in NASA's Education and Public Outreach Programs and efforts remained fragmented. The lack of relevant evaluation and agency-wide cohesion have been identified since 1985 by Burkhalter and James [9]. Poor coordination and decentralized programs are not unique in NASA's EPO. The same was repeated over all of the 14 science agencies addressed in COMPETES 2010 [10]. In response to the ineffective evaluation practices and fragmented EPO programs, America COMPETES will cut the number of federal STEM-ed programs from 226 to 110. A total of 38 programs will be consolidated, and 78 program completely eliminated [1]. Funds from the canceled and consolidated programs are redirected to "flagship programs". NASA's flagship education programs are in college level engagements. The NASA Reauthorization Act of 2010's framework, consistent with COMPETES' implementation plan, placed most of NASA education efforts into two university level research grant programs, the Experimental Program to Stimulate Competitive Research (EPSCoR) and Space Grant [11].

Confirming both policies, the FY14 budget request of \$94.2 million did not include any funding for direct K-12 programs. Of the \$94.2 million requested, \$87 million of the funding is allocated for higher education programs [12]. The increased funding for higher education opportunities can be credited to reallocation of canceled NASA EPO programs and not to America COMPETES. Ninety-nine percent of funding appropriated under COMPETES 2007 and 2010 went to three federal research entities, the National Science Foundation, the National Institute of Standards and Technology, and the Department of Energy [13].

Budget cuts and program consolidations are not necessarily detrimental to NASA's EPO. Streamlining programs for a cohesive effort is the right direction to improve the overall federal STEM-ed objective. The core problem remains in the lack of evaluation of program effectiveness. The NASA Office of Education does not have an overall evaluation plan for K-12 programs [14]. NASA EPO programs primarily measure number of participants served, student demographics, and geographic diversity of program implementation. Simply documenting geographic and attendance numbers do not produce scientifically-based evidence of impact [15].

The Act repeatedly called for the recruitment of underrepresented minorities (URM) and female students, who do not traditionally seek STEM career fields [3]. However, the evaluation metrics do not specify accountability for the number or engagement levels with URM and female students [1]. CoSTEM's implementation plan calls for authentic STEM experiences without clarity in how to measure them [1]. The stated goals of COMPETES do not match the evaluation metrics. NASA EPO's failure in evaluations is not a singular anomaly. The Government Accountability Office found scattered efforts toward STEM-ed throughout the science-based federal agencies. STEM education programs are consistently poorly evaluated [16]. NASA's Office of Education requested \$25 million for 2014 to be used for Evaluation Performance Monitoring & Accountability [11]. It remains to be seen if the new emphasis will change NASA's utilization of evaluation.

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