

The United States is standing at the cusp of a revolution in manufacturing. It's a revolution that will bring manufacturing back to the United States. But it is not our grandfather's manufacturing, with a row-after-a-row of human workers doing repetitive menial tasks. It is educated STEM workers creating and controlling sophisticated, intelligent processes and machinery (e.g., robots). The problem is, we do not have enough STEM trained American workers to create and control these processes and machines. The answer: support programs that inspire our youth and recognize their accomplishments in science, technology, engineering, and mathematics.

President Obama has challenged us to create an additional million STEM workers in the next eight to ten years. That means we need to inspire an additional million students to become STEM workers in the next three to five years. We have zero time to research and study how to inspire these students. Fortunately US *FIRST* (For Inspiration and Recognition of Science and Technology) has been changing the lives of K-12 students for the past 25 years. Today over 275,000 US school children from kindergarten to 12th grade are involved in *FIRST* STEM competitions. *FIRST's* survey of its alumni show that some 89 percent are either majoring in a STEM subject or are already in a STEM job. *FIRST* works. We do not need more research, nor do we have the time to engage in more research.

We have two examples of how government can successfully work with STEM engagement programs like *FIRST*. In Minnesota the state government has recognized *FIRST* as a competitive sport just like football or ice hockey. It is an astounding fact, but there are now more *FIRST* teams in Minnesota than there are ice hockey teams. In Iowa that state pre-selected a number of STEM after-school engagement programs, including *FIRST*. It then appropriated some \$3.6 million dollars of its own money and selected six hub universities. Iowa had those universities fund K-12 schools that picked one of the engagement programs. In one year, the number of *FIRST* teams doubled.

Recognition of Engagement Programs as A Competitive Sport

Accordingly, we would strongly urge the President to establish a national goal that states and local education entities recognize *FIRST* and other competitive after-school STEM engagement programs as a competitive sport. The trophy case in the lobby of every school should contain the awards of its *FIRST* teams as well as the football, basketball and hockey teams. But *FIRST* competition is different in significantly positive ways.

A *FIRST* core value is Coopertition®: “competing teams help cooperate with each other.” Gracious Professionalism® is also a core value: respect for others, being a good sport, sharing what you learn.” Failure is an important part of the learning process; it is not bad and jeered. But failure should be cheered when it instills the grit in our children to pick themselves up, learn from failure and overcome the obstacles. *FIRST* is already transforming our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology leaders. (See <http://www.usfirst.org/aboutus/first-promo-video-featuring->

[morgan-freeman](#).) Finally, unlike today's competitive sports, every *FIRST* student who goes on to get a STEM degree can turn pro, we know there is a job waiting for her.

Academic Credit

While we believe that students who compete a well-structured STEM after-school mentor-driven engagement program ("Program") should be given academic credit, results should not be measured in the mastery of a specific academic subject. The results of a good Program should be to inspire young people to be science and technology leaders, while building science, engineering, and technology skills, as well as to inspire innovation, and foster well-rounded life capabilities including self-confidence, communication, and leadership.

Accordingly, while academic credit should be granted for a student who participates and completes a competition, she should not be graded. The teacher and team mentor should grant credit to every student that fully participates in a competition.

NSF Funding

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..." Very little could be closer to NSF's mission than to help create the next generation of scientists and engineers. Unfortunately, NSF regards its mission to do research and not to sustain and advance those STEM programs that work. The Administration and Congress must make clear that NSF's mission is also to help expand the reach of successful Programs in order to solve two national challenges.

The first challenge, discussed above, is to meet the President's one million additional STEM worker goal. Our country's health, prosperity and welfare, as well as national defense will be seriously weakened if we don't. Today our hi-tech industries rely on tens of thousands of foreign STEM workers. Indeed, this year's quota of H1-B visas was snapped up in the first day they were available. This reliance has several problems. The first is that we take good STEM workers, make them better, and then ship them back to their countries to compete with us. The second is that as these countries use those workers to develop their own hi-tech industries, the pool of those workers willing to leave their homes for the U.S. will dry up. Finally, to the extent defense industries use these foreign workers, we will be spreading our defense technologies abroad.

The second challenge is to improve the diversity of STEM professionals. STEM is still predominately made up of white males. While the diversity of *FIRST* students is better than the STEM profession, it still is not equal to that of our nation. While considerably less expensive than fielding a football team, fielding a *FIRST* team does require the community to come up with supporting funds. Like the football coach, the teacher should be paid a stipend for working over time, the team needs space to build the robots, while our generous corporate sponsors provide many parts, the team still needs to buy some parts and tool, money is also needed for

transportation to competitions, etc. Thus, each school needs a minimum of \$10-to-\$15 thousand. While not an insurmountable sum for an affluent suburban school, it is for an underserved inner city or rural school. (See [Robotics changed my life: A troubled teen finds her calling in tech.](#))

Congress and the Administration determines an agency's goals. From the NSF mission quote above, it is clear that it could provide funds to field and sustain successful Program teams, rather than continuing to research a problem when there is already a solution. Indeed, NSF itself says:

NSF's job is to determine where the frontiers are, identify the leading U.S. pioneers in these fields and provide money and equipment to help them continue. (<http://nsf.gov/about/what.jsp>, accessed April 27, 2014.)

FIRST is a pioneer and to continue its mission in underserved schools, it should be NSF's job to fund teams from those schools.

US companies pay hundreds of millions of dollars in fees to the US government to obtain H-1B visas because we do not produce enough STEM workers. Doesn't it make sense to task NSF with the job of using that money to sustain working Programs in underdeveloped schools? This will go a long way to meeting the three challenges layout above: meeting the President's goal, ensuring a diverse workforce, and "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense."

Some suggest we should consolidate all STEM programs in the Department of Education. Whatever might be said of the agency there are at least two problems. First, DoE is a large bureaucracy. We simply do not have the time to engage a large bureaucracy in establishing a new program. For NSF, this is simply a matter of moving to the post-research stage: spreading and sustaining successful Programs. Second, DoE's focus has been in classroom curriculum. They have no proven expertise in after-school engagement programs, whereas NSF does. Moreover, we shouldn't take DoE's focus off of in-classroom education, as there is much to be accomplished there.

Conclusion

We believe that successful after-school mentor-based STEM engagement programs should be afforded the same status as competitive athletics. We also believe that it is reasonable to grant academic credit for students that fully participate in those programs. Finally, NSF should be mandated to provide funding to underserve schools to enable them to participate in Programs. Of all three, it is the third that will have the most impact.