Dear Mr. President,

Our panel of researchers shares your belief that STEM education is a high priority policy issue. Advances in science and technology accounted for more than half of our nation's per capita income growth in the 20th century (1), but the current demand for STEM-capable workers surpasses the supply of applicants who are trained in STEM fields (2), with our STEM education system lagging behind competitors like China and Singapore (3). Training future STEM innovators is vital to our nation's prosperity, and although programs like the "Educate to Innovate" initiative have taken steps toward this end, more needs to be done.

We are writing to you because our panel has found that government investments in STEM education are not being managed as efficiently as possible. Fortunately, doing more does not have to mean increasing the budget. Progress can be made by managing current investments more efficiently, and after a thorough analysis of the available research, our panel has two recommendations for policy actions to help achieve this goal. First, we recommend reorganizing the administrative structure responsible for overseeing federal STEM investments. Second, we recommend increasing the presence of STEM in primary education by redirecting funds toward a public after school program designed to help students discover their interest in STEM fields.

The OSTP's 2013 Federal STEM Education report listed 250 investments across the 13 agencies targeting STEM education initiatives. All of these investments were overlapping or duplicative to some degree (4), and the various agencies are potentially biased decision-makers with respect to reallocating funding amongst themselves. Our panel recommends conducting a study to organize all STEM investments into Strategic Funding Groups (SFGs) that will group the investments by objectives, products/services, target audience, and STEM field (as was done in the OSTP report). This reorganization would produce more effective investment allocations than the present administrative structure. If each SFG were given a total budget, from which each investment were allocated a percentage, there would be much more efficient channels for restructuring existing funds and for justifying new funds to particular subgroups. This SFG management structure would make it easy to avoid overlap and duplicity across investments, and more importantly, to close funding gaps in key investment areas.

The most pressing funding gap to be addressed is that of primary education, which receives an alarmingly low level of investment relative to secondary and post-secondary education (5), and this low level of funding means high marginal returns on new investments. We believe that increasing the presence of STEM in primary education is essential, because our research shows that the primary school years are critical in determining a person's interest in STEM fields (6). For example, one study has shown that not taking Algebra by 9^{th} grade prevents students from entering a STEM career (7), yet we face the distressing reality that 75% of American 8th graders are not proficient in math (8). To train future STEM innovators, we need to cultivate student interest from a young age, which is why we recommend starting a public after school program to get kids excited about STEM.

The ultimate goal of this program would be to bring STEM enrichment to every school district in America, but first it would need to be successful at a small number of flagship schools. We believe that the best places to start are low-income areas, where students would otherwise

have little or no extracurricular exposure to STEM. We want to target these areas because students cannot discover and strive toward their potential without opportunities for success, and the current system fails to provide such opportunities in economically disadvantaged communities (as discussed in the National Science Board's report) (9). The next step is getting kids to seize those opportunities, which is why the program would consist of intriguing experiments and engaging projects that span the entire STEM spectrum. Students will have a fun and interactive way to discover STEM, without the pressure of homework and exams. Funding would go toward supplying the materials for activities and staffing the program. The latter requires more attention, as the success of this program will depend upon the ability of its teachers. Interested teachers would be required to take a qualifying exam, and those who qualify would need to be trained in how to effectively communicate the material to students. Funds should also be allocated to research and analysis for reporting on the program's impact and on how to improve program implementation.

There is extensive research supporting the social and economic benefits of afterschool programs (10), and organizing our STEM education investments into Strategic Funding Groups would streamline the process of redistributing investments and initiating projects, making this program easier to fund than ever before. We believe that these proposed policy actions are the most efficient ways to move our nation toward filling its demand for a STEM-capable workforce, so that America may continue to prosper from the progress of STEM innovation. As students of Columbia University, our panel members are committed to improving the STEM education system in America. As individuals, we are ready to devote our time and energy to help move these policies forward and see their goals fulfilled.

With humble regards, and gratitude for your time,

The Columbia APPH E4901 Panel on STEM Education Research

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Appendix

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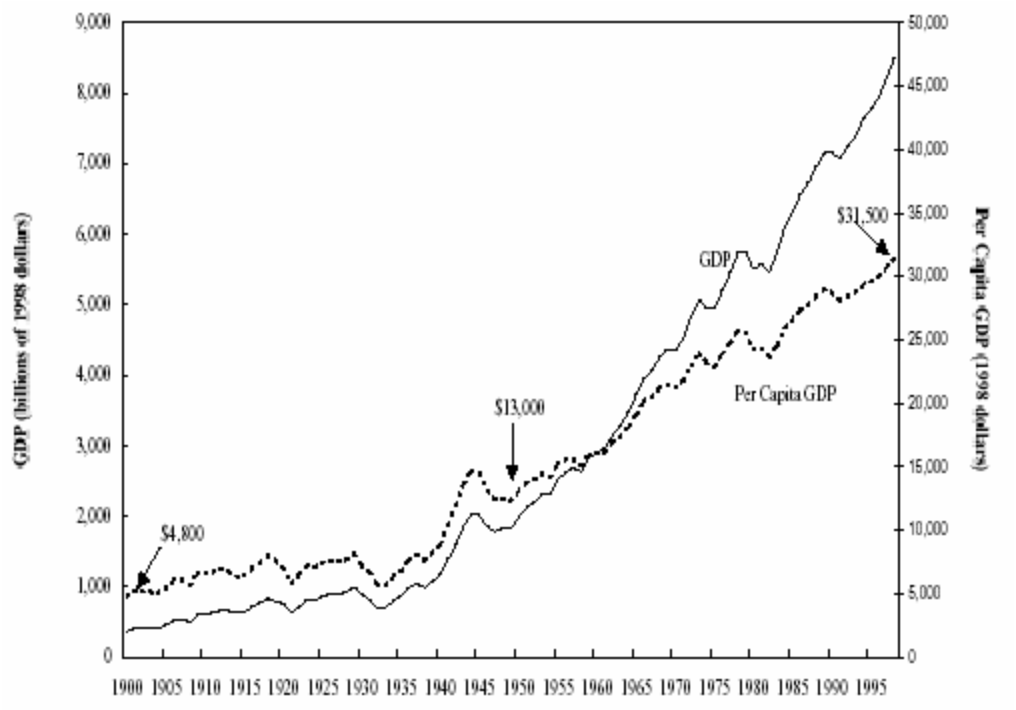

Figure 1: Gross domestic product during the 20th century. In the 20th century, US per capita gross domestic product (GDP) rose almost 7-fold (Source: Rising Above the Gathering Storm)