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The Importance of a Broad STEM Education

In today's world of rapidly advancing technologies and an ever-growing need for skilled professionals, the United States continues to falter in producing a sufficient quantity of scientists, engineers, doctors, and analysts to reinforce American ingenuity and compete among other first-world nations in technological innovation. Through the traditional American educational legacy developed around the concept of inculcating creativity, oral communication, and critical thinking abilities, coupled with the acquisition of relevant technical skills, America has been recognized in the past for generating some of the most intellectual and innovative thinkers and professionals in the world. However, in recent years, American high school students have scored poorly in the math and science sections on standardized exams compared with their international counterparts, while an inadequate number of college students graduate with degrees in science, technology, engineering, and mathematics (STEM) to keep up with a rising demand for jobs in these fields. Thus, it is essential for high schools and universities around the country to adopt a broad STEM education with a modest incorporation of liberal arts. By implementing a broad STEM education in public schools and universities, student aptitudes toward STEM careers will improve to meet industry demand, standardized proficiency rates in mathematics and science will increase, the economy will experience unparalleled growth, and American corporations will not need to rely on importing foreign STEM professionals to compensate for excessive unfilled positions. As a result, high school and college graduates will not only harness the necessary technical knowledge

to pursue highly specialized STEM careers, but also comprehend how to articulate their ideas effectively through oral, written, and analytical means.

Interestingly, there are several benefits of obtaining a broad STEM education. According to the Occupational Outlook Quarterly, a journal for the U.S. Bureau of Labor Statistics, "Data from the U.S. Bureau of Labor Statistics support that assertion. Employment in occupations related to STEM–science, technology, engineering, and mathematics–is projected to grow to more than 9 million between 2012 and 2022…And many STEM occupations are projected to grow faster than the average for all occupations" (pg. 3-7). The U.S. Bureau of Labor Statistics provided an exhausted list of occupations projected to experience the fastest employment growth rates, including operations research analysts, petroleum engineers, actuaries, and civil engineers, most of which only require a bachelor's degree. For college students studying to earn a degree in a STEM-related field, a consistent demand in the STEM industries means a high probability of practicing a specialized profession directly after graduation. This fact will prove to be especially useful for high school juniors and seniors confused about which major to study, because STEM fields are known to offer the most unwavering opportunities of having a stable and high-paying career in comparison with careers in the humanities.

In fact, there are several STEM opportunities for students to pursue immediately after graduating from high school, after having gained experience in a vocational program or receiving an associate's degree, such as IT computer user support specialists or environmental science and healthcare technicians. According to Rosaria Broesler, a graduate student at Empire State College, in her study titled "An Examination of CTE Funding and the Lack of a Future Middle Skills Labor Force," she states, "According to a 2001 Russell Sage Foundation Study, CTE graduates are 10-15% more likely to be in the labor force and earn 8-9% more than graduates of

academic programs. Also, seven years after graduating from high school, CTE students had earnings that increased by about 2% for each additional high school CTE course they took" (pg. 21). By attending vocational high schools, which specialize in career and technical education (CTE), becoming an engineering apprentice or a Certified Nursing Assistant, for example, are actually quite attainable immediately after graduation, as CTE students have the ability to demonstrate their skill attainment in an electronic portfolio to employers. On some occasions, employers are more likely to hire CTE students from vocational institutions who have four or more years of experience in training for particular occupations than some college students even after one year of introductory experience who did not attend CTE high schools. Truly, wide-ranging, high-paying, and high-demand opportunities for CTE students, high school, and college graduates alike in the STEM fields represent some of the most important factors as to why students should receive a broad STEM-based education.

Subsequently, because so many opportunities in STEM exist, a broad STEM education will encourage more future American scientists and engineers to occupy those open positions. In recent years, several American companies have resorted to insourcing foreign professionals with advanced degrees from U.S. universities to offset the shortage in skilled American scientists and engineers. According to Miriam Jordan, journalist for the Wall Street Journal, "US businesses clamor for the [skilled-worker] visas, which typically go to the foreign scientists, engineers, and programmers. They also go to workers in advertising, architecture and other fields" (para 4). By importing foreign workers, companies typically pay them far less than qualified U.S. workers, and upon acquiring experience and professional skills, are shipped back overseas, which Jordan remarks as "a practice that essentially promotes outsourcing of American jobs" (para 7). Thus, it is imperative to promote the development of future scientists and engineers to retain American

jobs in this country. By consistently encouraging students to explore the wide selection of STEM careers and the outstanding benefits associated with performing cutting-edge scientific research and constructing the future of American infrastructure, all of which should be reinforced in math and science courses, students will remain interested to persist in STEM programs, both in high school and college. Finally, creating more STEM professionals will cause unemployment rates to decline because open positions at companies will be occupied adequately to satisfy demand.

In order to bridge the educational domain between high school and college, which allows students to truly prepare for future careers in STEM, instituting a broad STEM-based education, particularly in high school, will improve standardized test scores in math and science. Higher test scores mean more domestic students can be admitted into selective university STEM programs. While a strong sentiment currently prevails in academia, especially among educators who vie against America's overwhelming use of test scores in gauging a student's intellectual aptitudes, standardized test scores continue to poorly distinguish the United States among other first-world countries in mathematics and science. At the same time, the majority of American colleges and universities, ranging from small liberal arts colleges to the prestigious Ivy League institutions, place a strong emphasis on test scores as an indicator of an applicant's potential success in a particular major program. According to Drew Desilver, senior writer for the Pew Research Center, "the most recent PISA [Program for International Student Assessment] results, from 2012, placed the U.S. an unimpressive 35th out of 64 countries in math and 27th in science" (para 4). By extensively adopting a broad STEM education in high schools, starting from freshman year, students can progressively prepare for the SAT/ACT each year of high school through one of the following methods: liberal arts students must enroll in at least one math or science class every year, while STEM students must enroll in at least two math and two science classes,

preferably Honors or Advanced Placement courses. Each option should include a designated standardized test practice unit in each class, which will allow students to familiarize themselves with different types of exam questions. Consequently, high schools can expect to observe a greater success rate in math and science sections on the SAT/ACT while also receiving federal grants to benefit the entire school, which could be dedicated towards supplemental after-school STEM tutoring programs, for example.

Conversely, while reinforcing and developing STEM courses are both equally important, American high schools and universities should also realize the critical role liberal arts courses play in a STEM student's future success, and vice-versa for liberal arts students. According to Matthew Sigelman, the CEO of Burning Glass Technologies, a leading labor market analytics company, "Across the full spectrum of jobs, what employers seem to call for, above all else, are foundational skills like writing, research, analysis, critical thinking and creativity." (pg. 1). In his article for Inside Higher Ed, Sigelman postulates the importance of having "bankable skills in the workplace" (pg. 2), such as Microsoft Excel. He emphasizes how courses should be "packaged" around certain skill sets, granting students more freedom to explore different fields at the same time to determine where they fit. For instance, he suggests, "Want to go into human resources? The sociology department's organizational theory course, plus the political science department's survey research course, plus the history department's industrial relations course, [as well as] the economics department's introductory stats course would be compelling cluster" (pg. 3). As can be noted, two STEM-related courses in the sample student's potential schedule include survey research and statistics, which will allow the aspiring human resources student to balance a broad STEM education along with humanities courses: organizational theory and industrial relations. The same concept can be applied to STEM students. Indeed, an engineering student who takes

calculus and physics should also take a technical writing and communications course, because to be a successful engineer, it is vital to know how to write compelling proposals for projects and deliver an effective presentation to clientele. Both engineering reports and presentations also require extensive knowledge of calculus and physics in order to provide accurate and succinct scientific analyses. Altogether, having a broad STEM education here is not only indispensable to acquiring the technical specialization required to become a professional, but also includes a mix of liberal arts courses to allow the student to cultivate relevant "foundational" skills.

In conclusion, the demand for STEM professionals in America has never been greater than today, because every American scientist and engineer participates in the global competition for innovation. Therefore, educational institutions should implement a broad STEM education for all students in order to effectively train the future skilled workforce for careers both inside and outside STEM. In doing so, high school and university students will benefit significantly because filling in empty positions at companies, improved test scores, or teaching relevant soft-skills are not the only objectives of a broad STEM education. STEM professionals are also more capable of paying off student debt faster due to high salaries, which simultaneously tackles the chronic issue of exorbitant tuition of higher education. At the same time, having a broad STEM education will encourage more research assistants in labs to discover cures to epidemics, a heightened concern for public policy issues affecting advancement of minorities and women in science, and more engineering interns to discover crucial solutions to drought in the Southwest. Last, but not least, if high schools and universities do not promote the growth of future STEM professionals, the United States not only risks tumbling in international test scores, but most importantly, being surpassed by other advanced nations seeking to be leaders in innovation and insourcing low-wage workers to acquire skills and displace qualified American workers.

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