

[President Obama recently sent a hand-written note of apology to University of Texas Senior Lecturer in Art History Ann Collins Johns, resolving a flap that began a few weeks previously when, during an event at a GE gas engine plant in Wisconsin, the President emphasized that Americans would be better off if more of them could work in the manufacturing industry. "Manufacturing jobs typically pay well," he said. And while some young people might not think of the skilled trades as a lucrative career, Obama added, they can probably earn more "than they might [with] an art history degree." CNN asked me to provide a 650-word written commentary, on 6 hours' notice. I submitted what appears below. They rejected it.]

Each and Every Student Should Study Computer Science

Ed Lazowska

Let's cut the President some slack! He was merely emphasizing that manufacturing is on the rise in America, and that modern manufacturing jobs are *good* jobs and *accessible* jobs. We should thank our lucky stars to have a President who can speak *ex tempore* without making us cringe, rather than getting our nighty in a knot when every phrase is not precisely the one that we – or he – might have chosen given the luxury of reflection.

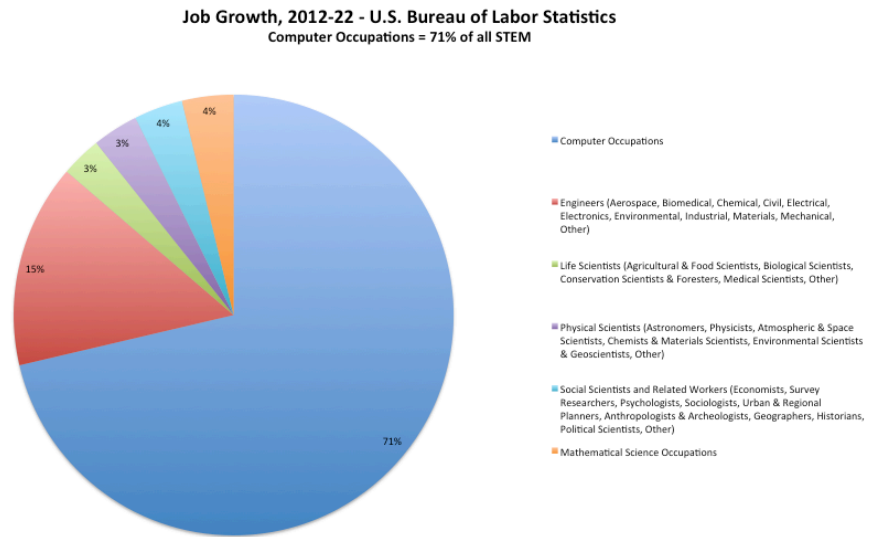
Let's also stipulate a few things:

- Four-year colleges are not about vocational training – they're about establishing the foundation for a successful and fulfilling life in a rapidly changing global society.
- Four-year colleges are also about discovering your intellectual passions. (I churned through three other majors before winding up in computer science.)
- The more years that elapse from receipt of your bachelor's degree, the less your success depends on what you majored in. What matters far more are the capabilities you've developed in areas such as analysis, critical thinking, persuasion, conflict resolution – capabilities that "job-ready" majors certainly have no monopoly in imparting.

With all of that said, *each and every student should study computer science*. Before you give me the Obama treatment, note that I said "study," not "major in"! Here's the argument:

1. Every 21st century citizen needs to have facility with "computational thinking" – abstraction, modeling, algorithmic thinking, algorithmic expression, problem decomposition, stepwise fault isolation (we call it "debugging"). Computational thinking is not "this particular operating system" or "that particular programming language." Computational thinking is not even programming. It's a mode of thought – a way of approaching the world. Programming is the hands-on, inquiry-based way that we teach computational thinking and the principles of computer science.
2. Fields from anthropology to zoology are becoming information fields. Those who can bend the power of the computer to their will – computational thinking but also computer science in greater depth – will be positioned for greater success than those who can't.

3. While fluency with computational thinking and with computer science are important to all fields, the job prospects in the field of computer science itself are *extraordinary*, and these jobs are creative, interactive, change-the-world jobs. The U.S. Bureau of Labor Statistics recently released its job projections for the decade 2012-2022. Computer occupations will be responsible for 71% of *all* the job growth in *all* fields of STEM (Science, Technology, Engineering, and Mathematics) – the many dozens of fields that comprise the life sciences, the physical sciences, the social sciences, engineering, and the mathematical sciences – and for 57% of all available jobs, whether newly-created or available due to replacement. “STEM worker shortage?” Fuggedaboutit! “It’s all computer science, all the time.”



So, how are we doing at preparing America’s kids?

High school provides the foundation. The famous 1983 report “*A Nation At Risk*” recommended that high school graduation requirements include one-half year of computer science. That’s not a lot, but in 1983, “personal computing” was an IBM PC XT with a 4.77 MHz 8088 processor and 128 kilobytes of memory, running PC DOS 2.0. In the 2012 National Academies study “*A Framework for K-12 Science Education*” – three decades later – the phrase “computer science” appears on 6 of 367 pages, 4 of which are lame excuses for why the field was omitted. In 9 of 10 American high schools, computer science is not offered. In only 17 of the 50 states does computer science, if offered, count towards math or science graduation requirements. This is progress?

What can you do?

- During December’s weeklong “Hour of Code” effort, more than 25 million students from across the nation and around the world spent at least one hour learning the basics of programming. It’s not too late! Wonderful materials are online at <http://code.org/>.
- Insist that your school, school district, and state offer a serious computer science course, and make it count towards the math or science graduation requirement.

It’s 2014! Time to wake up and smell the future!

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