The Future of Jobs

Walking past the students queuing for job interviews at the Carnegie Mellon Computer Science career fair, I saw some of my students.

Steve Young, one of the hundreds standing in line, told me: *"I graduated with a degree in Artificial Intelligence and there is a critical shortage of people with this skill. I am sure that I will have several job offers."* I nodded in agreement knowing that he prepared for his future career correctly. Artificial Intelligence (AI) is now being used in many products. From self-driving cars to manufacturing robots, from machines that can distinguish cancer cells from regular cells to smart thermostats and smart speakers used in smart homes. The expanding applications for AI have also created a shortage of workers in every industry. Although schools across the US are adding AI courses, there are still not enough AI graduates. According to a US government report, the country will need about 2.3 million AI workers in the next decade.

"The dearth of people with AI skills has impacted the growth of the entire U.S. industry," a senior manager told me. "We had difficulties hiring AI workers for the past three years, but it is much harder now as more companies are competing for these talents." The reason is AI will change the entire global economy in the same way that steam engines, electricity or the Internet did in past industrial revolutions. Many leaders talk about "Industry 4.0" without knowing that AI is the engine that drives everything and impacts the entire world's economy. But the speed of change will depend on the availability of AI workers and currently there are only a few of them.

According to the World Economic Forum Jobs Report, most companies will begin to reduce the number of their workers and replace them with robots and automation software during the next five years. The chief economist for the Bank of England predicted that as many as 80 million jobs might be automated within the next five years, especially in Asia, Africa, and South America where half of the existing jobs will be fully automated.

There are different opinions about automation. Some people believe that robots will destroy more jobs than the number of new jobs they create. Of course, nobody knows exactly how many jobs will be gone, but I believe that automation will happen in several steps. Labor jobs will be automated first, then office jobs, and then others that can be automated. This will happen, whether you like it or not. What is important is to be prepared and, if possible, change jobs to something with a better future. *"I see the technology tsunami coming, but people on the beach are still partying without knowing that their lives are in danger,"* an economist writes. *"The fourth industrial revolution will lead to massive unemployment and chaos."*

According to the Global Economic report, there will be over seven million high-tech vacancies, but not enough skilled workers to fill them. All companies are looking for skilled workers and competition

among countries is fierce. This is a good opportunity for many students, but the questions are: How many students know about this and how many of them have the skills to meet this demand? While many high school graduates are planning to go to college, how many of them are receiving proper career advice to guide them to learning and developing the needed skills? How many of them will finish college with the proper skills?

I think it is urgent for schools to focus on high-tech skills training to prepare students for these high demand jobs. What should we do to have a majority of students coming out of high school have some of the proper skills right away, whether they go to college or not? Before graduating from high school, all students should know at least one programming language such as Java or Python and know how to apply technology to their work. They should possess some soft skills, such as collaboration, communication, and teamwork as well as work ethics, so they can function well in all future jobs, regardless of where they work. For many years, I have advocated for more Science, Technology, Engineering, and Maths (STEM) courses, and for using more technology in senior high schools and colleges, as these are simply what the future of work actually is.

AI technology is changing so fast that most universities cannot keep up with. Carnegie Mellon was the first university to offer degrees in Artificial Intelligence. The reason is that the founding fathers of Artificial Intelligence, the Professors Allen Newell and Herbert Simon, are from CMU. Together with the Professors John McCarthy and Marvin Minsky from Dartmouth College, they wrote the first paper on Artificial Intelligence in 1955. Since then, many AI inventions have come from the CMU School of Computer Science, including the first self-driving cars, the Mars Rovers, industrial robots, and machine learning tools. Due to the high demand, many students get job offers several months before graduation with high salaries.

To prepare for the future, we need to start right now by answering the following questions: How many children meet grade-level standards in Maths and Sciences? How many high school students know at least one programming language? How many students are going to college with a written career plan, knowing what they want to do and what skills they need to learn in class? Only if we can measure these simple data will we be able to break it down to a level that is actionable, after which we can make improvements for our students.

The fourth industrial revolution is here and more things will happen soon. To change or not is our choice at this time. Do we continue to debate and to waste more time in meetings to find the best solutions or do we take action by re-training our teachers in technology so they can educate their students quickly and prepare them for the challenges ahead? The future is in our hands.

(Media Center)