Accelerating Technologies: Consequences for the Future Wellbeing of Students

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ABSTRACT

Today's students, K-12 and beyond, will face an ominous future unless educators quickly invest in preparing student perspectives for the accelerating technologies that will have global implications for the wellbeing of all humanity. Accelerating technologies are quietly, almost insidiously, transforming the world with little fanfare and certainly no "shock and awe" so fantasized in cinema. The pace of evolving technologies may prove too daunting for human acclimation to those advances. Knowing that the technological tsunami is coming is for young people a crucial consideration in how they choose to map out their futures.

Keywords: future student wellbeing, accelerating technologies, robotic systems

INTRODUCTION

There is a gathering storm of accelerating technologies that across the next fifteen years will cumulate in a perfect "techstorm." Wendell Wallach in his book *Dangerous Master: How to Keep Technology from Slipping Beyond Our Control* (2015) declares "The cumulative impact of new technologies expected to be available over the next few decades is difficult to imagine and likely to be unsettling. I refer to the incessant outpouring of groundbreaking discoveries and tools as a techstorm (p. 8).

This pace of evolving technologies may prove too daunting for human acclimation to those advances. What is at stake? Young people in Kindergarten today will have progressed in 15 years to a society that with great certainty will be so automated and dominated by robotic systems that any roles for humans swill be severely limited. Employment for unskilled persons will virtually disappear being replaced by automated robotic systems. Martin Ford in his book *Rise of the Robots: Technology and the Threat of a Jobless Future* said "the ongoing race between technology and education may well be approaching the endgame: the machines are even coming for higher-skill jobs as well" (p. 121).

Bryan Alexander stated the present "education system is not well positioned to transform itself to help graduates who can race against the machines. Not in time, and not at scale" (p. 12). The education assembly line must change and that change must be more than just automating the assembly line with digital technology to bolster an aging curriculum. The most crucial learning experiences for young people in school today and in the years to come will be learning experiences that focus on the ways and means to participate and collaborate in the evolving wave of accelerating technology. What is at stake is that young people in the coming years recognize that their economic wellbeing will depend on how well they interplay their lives with robotic systems.

TECHSTORM STATUS

Robotic systems are all around us, most require human monitoring and guidance, some are autonomous acting on their own, and some are learning as they go along. In the near future humanity will find artificial intelligence (AI) systems have been seamlessly threaded throughout the global social fabric. University of Paris economist Elizabeth Albrycht said, "By 2025 we may be witnessing the disappearance of AI and robotics into the ordinary landscape as they follow the usual path of technology. First we see it then it becomes invisible as it integrates into the landscape itself (p. 22). Yet some robotic systems will be all too obvious in the form of autonomous automobiles, a.k.a. self-driving cars. "And we're not talking centuries from now; the expert consensus is that 75 percent of the vehicles on the road will be self-driving in twenty to twenty-five years" (Kaplan 2015, p.195).

MOORE'S EYE OF THE TECHSTORM

The driving force for accelerating technologies is Moore's Law an observation made in 1965 by Gordon E. Moore of Intel Corporation. Moore projected that the number of transistors in an integrated chip (IC) would double approximately every 18-months.

The integrated chip is the heart and soul of digital devices ranging from smart phones and personal computers (tablets, laptops, etc.) to automated systems, robots and supercomputers. Computing capacity is doubling at an exponential rate and is predicted to do so over the next twenty years. In the early 1970s an IC had approximately 8000 transistors, today an IC has over 7 billion transistors, (Transistor Count) and just recently announced (April 2015) IBM now has reached 20 billion transistors on a thumbnail-size IC (TechRepublic).

Some fifty years (2015) and counting, "Moore's Law has essentially held up ever since -- and, despite the skeptics, keeps chugging along, making it probably the most remarkable example ever of sustained exponential growth of a technology" (Friedman 2015). It appears Albert A Bartlett was quite right when he said, "The greatest shortcoming of the human race is our inability to understand the exponential function." Given that caveat humanity continues to be oblivious to the immense social and economic consequences of technology driven by Moore's Law.

ARTIFICIAL INTELLIGENCE (AI)

For many years going back to the first computers in the 1940s and 1950s there was speculation that digital machines may one day acquire intelligence rivaling that of humans – artificial intelligence (AI). Modern day machines are growing more and more intelligent primarily due to the exponential growth in software programming in the form of learning algorithms. Computers use learning algorithms that allow them to build upon their prior solutions and discoveries. Such computers can even mimic curiosity and creativity (Ford 2015, 107-108).

In his book *Superintelligence: Paths, Dangers, and Strategies*, Oxford Profession, Nick Bostrom clarified the contemporary views of AI now and AI in the future. There are many automated and robotic systems running today with various levels of intelligence related to processing information. The expectation of a "human-level machine intelligence (HLMI) defined as one that can carry out most human professions at least as well as a typical human being" is a certainty between now and 2050. Whenever HLMI does happen Bostrom proposes that "superhuman intelligences or machine intellects that greatly outperform the best human minds across many very general cognitive domains" would not be far behind (52).

James Barrat's *Our Final Invention: Artificial Intelligence and The End of the Human Era* (2015) spares no words with "I've written this book to warn you that artificial intelligence could drive mankind into extinction, and explain how that catastrophic outcome is not just possible, but likely if we do not begin preparing very carefully now (p. 16). Wendell Wallach calls for a deliberate slowing down of technological advances if not actually calling a moratorium on selected realms of research. Perhaps it is simply too late as far as Marshall Brain is concerned. In his 2014 book *The Second Intelligent Species: How Humans Will Become as Irrelevant as Cockroaches*, the title succinctly declares the fate of humanity in the coming onslaught of artificial intelligence.

SURVIVING THE TECHSTORM

The first step in preparing students for the future is to make them aware of the crucial role technology plays in our daily lives and increasingly so into the future. There are technology curriculum models that address this use in place but rarely implemented. Curriculum guides developed by professional technology organizations do address the issue of advancing technology. For example, the International Technology Education Association (ITEA) K-12 Standards for Technological Literacy (2007) states, "Besides understanding how particular technologies are developed and used, students should be able to evaluate their effects on other technologies, on the environment, and on society itself. The benefits of a technology are usually obvious but the disadvantages and dangers are often hidden" (p. 4). ITEA further elaborates, "A technologically literate person understands, in increasingly sophisticated ways that evolve over time, what technology is, how it is created, and how it shapes society, and in turn is shaped by society" (p. 9). Certainly these "standards" are grounds for student discussions about accelerating technologies.

In their 2014 book *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies* Erik Brynjolfesson and Andrew McAfee believe "the most fundamental recommendation to students and their parents: study hard, using technology and all other available resources to fill 'up your toolkit' and acquire skills and abilities that will be needed in the second machine age" (p. 199). There is one movement that addresses this recommendation, the Maker Initiative (Halverson and Sheridan 2014). The notion that students learn more effectively by physically engaging in their learning experiences has been a long held principle in educational pedagogy and is the core of the Maker Initiative.

Maker students are immersed in a world of high-tech digital devices ranging from tablets with 3D design software to 3D printers and 3D scanners to microprocessor workstations and robotic workshops. The Maker Initiative encourages and shows students how to actively inquire, analyze, and critically shape projects with hands-on activities.

Maker students learn to design, program and control fully functional robotic models. They use software to plan, test and modify sequences of instructions for a variety of life-like robotic behaviors. And they learn to collect and analyze data from sensors, using data logging functionalities embedded in the software. An integral component of high-tech Making is coding and programming beginning with Kindergarten kids.

The Maker Initiative can load Brynjolfsson and McAfee's "tool kit" with hands-on experiences using high-tech digital devices and the programming skills to manage those devices. The universal design of making provides opportunities for students of varying abilities and talents to express themselves in a vast and diverse manner instilling personal confidence and inspiration. The high-tech maker projects invite collaboration, group discussions, enhancing language, reading, writing skills, and especially STEM and even more so STEAM finally giving credit to the artistic (A) sense inherent in the creations of science, technology, engineering, and mathematics skills all within a high-tech social environment.

CONCLUSION

The future for young students today is a digital future that today's adults marvel at as so much magic. Students involved in the Maker Initiative as adults will be confortable and productive working along side with robotic systems. Kevin Kelly in a 2012 Wired Magazine essay offered the advice "You'll be paid in the future based on how well you work with robots." In this respect Maker Initiative students should make very good salaries and survive the coming techstorm.

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