**Education Fails to React to Changes in Work**

[Deck text: As technology reduces knowledge work, education should prepare people for a new kind of design work]

The computing revolution is progressing at an amazing speed.  Smart phones reach the computing power of supercomputers twenty years ago, packing individualized apps to serve our personal needs and connect us every hour of the day.  Driverless cars are already on the roads.  The new business models like Uber and Airbnb challenge old ones.  Computers monitor health and diagnose illnesses.  Many jobs we remember as kids are long gone.

The force behind all these amazing things is our ability to turn everything into bits and manipulate them in ingenious ways. First, computer simulation became a cornerstone of science, opening up new frontiers in science and technology, and rapidly increasing our business productivity.  Then the personal computer made almost everyone a potential computer user.

The dawn of the Internet and World Wide Web made global communication ordinary.  Communication became one of the most important uses of computers.  The Internet grew to billions of computers.  High-speed connection to the Internet became essential societal infrastructure, enabling a proliferation of new web-based services.

Breakthroughs in artificial intelligence have brought to us easy access to things like automatic image recognition, language translation, and diagnostics.  With the use of machine learning the machines can perform carefully limited tasks faster, tirelessly, and often better than humans.

This revolution is comparable to the industrial revolution.  Two hundred years ago mechanical machines automated vast amounts of manual work such as textile manufacturing and farming.  The revolution shook the foundations of our societies and caused considerable social unrest.

The twentieth century saw a growing assortment of new jobs that relied on brain power, which came to be called knowledge work.  It was widely believed that knowledge work required that sort of intuition that machines do not have.  The university came to be seen as the training ground for knowledge workers, and the college degree became a ticket for entry into a knowledge work career.

Today, the machine-learning revolution is upending this assumption. Every job that can be learned by analyzing a hundred thousand records of finished tasks is a candidate for automation. Outsourcing and crowdsourcing are telltale signs of upcoming automation of a task.

Although many knowledge jobs are disappearing, another kind of work is becoming increasingly important. Let us call it design work. The field of computing requires fewer coding skills and increasingly skills and understanding of human communities, language, mentoring, innovating, cultures, values, worth, and social consequences. In Silicon Valley it is designers who are the creators of new services and automators of knowledge work.

Our education system is challenged by the changes above. Instead of adapting to the new turn of knowledge work, we are getting more obsessed with technologies for imparting knowledge—despite the fact that automation of knowledge work is already changing the roles of humans and machines in work.

Although the amount of design work is in rapid increase and it is opening up a new horizon of jobs and careers, we have very little in our education to help prepare students to be designers.

When preparing for the automation of knowledge work, it is important to understand information and be skilled in information processing itself. We must teach skills for describing and analyzing problems so that their solutions can be expressed as computational steps carried out by a machine.

It is also essential for design workers to develop a feel for human communities, understanding of the rich textures of our social world, and sensitivity to human habits and behavior. These skills help one to understand the needs of people and societies, and they help to avoid the belief that technology can solve any problem.

Continuing education that relies on people's existing competences can help people displaced by technology to reinvent their professional identities. The surprises and contingencies of business world require constantly changing combinations of new and old skills and knowledge.

Successful education for design work combines technological, human, and societal skills. We should not teach how to compete with robots. We should prepare people to use automation to solve existing problems, and to design new work that robots cannot yet do.

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[*Need a very short description of authors here. The editor suggested: "the authors are researchers focusing on the societal changes of digitalization and computers" which is not at all who we are. We can also suggest just our names and affiliations if we wish.*]