Chapter 29

Coding as an Essential Skill in the Twenty-First Century

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The pace of technological innovation has been felt across all industries, and digital literacy is becoming a key central skill that is important to include in the education system to give employment seekers their best chance at securing the jobs of the future. The way in which the education system itself has been affected by technology is also equally important to consider ensuring that the education system makes the best use of technology to maximize learning opportunities.

The use of cutting-edge technology has also been adopted in areas such as qualification storage and smart contracts by utilizing blockchain and distributed ledger applications. Alternative student payment mechanisms have also been explored, allowing access to learning resources for a new segment of the population that has no access to traditional banking facilities.

Education Today

The two major areas of education—school and college/university—have seen a significant change over the past decade. Both have experienced a more general shift toward vocational skills, and a large amount of funding has been redirected toward ensuring that the content taught leads more directly to current jobs and general employment opportunities.

There has also been a shift toward self-directed learning and the “flipped classroom” where the bulk of the theoretical content is learned at home or by oneself and

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the other, more engaged learning is conducted in a face-to-face classroom environment. This has also introduced the complexity of self-paced learning, which aims to tailor the pace and content of the curriculum to an individual's ability.

These movements are still very new, and, although extensively adopted, it is far too early to gauge their subsequent success or failure.

Issues and Challenges

Online Learning

The introduction of online learning content has taken longer to adopt than initially projected. And, there are still relatively few exceptional examples of online content delivery replacing face-to-face delivery; but certainly, access to learning resources has dramatically increased. The amount of online learning content available in traditional forms and media such as video has given rise to a new breed of learning content curators who make content available for microskills ranging up to full 3–4-year courses.

Massive open online courses (MOOCs) were initially rejected by traditional universities as a poor choice of learning platform in comparison to what a university experience could offer, but this trend has also changed, with major universities now working in conjunction with MOOCs and exploring ways to blend the offerings made to potential students. Free courses have had notoriously low completion rates and no direct link to accreditation. This is being tackled in a wide variety of ways by global providers and will continue to be a challenge over the next decades as technology offers more and more possible solutions to improving the remote student experience.

Online content has also never been so easy to produce. There is a wide range of content platforms that make it easier and easier for educators to produce quality content and broadcast that content to a wider audience. This is overcoming many traditional challenges of servicing regional/remote areas, but it brings us to a basic stumbling block that in the developing countries has not been adequately addressed: information technology (IT) infrastructure. Moreover, access to fast/reliable/cost-effective Wi-Fi is still a major blockage to relying on new technology products. Without this essential ingredient, we are still missing out on a huge proportion of potential students and the way in which they are able to experience online learning.

The Tech Industry Today

A major misconception that people have about youth and technology is that the young are naturally good at technology. Extensive research has indicated that the upcoming generations are very good at consuming technology but still proportionately lacking (as in previous generations) in creating technology.

The huge array of tech products/applications available today is increasing the chances that you will remain a consumer rather than a developer. The other worrying trend is that the development of technology is so heavily skewed toward Western countries and dominated by white middle-class males. This has a lot to do with access but is also heavily influenced by our perception of creating tech products. Whether it is hardware or software there is a perception that it is only for the mathematically gifted and is a very difficult discipline to learn.

An approach being adopted to combat this perception is to encourage learners to create products and applications quickly using simplified coding templates and focus on the rapid deployment of a product rather than the theory required to build it. This builds confidence in the creator and allows for rapid feedback from users of the product/system, which can then be adopted in another prototype in quick succession. This “agile” methodology promotes a more democratic approach to development and enables concepts to be demonstrated without becoming tied down to long and narrow production environments.

It is also interesting to note that, although it is widely thought that technology is moving at a rapid pace, the reality is that it could move a lot faster. One of the major bottlenecks is the IT labor shortage, which is a well-documented and clearly global phenomenon. It has been acute in high-tech regions such as Silicon Valley in the United States for a long time, but now that technology is an integral part of the economic success of most industries, it has taken on a broader role across all industries.

Asia cannot keep up with demand, and the United States simply cannot graduate enough students to meet even the existing number of employment positions available. This does not even consider the new jobs that are emerging that we have not even planned adequately for in terms of technology skills requirements. To further exacerbate the problem, current university/college graduates often do not have the skills (both soft and technical) that employers are looking for. This means that emerging technology industries are moving slowly and not taking advantage of the global economic opportunities that are available to remain competitive. This is a basic supply–demand problem that has precipitated some innovation in the education arena in regard to technology.

Proposed Solutions

In 2011, the first coding boot camps began appearing to try and supply employers with additional technology workers. The model has been hugely successful, and now there are over 100 boot camp companies operating across the United States. They have spread globally and are becoming a very real alternative to university IT qualifications. The main difference is that they are very condensed (typically 4–6 months) and focus on problem-solving using the most modern software frameworks available. This means that students learn to rapidly prototype in the technologies that employers are using today, including multinational tech giants and small start-ups.

Coding boot camps are usually focused on 1 or 2 front end and back end languages and are aimed at deploying applications and making their graduates ready to immediately add value to a workplace environment. Obviously, there is less concentration on theory, which the universities still excel at, given that they have 3–4 years with the students as opposed to 4–6 months; but coding is largely a trial-and-error exercise wherein the bulk of the learning is absorbed on the job. There is also an argument that coding has many levels of employees: basic quality checkers and testers and also scientific architects/engineers. The level of proficiency in most non-tech companies is skewed toward the basic coders, for whom 3–4 years at university may not be the best pathway for success.

These boot camps also open the doors to the opportunity of a distributed global workforce wherein tech teams can be geographically spread, giving employers wider access to IT talent and creating great opportunities for coders in developing countries. Online learning of coding skills is also growing rapidly, as technology makes it easier to digest the learning in smaller chunks and allows for online tutors/peer reviews and open-sourced problem-solving.

Women in Tech

The gender imbalance has been widely documented across the globe. It remains a major challenge to the tech industry as we experience a very one-sided development flavor and we also miss out on a huge number of potential employees to meet some of the demands that the tech industry is experiencing. There are a number of initiatives attempting to reduce this imbalance, including the use of scholarships, better marketing, corporate partnerships, etc.

One of the major movements that will require a long period of monitoring is introducing girls to tech before their perceptions are molded and stereotypes are embedded. By introducing young women at the age of 12–14 to a range of tech initiatives, we are able to form stronger bonds between women and technology and open the doors to career paths that were previously seen as the domain of the male tech stereotype.

School Curriculum Changes/Corporate Partnerships

The introduction to technology skills is being made earlier and earlier at the school level. This focus on problem-solving and using logic and basic algebra to architect solutions is proving to be instrumental in allowing young students to understand the possibilities of technology and science, technology, engineering, and mathematics (STEM)-related education.

The concept of coding/software development is being introduced in more creative ways and linked to existing subjects as a logic component rather than a completely

separate discipline. Examples also include game playing and game creation and the building on tactile applications that do not require a computer interface. This approach is also important in order to decrease the isolation of students who do not naturally gravitate toward science and mathematics and provides a pathway for young learners to build confidence in building quickly and making mistakes often without negative ramifications. This also allows for the early introduction of emerging technologies such as virtual reality/augmented reality (VR/AR), and students may use these tools in their learning and also use them to understand broader applications in industry.

The prevalence of technology in day-to-day devices including smartphones, household appliances, security sensors, lighting, etc., enables students to quickly recognize how these devices communicate and become a necessary part of working/social life. The bottleneck in this progress is the teachers themselves. Many of our existing school teachers are not comfortable with technology and coding and are unable to teach the students these skills. We need a huge movement in the professional development of teachers to take advantage of the technology appetite that our young students are experiencing.

Technology in Education

Advances in the technology itself are helping to distribute technology skills more effectively. The use of mobile phones as a teaching aid is being adopted extensively in regions like Africa, where it is difficult to access laptops but mobile adoption is high. Improvements in bandwidth and Internet speed are also assisting with broadcast tutorials, and VR/AR is making technical visualizations more readily available at much more economical rates.

Sophisticated coding suite tools that require a limited understanding of software development are also starting to gain traction, and artificial intelligence is improving to correct errors and make rapid prototyping more mainstream and available to a wider audience of users. All of these developments equate to a more expansive adoption of fundamental coding skills with more emphasis on self-directed learning and less intervention from mentors/teachers. The teachers become “guides” rather than formal instructors in this scaled-up learning environment.

Examples of Good Practice

Australia, Canada, the United Kingdom, and the United States are embedding coding skills as part of their primary school curricula. There are also global coding movements to create awareness and introduction to basic skills (e.g., code.org). Other initiatives are women in technology scholarship programs and women-focused accelerators or innovation funds. Coding boot camps are also working with universities and corporates globally to change graduate employment rates. There are also free

learning resources via platforms such as EdX, Khan Academy, and Coursera. Many countries and the United Nations are moving toward making Internet access a basic human right, which will require policy shifts to adopt digital skills toolkits and prescribed digital skills benchmarks.

Implications for the Future: The Changing Job Market; New Roles/Industries

IT graduates no longer just end up in tech companies. The majority of IT graduates are now working in a broader range of industries including finance, government, retail, mining, health, etc. This changes the landscape of job opportunities but also puts more pressure on our supply of tech-savvy graduates. We are also creating a whole new array of jobs that were unpredicted and at the same time rapidly losing a huge number of jobs in “older, more mature” industries. Without proper planning, we will see a huge number of underemployed workers, particularly in developing countries, where robotics/artificial intelligence are replacing old job roles. This creates problems but also huge opportunities with perhaps a fairer distribution of talent/remuneration such that remote workers can earn higher salaries for the tasks they are performing.

Companies that are investing in technology training and basic digital literacy for their staff are seeing positive results and healthier work culture. It is also important that we recognize more mature workers that have not had exposure at school/college to technology training. These workers need to be nurtured and given the opportunity to combine their experience with the new advances in technology.

The United Nations has been a driver of change in the area of digital skills adoption and has developed a digital skills toolkit that outlines a strategy for several sectors of society including youth, the employed, and the elderly. By creating a strategy for digital skills adoption across an organization that encompasses all levels of digital literacy, it enables an organization-wide focus on the resources available and identifies gaps and mismatches in company aspirations and current skill sets. Regional hubs of shared resources for digital skills adoption are also proving to be effective in allowing for the recognition of common challenges and the pooling of solution methodologies. This includes databases of professional trainers, libraries of tools/applications, and innovation centers.

Conclusion

A number of interested parties are involved in ensuring the success of IT training and the adoption of digital literacy including employers, government, education providers, and a range of global agencies. Assistance can come in the form of funding to schools, scholarships, various corporate donations, student loans, and curriculum

development projects. It is a huge task that will be successful only with a combination of public/private efforts that recognize the huge economic impacts that can be gained. We must also seek to be inclusive with respect to disadvantaged groups and minorities to fully realize the potential of our digital future.

Links to the presentation materials: <https://events.development.asia/materials/20160921/digital-literacy>. <https://events.development.asia/materials/20171214/switch-mavens-coding-boot-camps-and-blockchain-technology-applications-education>.

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