

# Preparing Digital Natives for Industry

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**Abstract** - *A huge skills gap crisis is raging and employers are unable to find graduates with necessary workplace skills for 21st century. More than 75% of employers want colleges to place more emphasis on skills that help students develop five key learning outcomes: critical thinking, complex problem-solving, written and oral communication, and applied knowledge in real-world settings. Discussions with college alumni further shed light on the significance and urgent need for such an education. This research explores ways to increase the versatility of college graduates to gain a strong foothold in the job market by enabling them to gain these skills while in college. A student embarked upon a project to become an active creator of technology rather than just being passive consumer of technology by developing applications (“Apps”) for handheld mobile devices on various platforms. Such a multi-platform approach facilitates our graduates to garner vital skills required by employers.*

**Keywords:** Teaching Digital Natives, Mobile Learning and Use of Mobile Technologies, Consumers of Technology to Creators of Technology, Experiential Education, 21st Century Skills

## 1 Introduction

We are facing a crisis in the United States whereby we have a huge skills gap and employers are unable to find graduates with necessary workplace skills for the 21st century. More than 75% of employers say they want colleges to place more emphasis on workplace skills that help students develop five key learning outcomes, including: critical thinking, complex problem-solving, written and oral communication, and applied knowledge in real-world settings. Fischer (2013) points out that more than half the employers had trouble finding recent graduates qualified to fill positions, as the graduates lacked basic workplace proficiencies: adaptability, communication skills, and the ability to solve complex problems. This implies that we are not adequately preparing our graduates in written and oral communication, decision-making, and analytical & research skills. Employers also place a high priority on forms of learning that emphasize a students’ active development and application of intellectual and practical skills to real world problems (Hart Research Associates, 2013).

### 1.1 Choice of a College Major

Carnevale and Cheah (2013) argue that not all college majors are created equal. Choice of major significantly affects employment prospects and earnings. Some majors offer substantially better employment prospects than others. In particular, people who make technology (creators) are better off than people who simply use technology (passive consumers). In general, majors that are linked to occupations have better employment prospects than majors focused on general skills.

### 1.2 Skills Gap

Employers claim that they are unable to find enough skilled workers in the United States implying a skills shortage. The OECD (OECD, 2013) report assesses literacy, mathematical, and problem-solving skills in people aged 16 to 65 in 22 advanced nations of the OECD and Russia and Cyprus. Based on this OECD report, Perez-Pana (2013) cautions that American adults lag well behind their counterparts in most other developed countries in the mathematical and technical skills – these skills are so essential in a modern workplace. He also cites a statement from Arne Duncan, the education secretary, saying that the findings “show our education system hasn’t done enough to help Americans compete - or position our country to lead - in a global economy that demands increasingly higher skills.” Porter (2013), also based on the OECD report, disagrees with Washington and the United States Chamber of Commerce that American workers are the best in the world and claims the skill level of our American labor force has fallen dangerously behind its peers around the world. So, what are these skills? How can we help our graduates attain these skills and be ready for a job in the industry?

### 1.3 21st Century Skills

The need for routine cognitive and craft skills in the services sector is diminishing rapidly as many of the manufacturing and low-skill tasks are being automated due to the advent of Information and Communications Technology (ICT). In addition to the “occupation-specific” skills, employers today are also demanding:

- “generic” skills such as information-processing skills (including literacy, numeracy and problem solving skills) and

- “soft” skills such as interpersonal communication, self-management, and the ability to learn new skills.

A Framework for 21st Century Learning, developed by the Partnership for 21st Century Skills (2011) P21 describes skills, knowledge and expertise students must master to succeed in work and life, which includes not only the 3Rs (the core subjects) and the 4Cs (Critical Thinking, Communications, Collaboration and Creativity) but also the Information, Media & Technology skills (the “generic” skills) and Life and Career skills (“the “soft” skills) (see Figure A1). What can we educators do to enable our students to master these 21st century skills using tools currently at our disposal? Is there a way to enrich our students with generic and soft skills with contemporary devices based on various platforms?

## 2 Mobile Apps Development

An App (or Application), for a computer or phone operating system, is a self-contained program or piece of software designed to fulfill a particular purpose. Apps are increasingly popular for hand-held mobile devices (smartphones and tablets) which are available for different platforms ranging from Google’s Android, Apple’s iOS to Microsoft’s Windows operating systems. In today’s global marketplace employers offer products and services for all such devices (on different platforms) and thus are demanding that our graduates be versatile and well-versed with all the available platforms (a 21st century skill), not just as consumers but as creators of technology.

### 2.1 Mobile Learning

Sales of hand-held mobile devices are exploding and drastically altering our education landscape by revolutionizing the ways we teach and learn using these on-line, social, and increasingly mobile computing devices which are ubiquitous and offer visual, tactile and personal experiences as never before. Figure A2 (Sanou, 2013) illustrates the growth in mobile phone subscribers worldwide from under a billion in 2000 to about 6 billion in 2011. This number is close to 7 billion in 2012, which is about 96% of our global population! For the first time in history, a majority of people can afford to buy personal ICT in the form of mobile devices, in particular mobile phones (Vosloo, 2012). These devices are digital, portable and provide multimedia capabilities to access the Internet. Our students today are “Digital Natives” – a term coined by Prensky (2009) – “native speakers” of the digital language of: computers, video games and the Internet. To speak the language of these “natives” we use an innovative approach - mobile application development for different platforms, so that they can experience mobile technology as creators of technology, and not just as consumers.

### 2.2 Mobile Technology

The traditional classrooms (chalk and blackboard) of yesterday are shrinking into the palms of our hands today! E-Learning including Computer/Web based training, technology enhanced learning, multimedia (Audio Video) learning, online classes, distance learning, virtual classes, etc. is readily available today due to advances in electronic media and ICT. Mobile technology impacts learning that takes place outside the “traditional classroom” and has the power to transform education. Mobile Learning represents a profound shift in the way education is delivered and received. It is not just distance learning with mobile technology but a union of ICT and education where technology-enabled learning solutions are available to learners anytime, anywhere. UNESCO (Vosloo, 2012) believes that this unification has great potential to facilitate knowledge dissemination, improve learning and assist the development of more efficient education services. Any portable device, such as a tablet, laptop or mobile phone that provides access to educational content through mobile connectivity can be a tool for Mobile Learning. As prices of mobile devices and connectivity continue to plummet, Mobile Learning can extend educational opportunities to marginalized groups; increase education quality; and reduce inequalities based on gender, class, race, age and disabilities (Vosloo, 2012).

### 2.3 Challenges

Aside from the immense benefits, Mobile Learning is burdened with several challenges. Negative perceptions around use of mobile devices (especially phones) in educational settings; safety, security and privacy concerns; and lack of training opportunities for educators to incorporate mobile learning in their classrooms further thwart innovation. Also, development needs as well as the hardware and equipment needs vary from platform to platform, further widening the skills gap.

To address these challenges and to overcome the skills gap we primed our student to design and develop mobile apps for the various platforms such as: Apple, Inc’s iOS, Microsoft’s Windows Phone Development and Google’s Android operating systems. For this our student had to learn three different programming languages and understand the different platforms they were based on. This enabled our student to adjust to any platform (a 21st century skill desired by employers) and be ready for the workplace.

### 2.4 Apple iOS App Development

iOS is the foundation of iPhone, iPad, and iPod touch and apps for these devices are developed using the Objective-C language using Apple’s Integrated Development Environment (IDE) Xcode (Conway, Keur and Hillegass 2014 and Kochan 2013). Xcode comes with an emulator which can

simulate an iPhone as well as iPad and is used to test the code for an app under development.

## 2.5 Microsoft Windows 8 Phone App Development

Windows 8 apps are written in the C# programming language (Sharp, 2013). The Windows Phone 8 Software Development Kit (SDK) is needed to create Windows Phone 8 Apps, and it comes with Microsoft's Visual Studio Ultimate 2013. This is an excellent IDE with many options for creating and customizing User Interface (UI) items for the app.

## 2.6 Google Android App Development

Android apps are written in the Java programming language and use the Eclipse IDE Eclipse (Harwani 2013). Google also has an excellent online Android Application Programming Interface (API) which serves as a reference for learning this new platform.

## 3 Results and Analysis

Each platform has its own development framework and tools which the student has to learn and master before attempting to develop real-world apps. The learning curve for each of the platforms varies depending on the student's background with that environment. Learning a programming language can be both quite interesting and challenging. Most colleges have requirements of at least three different programming languages. If a student is already well-versed with a particular programming language then there is a definite advantage to using that platform and thus having a short learning curve.

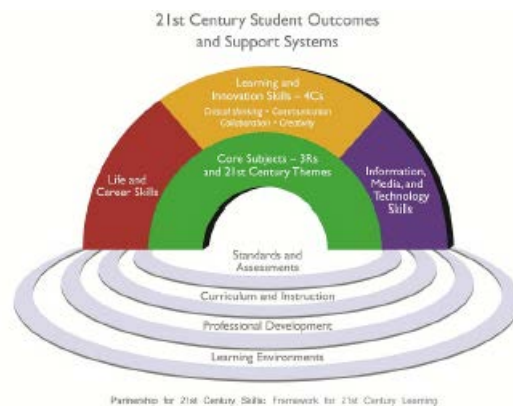
For students new to a programming language some lead time is spent learning the syntax and semantics of the new language. This could lead to frustration on part of the student since creation would not happen for a long time until they have consumed a lot of information about the language peculiarities. A lot of time is spent in writing sample programs simply to understand the language basics. Many times it helps if a student can think in simple English (or English-like) language and trace out a detailed path using an algorithm or pseudo code to guide the process of generating code. Flow charts and decision trees also help in the process of coming up with new ways to solve a problem. A study of some common programming paradigms, especially procedural and object-oriented, also serves to be very helpful. In order to formulate real-world apps, the student needs to understand the data structure and learn key subjects like searching, sorting, binary tree and linked list creation. Further, computer algorithms like divide and conquer, greedy method, backtracking, etc. should also be a part of the learning process. Student needs to understand that even the most accomplished programmers may fail to solve simple problems at times. So, finding or preparing a proper algorithm, learning data structures, and

many hours of practicing problem-solving skills on different types of problems is essential.

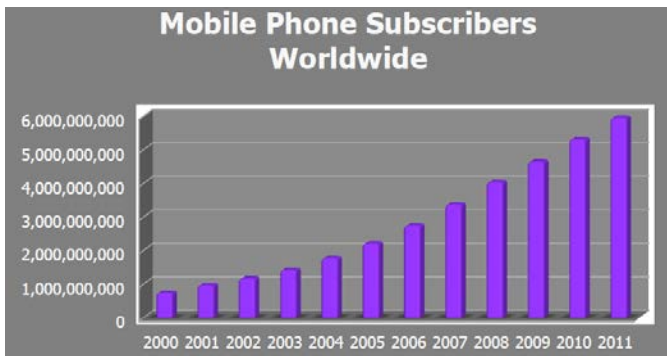
Computational skills are exercised while programming and it can be very frustrating thus having a solid foundation in mathematics and logic helps with the process of learning to program to solve a problem. Various mathematical topics – Equations, Calculus, Fourier, Vector, Boundary Value Problem, Linear Algebra, Matrices, etc. will come in handy while programming.

A student benefits tremendously from teaching others and sharing developed apps with others on the different platforms. However, a major impediment is the cost associated with the different platforms – these include the costs of the hardware (computers and mobile devices), developer's fees charged by the different platform authorities, books, training manuals, and other documentation. A way to mitigate some of these costs involves forming a partnership with potential employers and industries in the form of internships. The employers may already have the necessary hardware for the different platforms thus reducing the cost to the educator. Such experiential learning is beneficial to both the learner as well as the employer. Also, internships would put our student at the forefront of technology and we educators would be better able to understand the ever-changing needs of the industry.

### 3.1 Figure A1 - 21st Century Student Outcomes and Support Systems



### 3.2 Figure A2 - Growth in Mobile Phone Subscribers – Worldwide



## 4 Conclusions and Future Work

This research explores ways to increase the versatility of graduates so that they can gain a strong foothold in the job market and become active creators of technology rather than just being passive consumers of technology. The employers today are indeed demanding students with a well-rounded education who are “digitally ready” to jump into their workplace responsibilities. Using mobile technologies in this Mobile Apps Development study we have been able to help our graduates evolve from “consumers” to “creators” of technology and gain computational thinking skills at the same time. Interactions with various assessment tools and maintaining electronic portfolios also gives our students an edge so that they can be comfortably “digitally ready” to enter into the workplace. For the future we wish to incorporate experiential learning into our course so students can team up with local businesses/employers to gain more hands-on training while trying to design an app for these folks based on the specific industry they are involved with. A multi-platform approach facilitates our graduates to garner vital skills required by employers thereby diminishing the skills gap in a global economy that demands increasingly higher skills.

## 5 References

- [1] Carnevale, A. P. & Cheah, B. (2013). Hard Times: College Majors, Unemployment and Earnings: It Still Pays to Earn a College Degree But Not All College Degrees are Created Equal. *Georgetown University Georgetown Public Policy Institute Center on Education and the Workforce*. Retrieved from <http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/HardTimes.2013.2.pdf>
- [2] Conway, J., Keur, C., and Hillegass, A. (2014). *iOS Programming: The Big Nerd Ranch Guide*. Atlanta, GA: Big Nerd Ranch. 2014.
- [3] Fischer, K. (2013). *The Employment Mismatch: A College Degree Sorts Job Applicants, but Employers Wish It*

*Meant More*. The Chronicle of Higher Education: Special Reports. Retrieved from: <http://chronicle.com/article/The-Employment-Mismatch/137625/#id=overview>

[4] Hart Research Associates (2013). *It takes more than a major: Employer priorities for college learning and student success*. An online survey among employers conducted on behalf of: The Association Of American Colleges and Universities. Washington, DC. Retrieved from [http://www.aacu.org/leap/documents/2013\\_EmployerSurvey.pdf](http://www.aacu.org/leap/documents/2013_EmployerSurvey.pdf).

[5] Harwani, B. M. (2013). *Android Programming Unleashed*. Indianapolis, IN: Sams, 2013.

[6] Kochan, S. G. (2013). *Programming in Objective-C*. Upper Saddle River, NJ: Addison-Wesley, 2013.

[7] OECD (2013). *Organization for Economic Co-operation and Development (OECD) Skills Outlook 2013: First Results from the Survey of Adult Skills*, OECD Publishing. doi: 10.1787/9789264204256-en

[8] Partnership for 21st Century Skills (2011). *Framework for 21st Century Learning*. Retrieved from: [http://www.p21.org/storage/documents/1\\_p21\\_framework\\_2-pager.pdf](http://www.p21.org/storage/documents/1_p21_framework_2-pager.pdf)

[9] Perez-Pana, R. (2013). *U.S. Adults Fare Poorly in a Study of Skills*. The New York Times. Retrieved from: [http://www.nytimes.com/2013/10/08/us/us-adults-fare-poorly-in-a-study-of-skills.html?\\_r=1&](http://www.nytimes.com/2013/10/08/us/us-adults-fare-poorly-in-a-study-of-skills.html?_r=1&)

[10] Porter, E. (2013). *Stubborn Skills Gap in America's Workforce*. The New York Times. Retrieved from: <http://www.nytimes.com/2013/10/09/business/economy/stubborn-skills-gap-in-americas-work-force.html>

[11] Prensky, M. (2009). *H. sapiens digital: From digital immigrants and digital natives to digital wisdom*. Innovate 5 (3). Retrieved from: <http://www.innovateonline.info/index.php?view=article&id=705>

[12] Sanou, B. (2013) The world in 2013 – ICT Facts and Figures. *ICT Data and Statistics Division, Telecommunication Development Bureau, International Telecommunication Union*. Retrieved from: <http://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx>

[13] Sharp, J. (2013). *Microsoft Visual C# 2013 Step by Step*. Microsoft Press; 1 edition, 2013.

[14] Vosloo, S. (2012). Mobile learning and policies – key issues to consider. The United Nations Educational, Scientific and Cultural Organization UNESCO's Working Paper Series

on Mobile Learning. ISSN 2227-5029. Retrieved from:  
[http://unesdoc.unesco.org/images/0021/002176/217638E.pdf/](http://unesdoc.unesco.org/images/0021/002176/217638E.pdf)

Be prepared, get ready to open your hotel any time with HotelFriend Solutions. [Learn More.](#) Reopening Requirements. As the following line graph demonstrates, the era of digital natives has already begun and is now challenging the whole sphere of consumer services. If you want to keep up with the modern technologies and continue increasing your income, you should definitely rethink your business strategies and approaches. These digital natives are fast-paced, visually-oriented, nonlinear, always-on learners. They have a built-in instinct to swipe right when reading books, and the pace of technological change doesn't phase them. It's no wonder the old rules of engagement don't resonate with them, and, more importantly, aren't preparing them to thrive in an unknown future. "The role of a teacher is fundamentally changing," says Richard Culatta, chief executive officer of the International Society for Technology in Education (ISTE). And digital natives thrive on instant gratification and frequent rewards, preferring games over reading. Today's students prefer images to text, which may help develop visual-spatial skills, but can negate the potential for deep, reflective reading ability. Digital innovation is reshaping industries by disrupting existing business and operating models. But it is also having a profound impact on society, presenting a series of opportunities and challenges for businesses and policy-makers. This executive summary introduces the approach taken to unlocking the value of digitalization. Over the past two years, the DTI has developed a unique value-at-stake framework to support a consistent way of measuring technology's impact on business and wider society. Whether it's developing training programs to obtain necessary skills or hiring digital natives, companies need to be aware of where talent is headed and how they. Accept failure, and move away from the risk-averse mindset.

Be prepared, get ready to open your hotel any time with HotelFriend Solutions. [Learn More](#). [Reopening Requirements](#). As the following line graph demonstrates, the era of digital natives has already begun and is now challenging the whole sphere of consumer services. If you want to keep up with the modern technologies and continue increasing your income, you should definitely rethink your business strategies and approaches. [Digital Natives Digital Immigrants](#). ©2001 Marc Prensky. [\\_Digital Natives, Digital Immigrants](#). By Marc Prensky. From *On the Horizon* (MCB University Press, Vol. 9 No. 5, October 2001) © 2001 Marc Prensky. But how many Digital Immigrants are prepared to teach it? Someone once suggested to me that kids should only be allowed to use computers in school that they have built themselves. It's a brilliant idea that is very doable from the point of view of the students' capabilities. See also: [Digital Natives, Digital Immigrants Part 2: The scientific evidence behind the Digital Native's thinking changes](#), and the evidence that Digital Native-style learning works! For digital natives who have grown with technology, adapting and utilizing technology is a trait they are born with. Agility is required for organizations to quickly respond to the changes. With this combination, implementation of Industry 4.0 and digital transformation becomes comparatively easier. Discover the world's research. 15+ million members. The evolution of Industry 4.0 has called for digital transformation in all the organizations. This has pushed the organizations to change rapidly to adapt to the situation. At this point of time digital natives have entered employment. For digital natives who have grown with technology, adapting and utilizing technology is a trait they are born with. Agility is required for organizations to [\[Show full abstract\]](#) quickly respond to the changes.