RETRACTED CHAPTER: Designing a Mobile Applications Curriculum: Overview

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Contents

Abstract

As technology transforms higher education, changing the way that people conduct business, communicate, and learn, schools, colleges, and universities must accommodate and transform how curriculum is delivered and what programs should be delivered.

In years past, reformed conceptions of teaching, learning, and education, as well as new practices, policies, and organizational settings, for teacher learning, have been introduced by educational researchers and reformers. Reviewing these new concepts and practices have transformed learning for teachers, research groups, collaboration, and higher learning. Collaborative partnerships and professional communities in higher learning have taught us that the organizational conditions are essential to the development of instructional support and design of cutting-edge programs to align with current technologies.

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As technology changes the way people communicate, conduct business, and learn, colleges and universities across the country strive to provide engaging, current, and individualized learning environments using mobile applications that can be utilized on mobile devices such as tablets, iPhone, and Android and wearable technology to support collaborative education and distance learning and support the Internet of Everything. With these devices in the hands of students, faculty must provide education for a growing and diverse population of anytime, anywhere access to educational resources and applications. As the managing of education in a changing society is increasing pressure on organizations, colleges, and universities to provide and accommodate network access in a secure environment, there is an urgent need for skilled mobile technologist to provide the support, design, and security needed to support current and emerging applications on mobile devices. Students must also learn to design mobile applications for mobile learning and wearable technology. Students must also be skilled at providing secure coding on these devices.

The growing use of mobile, smart devices in the consumer market has also forced the software engineering community to quickly adapt development approaches of mobile applications. The combination of computing power, access to handheld devices, and ease of application transferable to market has made mobile devices the new computing platform for businesses, education, and independent developers. However, the growth of this new computing platform has outpaced the development of mobile applications. What is mobile technology? It is impossible to attribute one fixed meaning to the concepts of mobile learning. To fully understand this concept, it is critical to consider the relationships between each of the words used to describe mobile learning. The use of this foundation to understand mobile learning presents a vast challenge because there are many words and terms, which have been used to define and explain mobile learning as a miracle in the design of mobile application curriculum in education. Is there a need for mobile application curriculum? This chapter gives an overview of the need for mobile curriculum in education and explores the rationale for implementing mobile applications technology curriculum and examines what content is suitable for a mobile applications curriculum.

1 Introduction

As of January 2013 in the United States, Android made up 52.69 % of mobile device operating systems and Apple iOS accounted for 34.9 % (Statcounter 2013). Apple iOS had the lead 18 months earlier. In the summer of 2011, Android has steadily taken over the market from iOS as the most popular mobile operating system with all other platforms, like Windows Mobile, Symbian, and BlackBerry, accounting for less than 13 % combined (Statcounter 2013). Mobile devices include smartphones and tablets, both of which have become very popular among consumers. In 2013, consumers will purchase 1.2 billion mobile devices, surpassing personal computers as the most common method for accessing the Internet (Lookout 2013). These devices will not only be used for mobile devices which

are the fastest growing computing platform, with an estimated consumer usage of 1.75 billion in 2014. Nearly two-fifths of all mobile phone users worldwide will use a smartphone at least monthly in 2014. As the rate of mobile users continues to increase, mobile phone users are rapidly switching over to smartphones as devices become more affordable and 3G and 4G networks advances continue to evolve.

Smartphone users currently account for a majority of mobile phone users in 10 of the 22 countries and are expected to increase in 16 countries worldwide. Mobile devices and applications are quickly becoming as important and widely utilized in the organization as personal computers and traditional business applications. The workplace has expanded beyond the office and even the home to wherever the user happens to be traveling. Students, faculty, and individuals alike also expect to communicate, collaborate, and access their important work or school applications and data from anywhere and on whatever device they choose.

As technology changed the educational landscape in terms of how information is delivered and to whom; the speed of access to information, and the many options for the delivery of information also changed (Truluck 2005). Programs and curriculum in higher education must also change. Therefore the development of an information technology model curriculum which would deal with topics considered essential, but do not seem to fit any specific knowledge unit. Mobile curriculum fits this definition. Because new technologies and different learning platforms have emerged, i.e., distance learning and new education systems like mobile education have become increasingly popular, the need for mobile applications increased. Mobile devices represent an intense withdrawal from traditional computing platforms as they no longer represent a "static notion of context, where changes are absent, small, or predictable." Rather, mobile devices are highly personalized, and its environment must be continuously monitored, thereby making mobile applications fundamentally context aware (collectively time aware, location aware, device aware, etc.), thus what is currently called the smartphone.

Mobile devices are very important in the business, education, and governmental entities. As the needs for mobile application use increase from students, educator, designers, and entrepreneurs, the need for anytime, anywhere applications also increases. As the need to work more efficiently and faster is a necessity, the increased use of mobile devices has emerged a need for a new mobile education path. This path must be deliberate and evolve as the technology industry continues to develop.

Mobile education is defined as any service or facility that supplies a learner with general electronic information and educational content that aids in the acquisition of knowledge regardless of location and time (Chen and Kinshuk 2003). Research and reflections on mobile learning should stimulate multidisciplinary and interdisciplinary thinking and methods in education. They should facilitate our understanding of outdated concepts and rigid assumptions about learning and what it may be in a society that has changed, from a technology point of view. A mobile application pathway is essential in college curriculum. As these pathways are developed, they should also include a security component as mobile applications can pose a real vulnerability to a device.

Mobile devices, including bring your own device (BYOD) and corporate-issued devices, all pose new problems for technology professionals who do not quite know how to handle the problem yet. A recent study of technology security professionals

revealed 68 % of them have no way of identifying known mobile device vulnerabilities on their networks (Tenable-Security 2012).

As of January 2013, only 1.2 % of the devices on the market had the latest version (Platform Versions 2013). The previous version only accounted for 9 % of the market. The two most popular versions on the market are 2011s Ice Cream Sandwich (29.1 %) and 2010s Gingerbread (47.6 %). Adding to the problem of older versions of software in the market are delays in updating or patching operating system software. Research suggests that the time it takes for half of the Android users to update their software was 8–10 months and the likelihood they would buy a new. Contrary to how the Android platform works is the Apple iOS platform. The Apple operating system is not open and is controlled by Apple. Only one manufacturer makes devices for the platform and there is no fragmentation of the operating system (Mansfield-Devine 2012c). In contrast to Android's fragmented OS with many versions still on the market, Apple claimed that over 80 % of iPhone and iPad users had the latest iOS as of June 2012 (Mansfield-Devine 2012a). Other security benefits from Apple are that users are forced to download apps from the Apple's App Store and there are no allowable third party markets.

The popularity of smartphones and tablets poses new threats and issues for the enterprise. These threats from mobile devices are in the form of malware. Malware is a rapidly growing problem for mobile devices as forecasts predict that people will download 70 billion apps in 2014 (Lookout 2013). During the calendar year of 2012, Lookout (2013) estimates 18 million people will encounter Android malware. Android malware is on the rise at much higher rates than is Apple iOS. TrendMicro (2012) reported an increase from 1,000 Android malware samples in 2011 to 350,000 in 2012. The number of high-risk malicious malware applications for Android in just 3 years is significant compared to the 14 years it took the personal computers to reach those numbers (TrendMicro 2012). Android now exceeds personal computers for malware attacks in the United States (Mansfield-Devine 2013). Just over 99 % of all malware detected in 2012 was written for Android, with less than 1 % from the other operating systems (Kaspersky 2013). These statics support the rationale in the urgent need for higher learning institutions to develop a mobile curriculum to teach students how to design and secure mobile applications and how to identify vulnerabilities in various iOS.

2 Designing a Mobile Application Curriculum That Translates to Certifications for Students

An education that a computer science student must receive today must prepare them for the current workforce and the workforce of tomorrow. The education that a student will receive should be holistically designed to include technical concepts, application of the concepts, management skills, collaboration, and soft skills (including patients, work ethic).

Educational institutions are now increasing its efforts to design a more robust and comprehensive mobile applications courses and programs to meet the needs of

the mobile industry; and the course content must equate to the skill needed in industry to build a pipeline of skill workers.

In building any curriculum, course, or program, one must follow some guidelines; in a report written by the Joint Taskforce for Computer Science (2013), the guiding principles in designing a computer science curriculum are as follows:

- The curriculum should be designed to provide students with the flexibility to work across many disciplines.
- The curriculum should be designed to prepare graduates for a variety of professions, attracting the full range of talent to the field.
- The curriculum should provide guidance for the expected level of mastery of topics by graduates.
- The curriculum should provide realistic, adoptable recommendations that provide guidance and flexibility, allowing curricular designs that are innovative and track recent developments in the field.
- The curriculum should be relevant to a variety of institutions. Given the wide range of institutions and programs (including 2-year, 3-year, and 4-year programs; liberal arts, technological, and research institutions; and institutions of every size), it is neither possible nor desirable for these guidelines to dictate curricula for computing. Individual programs will need to evaluate their constraints and environments to construct curricula.
- The size of the essential knowledge must be managed.
- The curriculum should be designed to prepare graduates to succeed in a rapidly changing field.
- The curriculum should identify the fundamental skills and knowledge that all computer science graduates should possess while providing the greatest flexibility in selecting topics.
- The curriculum should provide the greatest flexibility in organizing topics into courses and curricula.
- The development and review of computer science must be broadly based. (Participation from many different constituencies including industry, government, Curriculum, and the full range of higher education institutions involved in computer science education). It must take into account relevant feedback from these constituencies.

Many educators believe that the same basic principles are valid for designing a mobile application curriculum.

3 Design Characteristics

In an introductory mobile applications course, the decision must be made on what content should be in the course, important concepts that are relevant to the subject taught may not be able to be taught from day one. Many topics will not appear in the first course and must be pushed back, which may lead to nontechnical students not

getting these topics. There are tradeoffs, but one must consider the essential concepts that should be taught in and introductory class that can be further developed in the next course for students moving forward in the technical program and the appropriate topics for those nontechnical students.

In designing a mobile curriculum, there must be multiple pathways into and through the introductory sequence and must have different entry points. Having multiple pathways into and through the introductory course sequence can help to better align the students' abilities with the suitable level of coursework. It can also help create more flexibility with articulation between 2-year and 4-year institutions and smooth the transition for students transferring from other colleges or programs.

Programming and computing are increasingly becoming more important to nontechnical majors in other fields. Courses for these nonmajors may or may not be distinct from courses that lead to years of computer science study. Additionally, having multiple pathways through introductory courses may provide greater options to students who choose to begin taking courses in computer science late in their college programs.

Programs in technology always needed adequate computing resources, both for students and faculty. The needs of technical programs often extend beyond traditional infrastructure (general campus computing labs) and may include specialized hardware and software and/or large-scale computing infrastructure. Having adequate access to such resources is especially important for project and capstone courses. Also, the institutions need to consider the growing need of computing devices (e.g., smartphones, tablets) that can be used as a platform for coursework.

4 Components of the Design

Computer science students need to understand the importance of secure software application development, particularly techniques to maximize application integrity and minimize the threat of reverse engineering. Sample topics include standardized libraries, cross-platform toolkits, vulnerability testing, automated code, logic, quality assurance, secure communication, secure data, and secure storage. Mobile devices must support multiple security objectives. These can be accomplished through a combination of security features built into the mobile devices and additional security controls applied to the mobile devices and other components of the enterprise IT infrastructure. The most common security objectives for mobile devices are as follows:

- Confidentiality – ensure that transmitted and stored data cannot be read by unauthorized parties.
- Integrity – detect any intentional or unintentional changes to transmitted and stored data.
- Availability – ensure that users can access resources using mobile devices whenever needed.

Table 1 Sample course mobile curriculum (Source: Wesley 2014)

Sample course	Course credit	Program of study
Introduction to prog/logic	Three credit hours	Computer information system
Principles of security design	Three credit hours	Computer information system
Programming mobile design	Three credit hours	Computer information system
Introduction to security	Four credit hours	Computer information system
Mobile web design	Three credit hours	Computer information system
Mobility design	Four credit hours	Computer information system
Scripting	Three credit hours	Computer information system

Students should have foundational concepts in security and concepts of risk, threats, vulnerabilities, and attack vectors, to name a few. Students must understand these concepts and must be able to apply the knowledge. The below sample design could be utilized to create a well-rounded program choice (Table 1).

Mobile technologies have been experiencing unprecedented growth and evolution, with no slowdown in sight, forcing management to rethink everything from infrastructure design to the details of integration with wired and wireless networks, and mobile certifications are following suit. Therefore, an educational institution offering a mobile applications curriculum should consider selecting a textbook that maps closely to the learning objectives of a certification exam in mobility. A certification credential certifies that you have the knowledge and skills required to compete in the global economy. The student will not only leave the educational institution with a degree but also a certification, a certification that says to the employer "I have the skills you seek."

CompTIA Mobile App Security+ is the first of two new mobile-centric certifications by CompTIA. The second will be the CompTIA Mobility+, a certification that is designed to validate an IT professional's skills for integrating, deploying, and managing a mobile computing environment. Both certifications were developed by the IT industry to meet workforce needs. Businesses perceive high value in accommodating mobile devices for their employees, but balancing end user expectations with IT requirements for reliability and security is a major challenge for many organizations. The CompTIA Mobility+ certification covers the knowledge and skills required to understand and research capabilities of various mobile devices and aspects of over-the-air technologies. This examination is suited for those individuals familiar with the operating system (IOS), software developer's kit (SDK), and principles of secure application development.

5 Certification

There are many mobile certifications on the market; for the purpose here, six of these certifications are listed, but the chapter will discuss in detail two that the author is most familiar with. Cisco Certified Network Professional Wireless, Citrix Certified Professional-Mobility (CCP-M), Aruba Certified Mobility

Professional (ACMP), VMware Certified Associate (VMCA), Workforce Mobility, and CompTIA Mobility Mobile App Security+ and Mobility+.

The CompTIA Mobile App Security+ certification covers the knowledge and skills required to securely create a native iOS or Android mobile application while also ensuring secure network communications. Students also learn how to create secure applications. This certification will allow a potential student to differentiate themselves as an applications developer and show integrity and commitment to keeping applications secure. Employers are confident that the students have learned and mastered fundamental skills in developing secure applications for Android and iPhone.

The CompTIA Mobile App Security+ can validate a developer's understanding of key security principles, features, and application programming interface (APIs) of the Android or iOS platforms. Android is an open source platform, meaning the underlining programming code is made public, but with some restrictions. This allows device manufactures, carriers, and others to modify the software, which gives them more flexibility in creating cutting-edge applications. The openness of the platform and the tools made available from Google encourage developers to write applications and also lead to quicker development. Applications developed from Android can be quickly submitted and made available on the Google market.

In order to prepare to pass the exam, one must have prerequisite knowledge of Objective-C programming (for the iOS exam) and Java programming (for the Android exam), plus SDK, structured query language (SQL) coding, mobile and app security essentials, and encryption implementation for the exam's specific operating system platform.

The CompTIA Mobile App Security+ exam tests a candidate's knowledge and skill regarding:

- Security principles, secure development life cycles, and threat models
- Security features of software development kits and APIs
- Service and network security
- Data security and implementing encryption
- Application hardening and reverse engineering
- Secure coding practices

The CompTIA Mobile App Security+ certification exam is now available worldwide. The exam is designed to validate that mobile application developers have the skills to securely create a native iOS or Android mobile app while also ensuring secure network communications and backend Web services available in an iOS edition and an Android edition. Candidates only have to pass one of the editions to become certified. The exam is ideal for individuals with a minimum of 24 months of mobile application development experience, including mobile application developers, software developers, network security developers, and application management developers. Careers in this field include but are not limited to the following:

Mobile application developer/software
Developer application

Development manager
Network security developer

The CompTIA Mobility certification exam is also available. The CompTIA Mobility+ certification covers the knowledge and skills required to understand and research capabilities of various mobile devices and aspects of cloud technology. This exam covers mobile device management, troubleshooting, security, and network infrastructure. It identifies IT professionals who can deploy, integrate, support, and manage a mobile environment while ensuring proper security measures are maintained for devices and platforms to mitigate risks and threats. Potential employers recognize the certification provided and know that the students can perform the desired task. Students can differentiate themselves as skilled in mobility issues. Mobile technology expert is ranked as fourth in the hottest IT careers list for 2014, according to InfoWorld. Potential careers include but are not limited to mobility engineer, network administrator, and mobility architect security administrator. This exam would only enhance a student's competitive advantage in seeking a career choice. There are no prerequisites for the exam, but it is recommended individuals have 18 months of experience in a mobile environment.

6 Future Direction

Mobile devices, including smartphones and tablets, enable users to access data anytime, anywhere. In 2013, individuals purchased 1.2 billion mobile devices, exceeding personal computers as the most common method for accessing the Internet. Mobile devices are the fastest growing computing platform, with an estimated consumer usage of 1.75 billion in 2014. Smartphone adoption is expected to continue on a fast pace through 2017. Nearly two-fifths of all mobile phone users worldwide will use a smartphone at least monthly in 2014. The growth of this new computing platform has outpaced the development of mobile applications.

Institutions find themselves in need of robust and practical mobility curriculum to train the current and future workforce with skills needed to program secure mobile transmissions and mobile devices. As education, business, and government continue to see the increased need in bring your own device(BYOD). The rise in technology labor associated with installing, administering, and supporting devices will continue to increase above 90 %. The rise in the purchase of smartphones totaling 62 % of the mobile market has helped create a new career pathway. The Internet of Everything has taken society by storm and also created a need for a skilled workforce. The need for skilled mobile professionals is greatly desired. Therefore, higher learning institutions must design mobile curriculum that will build a pipeline of skilled mobile professionals.

As bring your own device and mobility initiatives become a common occurrence in education, in the industry, and in the health arena, there is a critical need for skilled mobile technologist including the need for mobile application development (Babb and Abdullat 2012). The direction that educational institutions must follow is very

clear: students must be trained for a career in computer science, specifically in mobile design, to address the workforce needs of today and the workforce needs of tomorrow.

A current and comprehensive course content is imperative to provide a skilled pipeline. The need for computer science professional will continue to grow by 50 %. Threats on government, business, and individuals will continue to increase, creating a need for more skilled technologist and mobile professionals.

Lastly, technology organizations are seeing a niche in the market for security software specifically designed for mobile operating systems. Ensuring that student received current content and practical applications in mobility courses will allow for a stable pipeline of technology professionals in the workplace presently and in the future. Security of these mobile devices is a major concern for organizations. The two leading mobile operating systems (OS), Google's Android OS and Apple's iOS, both have security concerns as do the mobile applications and the major application markets. "Bring your own devices where employees supply their own equipment for work-related purposes" can cut costs for organizations, but failing to address security can significantly increase those costs.

The major advantages of mobile learning include greater access to appropriate and timely information, reduced cognitive load during learning tasks, and increased interaction with other people and systems. It may be argued that network mobile devices can help shape a culturally sensitive learning experience that can offer additional and, possibly, more powerful means of encoding, recall, and transfer. In addition, it is very important to consider the development of learning objects as well as the recognition of learning styles, cognitive processing, and motivation of learners (Koole and Ally 2001). There is an immediate need to develop mobile curriculum to meet the needs of the industry and education. It is imperative that the curriculum be designed to address the skills currently needed and the skills that may be transferrable to unknown skill needs of tomorrow. Education entities must establish a culture of highly trained technology professionals that can address the mobility skills gap.

7 Cross-References

- ▶ Characteristics of Mobile Teaching and Learning
- ▶ Design Considerations for Mobile Learning
- ▶ Design of Mobile Teaching and Learning in Higher Education: Introduction
- ▶ Development of Mobile Application for Higher Education: Introduction

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