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HEALTHCARE MOBILE APP DEVELOPMENT WITH APP INVENTOR IN A HEALTH IT COURSE

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ABSTRACT

App Inventor for Android is a no-code open platform for mobile app development using drag-and-drop approach. This paper describes a student mobile app development project designed for a health IT course. Healthcare mobile apps were introduced in the course to strengthen students' understanding of the concept of health IT and the role of IT applications in healthcare. Student feedback on the project were collected and analyzed. The challenges with the project and instructional implications derived from the experiences are discussed in this paper.

Keywords

Health IT (HIT), EHR, mobile app, app development, course design

INTRODUCTION

Health Information Technology (HIT) professionals are in increasing demand due to the American Recovery and Reinvestment Act of 2009 (ARRA, 2009) that requires healthcare providers to adopt and use certified electronic health record (EHR) systems and use the systems meaningfully (CMS, 2014). As a result, educational institutions have engaged in training HIT specialists. Students need to understand the concept of HIT and how IT systems and applications transform healthcare.

Mobile applications have become ubiquitous and many healthcare apps are now available for download to mobile devices and to be used by health care professionals, consumers, and patients. Mobile apps can help people manage their own health, promote healthy living, and gain access to medical information. Mobile health apps are considered to have the potential to disruptive shift in patient engagement and healthcare delivery (Tyler, 2013). Half of healthcare IT professionals who responded to HIMSS (Healthcare Information Management Systems Society) second annual Mobile Technology Survey believed "mobile technology would substantially impact patient care delivery" while with another 16 percent reporting that "mobile technology will dramatically change the future of healthcare delivery" (mHIMSS, 2012). The survey findings suggest a movement in a direction that using mobile apps to interact with patients increased. When it comes to physicians using apps, two main areas were found – to view patient information (e.g., lab results), and to search medical information (e.g. guidelines or non-personal health related information). The survey findings also noted the increasing development of mobile policies within organizations. It is foreseeable that the development and use of mobile technology in healthcare will increase significantly.

App Inventor is a no-code open platform for app development using drag-and-drop approach. It provides an easy environment for non-programmers to create a mobile application. The health app project in the course let students have hands-on app development experience and a chance to survey health applications in terms of the needs that the applications address and the process of designing and evaluating a mobile user interface.

To respond to the current trend of mobile apps in healthcare, HIT students may feel beneficial to have experiences of health app development by learning the design considerations and how it may be connected to EHR systems. At a regional southeastern university in the US, we have established a series of HIT programs and a sequence of HIT courses. In one of our HIT courses, we experimented with mobile app development as the student term project. In this paper, we discuss our experiences with this App Inventor project, the process and activities of the project, and the results from the student feedback on the project.

RELATED WORK

Since the release of App Inventor in December 2010 developed by Google and later moved to MIT (Wikipedia, 2014), a variety of studies have been conducted on teaching and learning App Inventor. App Inventor has been experimented in K-12 educator trainings (Hsu et al., 2012; Morelli et al., 2011; Roy, 2012), teaching programming concepts (Riley, 2012; England, 2012), game design (Wolber et al., 2011), information security (Arachchilage et al., 2012), and health IT (MacKellar, 2012; MacKellar & Leibfried, 2013), just to name a few. App inventor was found to be an interesting and engaging tool for the students and workshop participants. Peer support and instructor guidance were found to be the key factors for successful

learning experience. Hsu et al. (2012) pointed out from the online workshop they conducted that App Inventor helped participants realize they can “leverage the power of mobile computing and design their own apps to serve their needs.”

APP DEVELOPMENT PROJECT

App Inventor

App Inventor for Android (<http://appinventor.mit.edu/explore/>) is an open web-based platform for building apps. The major elements in App Inventor: Component Designer, Block Editor, and Emulator. Interface and integration of components (both visible and non-visible components) can be designed in Component Designer whereas the program’s logic is created in Block Editor. If not connected to a mobile phone, the application can be tested using the Emulator. The design and implementation process allows people without programming skills and prior programming experience to develop mobile apps. The drag-and-drop visual programming tool for designing and building fully functional apps for Android let users easily design and arrange interface components and connect logic blocks to create mobile applications.

Project Structure and Activities

The project consists of three sub-projects, lasting 1-2 weeks each. 17 students signed up for the course, a second-semester HIT course in the sequence. Students are required to work on three sub-projects, as shown in Table 1.

Project #	Objectives
Project #1	Get familiar with MIT App Inventor, App Inventor for Android Component Designer, Block Editor, and Emulator
Project #2	Explore sample projects in “Educator Resources” and work on one project of student’s interest to acquire more techniques for building applications
Design of Project #3	Read papers describing mobile applications in healthcare, and submit a plan for the health app to be created
Development of Project #3	Finish building a health app and test it

Table 1. Objectives of Sub-Projects

Project 1 is to let students set up their computers to run App Inventor and be sure they are ready to start working on creating apps on this platform. The detailed instructions are given for project 1 including signing up for Google account if they have not had one, how to download App Inventor software, how to save and share the App Inventor projects, and where to find troubleshooting page and FAQs. Figure 1 illustrates one of the instructions demonstrated.

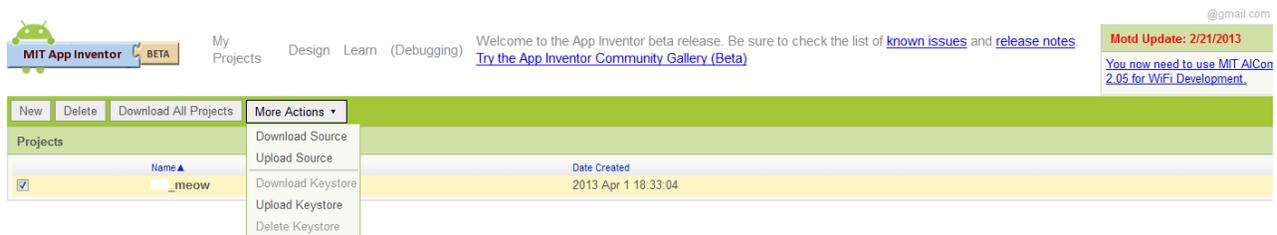


Figure 1. Sample Demonstration for Students

Project 2 asks students to follow the step-by-step instruction to build one of the sample apps introduced on the App Inventor website and in the “App Inventor” Book (Wolber et al., 2011). Project 3 is about designing and creating a healthcare related app. Students are required to first choose a general healthcare need for their projects (for example: asthma control, diabetes education, nutrition, etc.), and then examine other software applications (including desktop, web-based, and mobile systems) addressing the same healthcare need that they have chosen. Prior research papers describing types of mobile applications in healthcare and the process of designing and evaluating a mobile user interface are provided for students to read. Students are required to answer three questions in their design deliverable: (1) What need does the project address and why is it important? (2) Who are the target users? (3) How does your design meet the special need(s) of your target users?

Sample Student Projects

At the end of the semester, a variety of health apps were created by the students ranging from daily healthy food suggestions to continuous glucose monitor. Figure 2 and 3 show the interfaces of two sample apps.

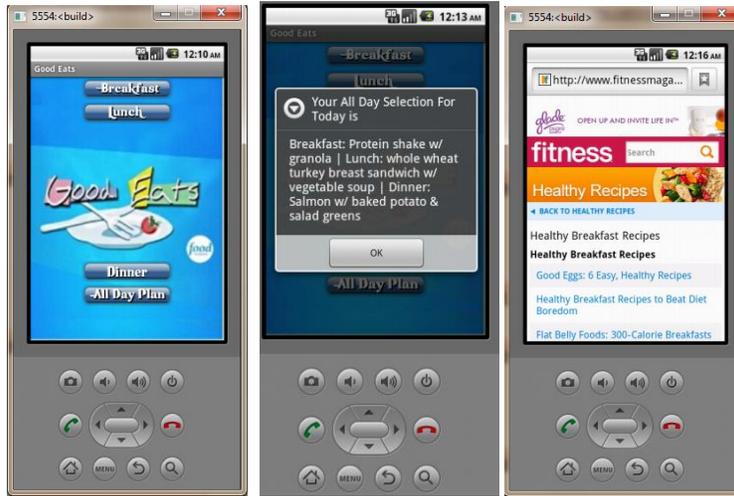


Figure 2. Sample Student App #1



Figure 3. Sample Student App #2

EVALUATION

Students were asked to provide their reflection in an essay on their experiences with the project. Since this was the first time to have health app development in the course content, students were not given any guidelines on what the instructor was looking for from their reflection. It was intended to be an open-ended question that allows students to freely discuss their viewpoints.

Student Feedback

The feedback result showed that the App Inventor is a great start especially for students who may understand programming but do not want to be programmers. Students found the project was very interesting and important since hands-on experience will be beneficial to students when they go out looking for jobs in the industry. Students also reported that they had difficulties learning how to use App Inventor and features in App Inventor are not sufficient for relatively complex app

design. Some of the students would like to have more time for the project and in-class lab sessions during the project period. Table 2 summarizes student feedback on their major benefits and difficulties of the App Inventor project.

Aspects they liked about the project	Difficulties they had with the project
Hands-on experience	Lack of instructions and guidelines on how to use App Inventor
Health mobile app research and how the project could be integrated with the concepts covered in other HIT courses	Need more direction on the types of apps that are possible to make with App Inventor
The sample projects provide inspiration besides the development skills.	Some App Inventor features need improvements (e.g., multiple screens, emulator)

Table 2. Student Feedback Summary

Students commented on three major aspects: overall experience, how it helped deepen their understanding of health IT, and likes and dislikes of App Inventor features. The majority of the students were satisfied with their experience. They found the project interesting, enjoyable, and tasking at the same time. They think the drag-and-drop programming style made it easier and quicker to create applications, especially for those who may not have a lot of programming experience.

The remarkable finding from the feedback is that the project served its main purpose, which is to help students better understand health IT and health IT applications. The project gave them an opportunity to do research on apps geared towards health-related issues. They examined a lot of the health apps out there. Another notable finding is students realized that the App Inventor project could be integrated to clinical workflow and process analysis, another HIT course, in the sense that they can figure out a problem or bottle neck in a clinical process and develop a simple App to help streamline that process or develop a solution from that. A couple of students reported that they incorporated the process flow & analysis with this project and that helped them really gather their thoughts and ideas.

With regards to the functionality and the layout of App Inventor, students showed distinctive opinions. Those who liked most of the features of the tool were satisfied with the easy-to-use set up and guides. They thought the blocks are an ingenious way for someone to write code. Most of them have very little experience with writing code, and they said they could not have done it without the use of the blocks. They also felt the tutorials that were provided by the website were excellent tools that truly gave the insight on the fundamentals of creating an application using App Inventor.

On the other hand, some student reported that the tool had flaws. They were not happy with the lack of instructions, and the features (or the lack thereof) such as the alignment process, the auto saves, no multi-screen switch capability, hard to connect to their phones, and no undo button. Some students felt frustrated during the project due to the amount of time, and trial and effort on their part.

Selected student comments are displayed below.

Our experience has been quite good using App Inventor.

Developing this App was both entertaining and tasking at the same time.

My experience with the App Inventor was really great because creating an app for me is fun. I was able to learn a lot especially when I was making research on the type of app to present for this class.

Everything came out great and fun and I believe given more time we would have incorporated a random workout section with the nutrition ideas.

We had fun researching healthy food ideas and testing out other Apps out there to make sure we develop a competitive advantage. But given the limited time with the project we could not incorporate workout section of the project which was disappointing but we still enjoyed the project and the time spent developing and testing the App.

This was a very interesting but difficult project. Because of my limited knowledge of programming in general and the limited time to learn App Inventor, I found it difficult to come up with a concept I could actually create and that would work.

I would like to say this was a great experience. I had fun creating and playing with the apps. I felt App Inventor was very user friendly. I have never used this program before and found it pretty easy to maneuver around in.

Overall I had an enjoyable experience using App Developer to create my healthcare application.

I had a lot of fun with this project. Great way to end my graduate experience.

My experience with this project was stressful. Creating the idea and building the layout part was fun and ignited my limited creativity skills.

I did not create the most complicated of applications, but I feel for a non-programming type person it was a very important step forward in learning a new way to perform software programming.

Being a beginner in technology and programming, I was able to program a simulation of the intended App for the current version. In my design, in order to save all the log data and generate reports/charts based on the data, I discovered I have to use a Tiny Database component.

This exercise otherwise may have been more exciting and definitely would strike the interest of anyone interested in pursuing building mobile apps.

The best thing about the Inventor is that there is no coding; this is very useful for people that do not have a lot of experience in coding and for people wanting to make a quick app.

I am happy that I was able to use my creative skills to develop a health application that can possibly help stroke victims someday.

Student Suggestions

Students gave valuable suggestions on the App Inventor project in their feedback. They think that this great program could easily be incorporated in a multitude of classes. They believe it would be an exceptionally useful module to use in the transition courses at the university. It is a great building block for those new to the IT program and learning hard skills. Some students think that a class devoted to developing HIT mobile apps would be a huge bonus to the program because it would help greatly familiarize students with mobile apps while also giving them something hands-on to work with. They consider that it is a very handy tool that could produce some great new applications by the students.

When it comes to specific suggestions, project timeline, instructor guidance, and peer support were mentioned. They suggested that to have in-class lab time so the whole class can have a walk-through with the applications. They feel more time could be spent in this class or another HIT class learning to use App Inventor. A couple of students think it was a really neat project, but think if it is used in future classes that it should start at the beginning of the semester so that students have enough time to learn more about App Inventor and can build more robust programs.

Other suggestions include having more screenshots and examples to help creating apps. One student pointed out that providing a couple of examples of good projects that students have done elsewhere using the tool would be helpful. This would give students an idea on what they could do with this type of software.

Instructional Implications

Based on the student feedback, future improvements can be explored in several areas:

- Lab sessions could be arranged at the start of the project when students are introduced to App Inventor for the first time.
- For each of the practice mobile app assignments, the students can be asked to “change at least one aspect” of their apps to show customization.
- Projects from last year’s class or elsewhere can be shown to students to give them an idea of what types of apps can be created and let them come up with ways to improve that project.
- Testing each other’s app could be beneficial. Along with the chances to test others’ apps, it may increase students’ motivation and interest to make their own apps better.
- A discussion forum for discussing health mobile apps and mobile computing could be useful.
- Collaboration with healthcare majors or working on applications for real clients would be ideal for the students.

CONCLUSION

In order to provide students a better understanding of health IT and hands-on opportunities in the context of health IT, a health mobile app development project was designed for a health IT course. Most of the 17 students in the class did not have any prior programming experience but they managed to finish the project successfully. They found the project interesting and

beneficial but also reported some difficulties they had during the process. The three-sub-project format and 6-week length worked well for most of the students who are first-time App Inventor users.

The student feedback showed that they were satisfied with the overall experience and believed that App Inventor is a good and easy-to-use tool. We plan to continue with the app development project in the same course when it is offered next time. App Inventor 2, an improved version, is already available. Improvements include Block Editor being available in the browser (without the need to install and run a Java file) and the new feature of adding additional screens while in Blocks or Designer mode, which would solve most of the difficulties that students reported for the project. App Inventor will provide students without prior programming skills hands-on experience in application development and allow them to explore design and usability issues for health mobile applications.

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