An iPhone Application Developed for Time Study Practice

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Extended Abstract

Tools developed for the engineering professional often don't work well for teaching purposes. The cost/benefit ratio is usually very high considering the limited amount of a semester in which the tool would be useful. In learning situations instructors often want students to not only gather data but also to complete calculations and evaluate the results themselves. This allows the student to understand why equations are derived in the way that they are so that they may alter those equations if the need arises. Those options are not usually available in off-the-shelf software. Professional tools are usually designed to not only gather data but to also complete the calculations for the professionals using them. For these reasons the author developed an iPhone application developed for students in an Industrial Engineering Metrics & Measurements class. The application is a data gathering and reporting tool for direct time studies. It requires the user to make all relevant calculations.   This extended abstract describes the need for and the advantages of using mobile class applications developed for teaching purposes. It also describes the author's experiences in developing one such application.

Engineers are, at the core, problem solvers. Engineering educators spend a lot of time in the engineering curriculum teaching aspiring engineers the algorithms, heuristics, and methods to solve problems for a given set of data. We typically give them a problem in a nice, tight paragraph which has all of the variables needed to solve the problem. Their goal is usually to find the right method, plug in the given variables and get an answer that matches the one in the back of the book. If only the real world were so easy! Real world problems don't come with a paragraph summarizing the problem and the few variables required to solve it. The professional engineer must usually gather data in order to determine the cause of the problem as well as gather data on each of the variables needed to solve the problem. Mobile devices are a great tool for a variety of data gathering applications. There are many mobile applications on the market developed for the professional engineer. Most of the tools though are not very practical for the student engineer.

Applications developed for professional engineers are usually designed to not only gather data but also to internally manipulate the data through the required algorithms and produce an output that can then be used by the engineer. If students use these same applications they aren't given the opportunity to practice using the data. While the practice of gathering of data is important,

an important goal as engineering educators is also to teach the algorithms, heuristics and methods. Students need to understand what goes on in the "black box" and why. They need to know the algorithms so that they can change them to fit a specific situation or understand the type of data that needs to be gathered and why it needs to be gathered. If an application allows the student to skip this very important step they are not learning all that they need to learn. Professional applications are also typically very expensive. We may only be teaching a topic for a week or two a year before we move on to the next topic. It's impossible to justify the cost of most professional applications for this very limited use.

Unfortunately there are very few mobile apps developed with the engineering student in mind. Amateur app development is a useful solution for engineering educators who view this absence in the market as an opportunity, as opposed to a problem.

The mobile app arena has opened up opportunities for individuals to develop and distribute software that didn't previously exist. The cost and time commitment to develop is relatively low. Amateur developers can take an app from idea to distribution in a matter of months, even without much (if any) programming experience. Developing allows the engineering educator complete control over the features that are in or are left out of an application. This allows us to teach students all aspects of the problem solving cycle. Applications can be customized to an educator's own wants, needs, experiences, formats, input types, or output types.

The author's experience in teaching an industrial engineering Metrics and Measurements class led to the development of a mobile app developed specifically for classroom use. Time & Rate is an iOS app written for students to learn and practice performing direct time studies. It was developed, because of need, to be used in the classroom and was customized as such. The app is a data collection tool only; it leaves all calculations up to the student. Prior to designing this application, the author had no C, Objective-C, or C++ programming knowledge and didn't even own a Mac. The timeline of the entire development project from purchasing the Mac to seeing the app appear on iTunes was three months working entirely after work hours and on weekends. The cost to develop the app including the computer, the developer license, and the LLC creation was around $2000.

Time & Rate has been in use for several years. The app is not required for coursework. Students who own an iOS device and want to use the app may do so. Students who do not own an iOS device or who don't want to use it are allowed to use mechanical stop watches provided in class. This increase in tools has allowed for more efficient lab work experiences without any increase in resources needed to be provided by the school. Students feel like they are getting introduced to a tool that will be useful to them after graduation while still getting a chance to practice all of the knowledge necessary in the classroom. The quick and low cost development cycle has allowed the developer/educator to provide the tool to students at a very low cost ($2.99 per student) compared to the professional tool that had previously been used which cost the department over $1000/year in licensing costs to maintain.

Engineering educators who would like to give their students a real world data gathering experience while still requiring the classroom calculation practice should consider educational

mobile app development. There are endless opportunities to develop tools to prepare our students to be successful engineering professionals.

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Dr. Professor currently serves as a Senior Lecturer and Undergraduate Advisor of Industrial and Manufacturing Systems Engineering at the University Texas at Arlington. Her research interests include engineering education, engineering software development, and resource optimization problems. Dr. Boardman is an active member of the Institute of Industrial Engineers, the American Society of Engineering Education, and Alpha Pi Mu.