Mobile Apps for Chemical Engineers Developed by Chemical Engineers

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Although we have seen a nearly complete shift from desktop to laptop computers among chemical engineering students, it has merely created an incremental change in their education. Without much delay, disruptive change is already arriving as smartphones have become ubiquitous. However, mobile devices can be used for much more than social networking, games, photography and online shopping. Students currently in K-12 are growing up with iPads as integral components of their education. The benefits of mobile devices in engineering education still remain largely untapped. There is a great need and opportunity to put chemical engineering course materials in students' pockets. When I started as an Assistant Professor in 2010, I began to seek out chemical engineering-oriented apps, only to be very disappointed in the offerings. With the help of a former student, we decided to take matters into our own hands. Several months later, we released our first app for iOS, *Chemical Engineering AppSuite* (*aka* the *"ChemE App*"), which is now in use in over 190 countries worldwide and has been launched over 100,000 times in the past year.

The *ChemE App* includes a great deal of functionality designed to mirror the most utilized data in the undergraduate curriculum including: unit converters, steam tables, EOS, Raoult's Law and Wilson Model VLE prediction for binary mixtures, and thermophysical properties for > 1000 molecules and elements. Other features also have broad utility across STEM disciplines include an open environment for spreadsheets/graphing, a linear equation solver, polynomial solvers and a graphing calculator. The *ChemE App* facilitates access to full-color reference materials such integral tables, physical constants, charts and diagrams via exportable PDFs. The *ChemE App* takes advantage of the integrated communications tools in iOS and allows the user to export and share the results of their calculations via email or Twitter as images, CSV files or PDFs. While both the universal and iPad versions share the same core functionalities, higher-level features such as graphing and spreadsheet tools are only available on the iPad given the larger format screen.

In addition to *Chemical Engineering AppSuite*, we have also released two other mobile apps useful for ChemE students, faculty and professionals. *Engineering Unit Converter & Calculator* is a free iPhone application featuring a streamlined interface for quick unit and currency conversions. *ODEsseus: Numerical Solver for Differential Equations* is an iPad application which

provides an intuitive workspace for solving systems of ODEs and analysis/graphing of the results.

Two new apps are forthcoming. *Thermopylae* will be released for the iPhone and will greatly expedite thermodynamic property calculations (i.e. P, V, T, H, U, S, etc.) for over 100 fluids. A McCabe-Thiele app is also in development and will provide rapid analysis of distillation column design.

All of our apps are available via Apple's App Store and are marketed by Vector 254 LLC:

https://itunes.apple.com/us/developer/vector-254-llc/id821141755