



Do Apps really help students learn chemistry?

Enrique Arce-Medina and Patricia Flores-Allier

ESIQIE, Instituto Politécnico Nacional, Edif. 7, Unid. Prof. A.L.M., México 07738 D.F., Méx., earcem@ipn.mx.



Abstract

This poster presents a review of most useful mobile Apps for learning chemistry. Our objective on this ongoing research program is to examine the implementation of smartphones Apps for improving learner outcomes. It was applied to a theoretical course taught in a chemical engineering degree.

Introduction

Apps are application software designed to run on smartphones and other mobile devices. The Apps provide new ways of interacting with information. Interaction happens anytime, anywhere, with anyone or anything (course materials, outside resources, experts). The challenge to teachers is how to take advantage of the Apps, in the context of the course, to help students learn chemistry. Use of mobile phones and tablets as a medium for learning is defined as M-Learning. M-Learning can support and enhance both the face-to-face and off campus teaching and learning contexts by using the mobile wireless devices as a means to leverage the potential of Internet tools. The use of the wireless mobile devices can be done at home, at the school or anywhere, anytime. The mobile technology that our students are using everyday, hours-a-day, deserves some consideration for potential use to help students learn.

Course description

For more than ten years the author has been lecturing the undergraduate course of Basic Chemical Process Design in the 7th semester at the Chemical Engineering School of the National Polytechnic Institute (IPN), of Mexico. All course material was available online throughout the course Web page. Students work in a project to design a chemical process. The project acts as the stimulus and focus for students learning. The teaching approach integrates team problem solving, turn-to-your neighbor exercises, project-oriented learning, and some web-based interaction combined with the traditional lecture instruction strategy. The selection of the most appropriate chemical process route to fabricate a product is the first and most important step of the project. The set of chemical reactions that use the cheapest raw materials and produce fewest by-products are preferred, but other quantitative and qualitative measures must be taken into account, such as safety and pollution prevention measures. After this stoichiometric and material balance calculations have to be done.

Method

Students are asked to revise the Apps and to practice with them for homework. We try to make homework more interesting and relevant to students. By practicing with the Apps students get a better understanding of chemistry and feel more confident. Questionnaires were answered by the students about the use of smartphones for learning. Most students made positive comments about what they thought of the use of Apps for learning chemistry. More than 80% of students consider the use of Apps to be fun and useful. In the questionnaire there are questions asking for their level of agreement about activities where they work on solving problems, and searching for information.

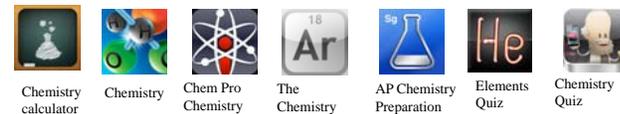
Apps that provide lessons on reactions mechanisms and stoichiometry and reaction animations are highly appreciated by students at our school. There are Apps with lots of exams with difficulties range from easy to hard and include answers for each.

Lots of chemistry Applications

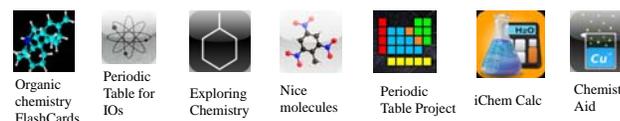
It is imperative for learning chemistry to understand how the periodic table of elements is organized and how to read information from it. There are more than 60 Apps for periodic tables. Many are free, approximately 30%. Students can click on any element to get detailed information including images, isotopes, electron shells and more. Some periodic tables are easy to zoom in and out with two fingers



These Apps includes properties for each individual element with history of discovery, and can perform some calculations like formula mass and a chemical equation balancer. Most Apps features flashcards filled with questions that help students learn difficult concepts, and even offer opportunities to play games while learning chemistry or watch lesson videos offline. Lessons show how problems are solved step by step at a slow and easy to follow pace while games can be fun and interesting. The lessons include quizzes for self-evaluation. With multiple choice style questions for instant feedback on student understanding. The cards are organized into major chemistry categories.



Many Apps provide lessons on general chemistry and organic chemistry with exercises and quizzes to help students master the concepts and evaluate their level of comprehension. Students learn organic chemistry nomenclature by practicing the identification, naming and recognition of organic molecules and their functional groups. Some Apps can open the Wikipedia page for the selected element or compound.



Teachers must become informed on the current available Apps as possible supplements to enhance learning, because many available Apps are constantly changing.

There are Apps that can view, edit and build molecules in 2D and 3D, others with screencasts for analytical chemistry calculations of molarity and dilutions, games for experiments, dictionaries of chemistry terms, and titration simulators. Others provide features to perform complex calculations on topics ranging from gases, solutions, thermodynamics, electrochemistry, and acids and bases.



Students are immersed in digital technologies as essential tools for learning however there are some pros and cons:

PROS: Flexibility, affordable most students have their own device, portable, “anywhere, anytime” learning, enables a personalized learning experience, Student’s choice in device, Immediate feedback.

CONS: Some students do not have a phone, classroom distraction, Potential for unethical behavior (cheating), privacy concerns, health concerns, raise questions about how to evaluate, lack of competence . These affects M-learning readiness and acceptance.



The survey

Students were asked to rate each activity in terms of importance and their satisfaction with the extent to which each was useful for learning. In addition to asking for their preferences the questionnaire also includes open-ended questions to encourage students to express their opinion thoroughly. Students were asked to indicate the extent of their agreement on each of the ten skills items using a seven-point Likert-type scale. The higher the ranking the greater the level of agreement, most students responded that they didn’t thought the mobile phone could be a useful device to use for studying, they feel comfortable using the smartphone Apps. Females spend more time on their phones than males and check their phones more often. Some Apps have helped them to improve the quality of their work.

Conclusion

This study demonstrated that an increasing attention must be paid to the use of emerging technologies that improve student’s skills.. We conclude that the smartphone can simplify learning and it could be of a great help when teachers supervise and direct the use of the Apps.