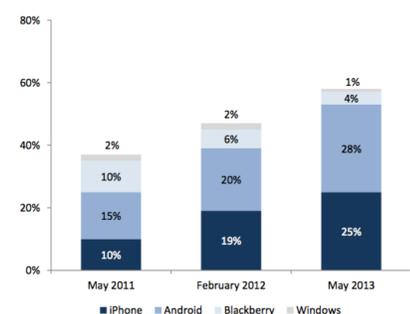


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Background and Motivation

As reports from the Pew Internet and American Life Project suggest, American adults increasingly rely on mobile devices to access the Internet. Fifty-six percent of American adults own a smartphone and 79% of the 18-24 year olds sampled (n=243) reported owning a smartphone.¹ Tablet devices are growing in popularity, and the number of Americans owning at least one tablet computer or e-book reader increased from 18% in December 2011 to 60% in May 2013.²

Cell owner platform choices, 2011-2013
% of cell phone owners who say their phone is ...



Source: Pew Research Center's Internet & American Life Project April 26-May 22, 2011, January 20-February 19, 2012, and April 17-May 19, 2013 tracking surveys. For 2013 data, n=2,252 adults and survey includes 1,127 cell phone interviews. All surveys include Spanish-language interviews.

Mobile technologies, specifically tablet-based mobile devices, are poised to shape the delivery of texts and the experience of textual study in higher education. Yet current e-textbooks offer little more than enriched pdfs with engaging illustrations, some limited social interaction, and links to references.

We are building a model of a text-based application that requires our students to engage actively while reading, that is to think (and play) while they read and study. Our goal is to make their implicit learning explicit.

Furthermore, by incorporating new ways to engage with text, mobile technologies allow students to develop a new relationship with the learning process itself. Engaging students in learning is critical to achieving education goals. By embracing students' love of these devices and drawing on their extensive use of these devices for more than phone applications, we believe we can exploit the satisfying human-computer interaction that an iPad (or similar touch screen tablet) provides to motivate learning.³ Positive engagement with material for long periods of time encourages deep learning.

After reviewing the diversity of mobile devices that our students use, we chose to focus our development in HTML5 and Javascript and to use PhoneGap, a product that can create native applications with web technologies and deploy those apps to multiple platforms.

Acknowledgements

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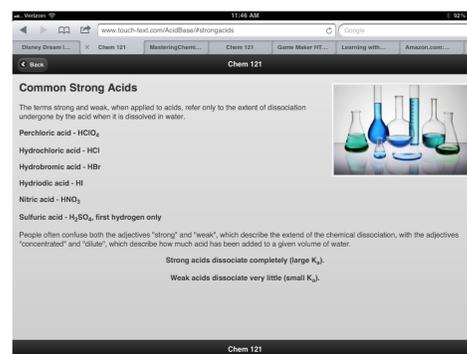
Mobile Webapp for Learning about Strong Acids and Strong Bases



Where appropriate, we try to incorporate an element of play in the form of games. In this particular webapp, a game (developed using GameMaker HTML5) has been included as a memory aid.

Exercises are incorporated to help students test their understanding of the material.

Each webapp has a learning goal related to one of the learning goals or outcomes for a particular course. This one is designed to help students recognize strong acids and strong bases, a critical first step in mastering the theory of acid/base chemistry.

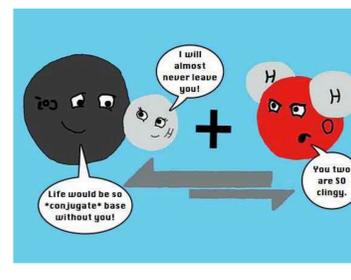
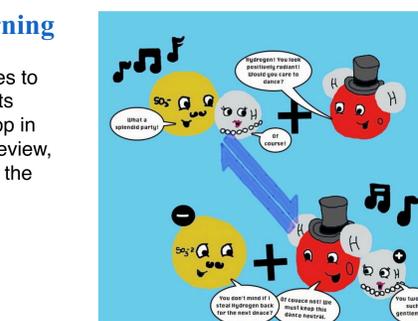
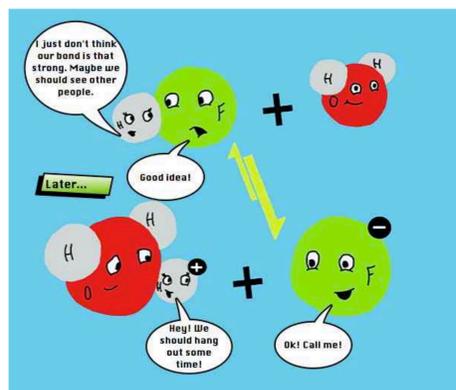
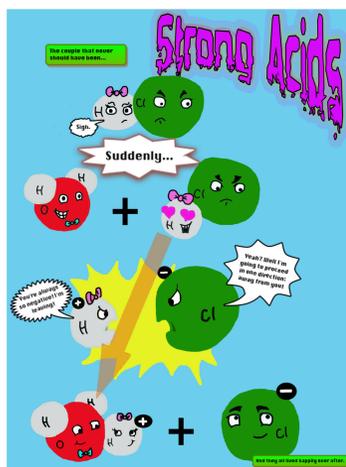


Traditional chemistry e-textbooks can be limiting because they are written for a generic course. Students often have difficulty identifying the important concepts amid the large quantity of contextual information.

Since the webapps are written in HTML5, students can access them using a web browser on any device (smartphone, tablet, e-reader or traditional computer). The appearance of the web content is optimized for the type of device used to access it. On the other hand, while HTML5 allows for crossing multiple platforms, different web browsers read and render code differently. This continues to be an implementation challenge for us. Students are easily frustrated with technical glitches, especially if they are struggling to learn the concepts.

Multiple Approaches to Facilitate Learning

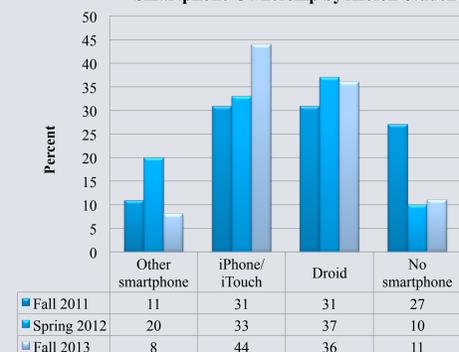
Concise, targeted content and multiple approaches to facilitate understanding are key in helping students learn. Students report using the *AcidBase* webapp in different ways, some as a reference, some as a review, others to test learning through the quizzes and/or the game.



Albion College Demographics

In an informal survey of the students in our introductory courses, we saw similar increases in smartphone ownership and tablet or e-reader ownership. Currently, more than 33% of our students own multiple mobile devices.

Smartphone Ownership by Albion Students



Student Reaction and Assessment

Students in introductory chemistry courses provided feedback on the alpha version of this webapp. While the students perceive the webapp to be an useful aid in helping them learn the material, they have mixed reactions to the idea of using a mobile device for studying chemistry. Their comments:

I bring my iPhone everywhere so I could study chemistry anywhere.

If it was fun and interactive almost in a game format it would be very helpful, but if it was setup like a lecture, it would not be intriguing.

I like the sound it plays when you get something right!

Comments from those who are less interested:

I don't own a smartphone.

I don't get very good Internet service and it would cause more headaches than anything.

Preliminary data from the use of *AcidBase* suggest that students are learning the material faster. 50% said they accessed the webapp within a couple of days of learning about it and 40% said they used it 2 or more times. 64% of the class reported using *AcidBase* for more than 5 minutes with 36% saying they spent more than 10 minutes on it. 23% chose not to use the webapp.

% Correct in Listing the Strong Acids, Spring 2012	CHEM 121, section A (had use of <i>AcidBase</i> webapp)		CHEM 121, section B (did not have access to <i>AcidBase</i> webapp)	
	Perfect	Recognition	Perfect	Recognition
Surprise Quiz 1	41% (7 of 17)	59% (10 of 17)	25% (6 of 24)	29% (7 of 24)
Surprise Quiz 2	67% (12 of 18)	83% (15 of 18)	48% (11 of 23)	65% (15 of 23)
Surprise Quiz 3	81% (13 of 16)	88% (14 of 16)	76% (19 of 25)	92% (23 of 25)

Literature Cited

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