ICT IN TEACHING AND LEARNING CHEMISTRY ACTIVITIES ON THE IPAD

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ABSTRACT

The purpose of this workshop is to equip chemistry educators with practical activities and logistical training to incorporate Information and Communication Technologies (ICT) into their chemistry curriculum. During this workshop, participants will gain hands-on experience using technology such as iPads and a variety of interfaces and sensors (probes) bundled with computer-based activities for chemistry and general science. Participants will gain familiarity with the general chemistry modules, learn about logistics related to implementation, and develop new activities for future use. *[AJCE 4(3), Special Issue, May 2014]*

INTRODUCTION

"We need to understand the learning needs and different learning styles of our students to equip them to contribute to using the tools of chemistry to improve the human condition and that of our environment, and to help each one of them understand the crucial role that chemistry plays in our lives" [1]. However, learning will not happen until the learner is engaged with the subject matter that the instructor intends. The important factors that must always be taken into account when teaching all subjects are (a) what the learner already knows, (b) the abilities of the learner, and (c) the motivation of the learner [2]. Providing students with activities that are appropriate for their ability and encourage engagement will motivate them to learn. The old Chinese proverb remains appropriate for today's classroom and students:

Tell me, I'll forget.
Show me, I'll remember.
Involve me, I'll understand.
Chinese Confucian philosopher Xunzi (312-230 BC)

Objectives

This workshop was intended to involve the participants with the iPad, which is one of the latest Informational and Communications Technology (ICT) tools developed to involve students with their lessons. Technology is today's major link between pedagogy and current, ever-evolving content. With the ability to individualize instruction, provide immediate feedback, and incorporate the three basic learning styles (visual, auditory and tactile) with auditory output, visualization, and manipulation together in a single educational event, the iPad serves well to engage learners. According to a study [3], students tend to be more apt to be on-task and

consequently have a greater chance of success when experiencing online instruction as compared to the traditional classroom presentation.

In this workshop iPad activities were demonstrated in a classroom setting. The overall objective was to use ICT procedures, including iPad apps and the use of Pasco® probeware to collect laboratory data to further develop new personalized activities for future use of the iPad.

Global Learning Objectives:

a) Use ICT to promote and conduct laboratory investigations on a variety of topics appropriate for introductory-level chemistry.
b) Use ICT to collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as data-collecting sensors (probes).
c) Use ICT to identify and explain the process of naming and writing ionic compounds containing main group or transition metals, covalent compounds, acids, and bases, using IUPAC nomenclature rules.
d) Modify classroom modules for demonstration purposes.
e) Develop classroom ready modules to be shared with workshop participants.

DESCRIPTION

The purpose of this workshop is to equip chemical educators with practical activities and logistical training to include ICT into their chemistry curriculum. During this workshop, participants gained hands-on experience using technology such as iPads and a variety of interfaces and sensors (probes) bundled with computer-based activities for chemistry and general science. Participants will gain familiarity with the general chemistry modules, learn about logistics related to implementation, and develop new activities for future use.

Required Materials: iPads, Apps, and Sensors

The workshop was attended by 25 participants. These learners self-selected into groups of 3-5 educators from five countries (Ethiopia, Kenya, Egypt, Russia, and the United States of America). Six iPads preloaded with the following apps were provided to the workshop participants. (Costs reflect prices for fall 2013.)

Name	Seller	Cost
Productivity		
Dropbox	Dropbox Inc.	Free
GoodReader	Good.iWare Ltd	$4.99
Noteshelf	Ramki	$5.99
Penultimate (Alternate to Noteshelf)	Evernote	$0.99
Keynote	Apple	$9.99
Pages	Apple	$9.99
eTextbooks	CourseSmart, LLC	Free
Educreations	Educreations, Inc.	Free
ShowMe	Easel	Free
Graphical	Vernier	$2.99
Chemistry		
Chem Lab	Brian West	$0.99
The Elements (Gray's Periodic Table)	Element Collection, Inc.	$6.99
NOVA Elements	PBS	Free
Molecules	Sunset Lake Software	Free
Mobile HyperChem	Hypercube, Inc.	Free
ChemDoodle Mobile	iChemLabs, LLC	Free
Lewis Dots	Carlo Yuvienco	Free
AtomsInMotion	Atoms In Motion	$2.99
Salts: atoms, ions, electrons	Atoms In Motion	$2.99
GasLawsHDLite	T. J. Fletcher	Free
Elemental	Dotmatics Limited	Free
MahjongChem	Stetson University	Free
ACS Mobile	American Chemical Society	Free

Participants also had opportunities to experience the following Pasco® sensor: Advanced Chemistry Sensor, which includes a temperature probe, pH probe, conductivity probe, and a built-in pressure probe. Some of the laboratory activities are structured and others unstructured.

Schedule and Activities

Intended participants: Educators interested in teaching laboratories concerned with chemistry concepts. Science teachers at the pre-university and university levels (e.g., secondary teachers, university professors, lecturers, staff members, etc.)

Objectives:

(1) Use ICT to promote and conduct laboratory investigations on a variety of topics.

(2) Use ICT to collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as data-collecting probes.

(3) Use ICT to identify and explain the process of naming ionic compounds containing main group or transition metals, covalent compounds, acids, and bases, using IUPAC nomenclature rules.

(4) Use ICT to write the chemical formulae of common ionic and covalent compounds, acids, and bases.

(5) Participants will gain hands-on experience using the iPads, gain familiarity with the general chemistry modules, learn about logistics related to implementation, and develop new activities for future uses of the iPad.

(6) Instructors will share classroom-ready modules the with workshop participants. We will also discuss how these activities can be modified for demonstration purposes.

(7) Participants will develop new modules; these new activities can be incorporated into classes after the workshop is complete.

Agenda of Activities

0900-0930 Opening remarks Bob Shelton

Session -1
0930-1030 Active Learning with Project iPad Bob Shelton

1030-1045 Break Organizers

Session-2
1045-1145 Experience the Modules Bob Shelton
MODULE 1: Understanding the Scientific Method
MODULE 2: Flash activities on the iPad
MODULE 3: Element Scavenger Hunt
MODULE 4: Writing chemical formulas from names

1200-1330 Lunch Break Organizers

Session-3
1330-1430 Explore the available Apps Bob Shelton

1430-1445 Break Organizers

Session -4
1445-1545 Digital Laboratory Denis Zhilin

Session-5
1545-1630 Developing implementation plans Bob Shelton
Question/Answers/Wrap-up

Session-6
1630-1700 Assessment Participants

LIMITATIONS

ICT tools are becoming more assessable and less expensive as supply and demand benefits increased classroom use. As compared to the updating of a static textbook, apps appropriate for teaching concepts and laboratory probeware of sensors for collecting data have several advantages beyond cost. Yes, iPads do become outdated but even older versions can be passed down to either the lower levels or to classrooms that lack in ICT tools. Internet access

with appropriate bandwidth is always problematic, but as long as the faculty is committed and willing to accept change, issues can be overcome and a positive experience provided to your students.

DIGITAL REVOLUTION

Interactions that provide learners with immediate performance feedback will engage and hence motivate students. Visualizations and animations go well beyond what has been possible in the past. As new apps and sensors become available, changes are easy to make. Technology does not make education better but what is provided is the platform for making education more meaningful for the learners involved.

REFERENCES

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3. Schoenfeld-Tacher, R.; McConnell, S.; Graham, M. (2001). Do no harm—A comparison of the effects of on-line vs. traditional delivery media. *J Sci Educ & Tech*, *10*, 257-265.