



A Primer on the Use of iPad for Science Teaching and Learning

Version 1.0

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Introduction

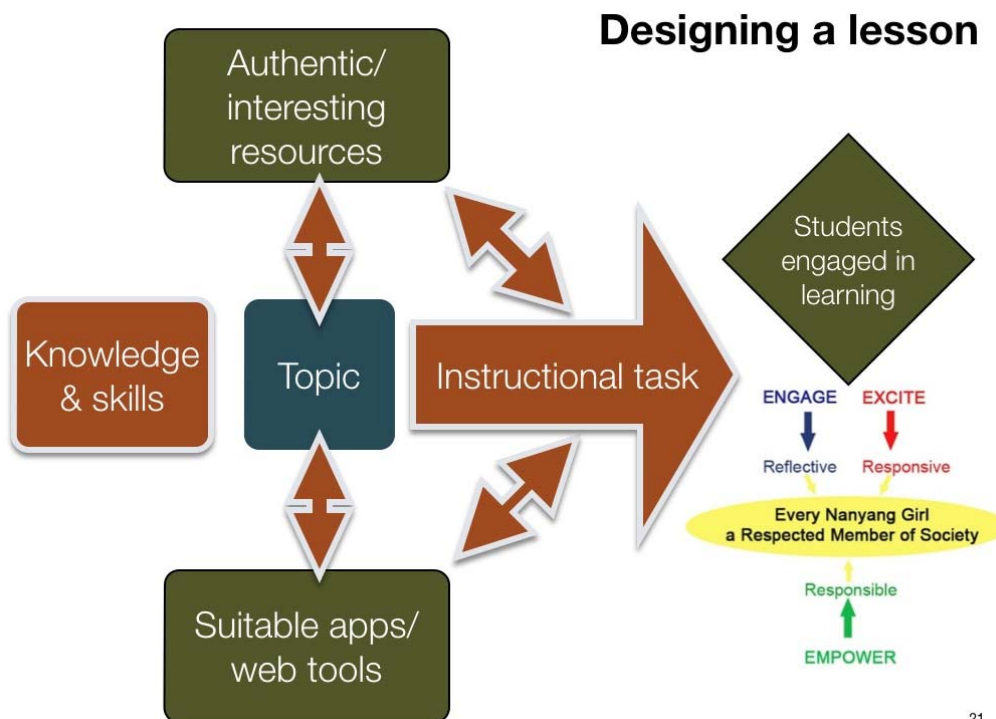
- With the convergence of learning and technology, Sharples, Taylor, & Vavoula (2007) noted that "education in the mobile age does not replace formal education, ...; rather it offers a way to extend the support of learning outside the classroom, to the conversations and interactions of everyday life".
- The iPad was chosen over other devices based on the following features: quick start-up and shut down, long battery life, light weight (Wifi + 3G model: 0.73 kg for iPad and 0.607 g for iPad 2) and suitable display for multimedia and inputs (P21C2, 2011a).
- A school-based learning framework for P21C² which Engage, Excite and Empower the learners (see below) was used to design the lessons (P21C2, 2011b). The framework seeks to enhance the quality of learning with several instructional strategies.

Achieving 3Rs through P21C²



Designing lessons

- Subject teachers design lessons to tap on the affordances of the iPad to enhance teaching and learning, especially as a device for mobile learning anywhere, anytime (with wifi connection).
- For each topic, interesting and authentic resources may be used in conjunction with suitable and interesting apps (software applications from the Apple Store) and web tools to design lessons as illustrated below.



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iPad Apps to Get

- **Appendix A** shows an overview of the apps to get, organized by the main categories of Creating office documents, File management, Image handling, Learning tools and Content (both Reference and Subject-based apps). This is by no means exhaustive and new apps are being developed all the time.

Teaching and Learning Resources

- Some examples of how lesson resources, apps and web tools are used in science lessons are shown in the following tables based on the affordances of the iPad.

General

Topics	Resource Type	Role of Resource	Learning framework
All topics	wiki: pbworks.com	Upload lesson materials and resources for student access; Provide forum discussion by students on teacher-directed topics Provide sharing platform for student-directed queries	Online resources & collaboration
All topics	App: eClicker	Use wiki to deliver instant quiz and feedback	Formative assessment and feedback

Topics	Resource Type	Role of Resource	Learning framework
Most topics	App: YouTube	Stream video clips from YouTube	Real life connection and application
All topics	App: Dropbox	For students to submit work and passing files from teacher to student	
All topics	App: Total Recall	Create mind maps	Student construction of knowledge
All topics, experiments, demonstrations	App: Camera using camera on iPad2	Capture video clip of laboratory experiments, e.g. a physics demonstration, motion of a ball	

Biology

Topics	Resource Type	Role of Resource	Learning framework
Biology SIA	Wikispace.com	Students' SIA oral presentation videos can be posted on the wiki. Classmates can view these videos online. Students can post comments on the videos (ongoing project)	Real life connection and application
Most topics	School LMS	Students to access learning resources (in pdf format)	
Most topics	App: YouTube	Students view topic-related videos after class.	
Most topics	Internet access	Students access websites related to biology assignments in class as part of class discussion	
Cells	App: 3D Cell	Cell simulation and interactive learning resource	
Transport in Cells	Movie Player	Show video clips on topic	
Digestion	App: Frog Dissection	Interactive simulation and learning resource	
Microorganisms	Movie Player	Show video clips on topic	
MicroBiology	App: Basic Techniques in MicroBiology	Interactive simulation and learning resource	
General Biology	Wikispaces: BioBull	Biology portal for all course material	
All science topics	Science 360	Resource (interactive information, videos and news)	

Chemistry

Topics	Resource Type	Role of Resource	Learning framework
Elements, Atomic Structure and Periodic Table	App: Periodic Table	Shows the categorization of metal, non-metal and metalloid Provides information on the elements: proton number, mass number Shows the states of elements at different temperatures	
Elements, Atomic	App: Elementals	A simplified version of the Periodic Table App that is more attractive to students	

Structure and Periodic Table			
Elements, Atomic Structure and Periodic Table	App: The Elements	An app that provides more comprehensive information on Periodic Table than the periodic table app	
General	wiki: pbworks.com	Discussion platform for students to ask questions	
Most topics	School LMS	Students to access learning resources	

Physics

Topics	Resource Type	Role of Resource	Learning framework
Kinematics	App: Vernier Video Physics	Students get to analyse their own video clips to explore the relationship between the motion they observe and the V-t graph that results.	Student construction of knowledge
Vector Addition	App: Keynote	Use keynote draw function to explore how vectors are added together graphically.	Student construction of knowledge
Measurement	App: PreSize	Explore using vernier calipers to take measurements.	
Units	App: Convert Units	Conversion of units for most physical quantities	
Time	wiki: pbworks.com	Sharing by students on specific teacher-assigned questions based on internet research done.	Real life connection and application
Time: simple pendulum	App: Spring 'n Things	Simulation of a simple pendulum with control of variables like gravity, air resistance	
Time	App: Metronome	Example of application of period and frequency	
Time	App: SPARKvue	Acceleration vs time graph - detection of vibrations by accelerometer in iPad	
Temperature	wiki: pbworks.com	Post mind maps created by students for sharing and feedback	Online collaboration
Transfer of Thermal Energy	App: Photo Booth - using camera on iPad2	Using "thermal camera" mode to highlight "thermal radiation"	
Thermal properties	App: BounceBounce	Simulation of behaviour of molecules in a liquid	
Beyond syllabus enrichment: Tsunami	App: Keynote App: YouTube	Create slides to inform students of science and impact of tsunami Show animation of tsunami	Real life connection and application
Beyond syllabus enrichment: Nuclear Crisis	App: Keynote App: Mobile REMM	Create slides to inform students of science and impact of tsunami Provide information of types of radioactive elements, effect of radiation on human beings, type of treatment	Real life connection and application
Beyond syllabus enrichment: Exoplanets	Apps: NASA, Planets, Exoplanets, TED Internet resource Physics Ethics	NASA: Provides updated information, images and videos of space exploration; Planets: Provides information on planets Exoplanets: provides database of exoplanets and correlation diagrams; TED: streams video clips (also allow video downloads) of inspiring speakers. Group discussion on physics ethics of "space exploration"	Real life connection and application Collaboration

Survey Results

- At the end of the first term of teaching the secondary 1 classes in the iPad pilot project, a survey was conducted to evaluate the students' response to the use of the iPad in their learning. A total of 29 responses (out of 58) were obtained through an online survey.
- Some of the key findings (Ang, 2011) include:
 1. Most of the students are comfortable with the use of the iPad, can easily follow the teacher's instructions in using new apps, and can easily organize subject materials on their iPad.
 2. Most of the students like to use the iPad for learning, feel the iPad allows them to share ideas and asks questions easily online, use the iPad not just for learning school subjects.
 3. Key difficulties raised by students include: making annotations (taking notes) using the iPad, managing files, and the availability of online access and distraction from meaningful learning.
 4. Suggestions for improvement from students include: use of more educational apps with sufficient time for familiarization, more online discussions, and extending the use of the iPad to research, projects, lab experiments and assessment.

Approach To Adopting the iPad

- For teachers who have to adopt the use of the iPad sometime in the future, some ideas to keep in mind:
 1. The iPad is not a personal computer, and is unable to replace it at the moment.
 2. The iPad has features and functions that are different from the personal computer.
 3. It takes time to familiarize with iPad features and functions (both as a working tool and as an educational tool) as well as to build up your resources. The earlier you start, the better.
 4. During term time, you have the chance to explore the creative possibilities of its use in class, in terms of pedagogical and assessment practices.
 5. The experience of actual use would help in your review of curriculum materials in preparation for 2012, in order to integrate these with the affordances of the iPad.
 6. Read up on basic documentation materials (P21C2, 2011a) provided for students in the pilot project.
 7. Anticipate students' concerns and prepare strategies to scaffold students' learning using this mobile device.
 8. The internet is a good source of technical support as well as educational resources (including suitable apps) in your learning journey to adopt the use of the iPad in teaching and learning.

References

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Lesson resources shared by:

- *Physics:* Joo Liak & Mark Shone
- *Chemistry:* Weixuan & Eric Tan
- *Biology:* John Lee & Benny Koh

Compiled by Joo Liak

Appendix A: Overview of Apps to Get

