Use of Tablet Technology in the Classroom
NSW Curriculum and Learning Innovation Centre

A Partnership between Sydney Region and the NSW Curriculum and Learning Innovation Centre

Phase 1 iPad Trial

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Executive Summary

Origins and Purpose of the Evaluation

Sydney Region has sought to provide schools with evidence-based information regarding the use of iPads in the classroom. The Region purchased 75 iPads and distributed them to 3 primary schools during semester 2 2011. A partnership was then formed with the NSW Curriculum Learning and Innovation Centre (CLIC) to scope an evaluation of their use. Key focus areas for this evaluation were:

- providing information to schools to allow informed purchasing decisions
- identifying critical ramifications of tablet technologies on teaching and learning
- identifying appropriate opportunities for professional learning for teachers

Another, less significant focus was ascertaining parent questions and concerns about young students' use of mobile touch devices in out-of-school contexts.

Background and Objectives

Mobile touch-screen technologies, also referred to as tablet technologies, have introduced a new generation of educational tools that afford creative use and instant access to a wealth of online resources. They have been touted as 'revolutionary' devices that hold great potential for transforming learning.

One of the chief benefits of mobile devices is that they enable learning anywhere, anytime. This allows a shift away from the industrial era model where the classroom is the central place of learning driven by the teacher and limited to instruction within the school day. In deploying mobile devices, the teacher is no longer at the centre of the learning process and the instructional time can transcend the school day.

The portability of mobile devices provides users with access to a broader and more flexible source of learning materials than what is offered in current classroom settings. With over 500 000 apps (mobile applications) available to download from the App Store teachers have access to an abundance of learning materials for use on mobile devices such as the iPad.

There is emerging evidence to suggest that apps have a significant potential to support the learning process (Shuler, 2012). However, to date, there is a paucity of research to confirm that assertions about tablet technologies are actualised in real classroom settings. Limited research has been conducted on young students' use of touch screen devices and their educational impact. Research has also failed to keep pace with the emergence of apps despite an 'app culture' emerging since the inception of the iPhone in 2007 (Purcell, Entner & Henderson, 2010; The NPD Group, 2010). There is a dearth of empirical evidence to confirm that educational apps are valuable for learning despite the preponderance of apps marketed as 'educational' (Shuler, 2012).

This evaluation seeks to provide evidence-based information about the practical and technical implications of deploying mobile devices (iPads) in classroom environments and their subsequent impact on teaching and learning. In addition, it explores students' and teachers' perceptions and use of mobile devices and provides a systematic analysis and classification of educational apps. It seeks to contribute to the emerging body of literature on the effective implementation of tablet technologies in classroom settings.

In order to address the inadequacies in the existing corpus of research and tackle the lack of practical information about implementing mobile devices in school settings, Sydney Region conducted an iPad trial. This evaluation reports the findings of this trial, conducted in 2011 in Terms 3 and 4 in three primary schools in the Sydney region. The trial period included approximately eighteen weeks of instructional time with the iPads. The genesis of this trial was the desire expressed by many schools in the Sydney Region and many other areas of New South Wales to implement iPads into their schools. Many schools have purchased significant numbers of iPads and other mobile devices without being aware of the deployment implications or pedagogical ramifications. The objective of this trial was to provide consistent advice regarding:

(i)   The implications of mobile devices for teaching and learning; and

(ii) The technical and logistical procedures for effective deployment and management of the devices in school settings, primarily NSW Department of Education and Communities (DEC) schools.

Methodology

A qualitative research study was conducted with three schools, five teachers, over 90 students and 75 iPads were used. A mixed method approach was implemented with a multi-setting case study comprising the data set. Multiple data sources were used to provide descriptive information about the technical and logistical enactment of iPads and to identify the implications for teaching and learning. A comprehensive data set was provided: lesson observations of the iPads in use, teacher and student online surveys; teacher, student, principal and parent semi-structured interviews; digital work samples; teacher and student blogs; and an 'app matrix'. After repeated viewings of the multiple data sources, the evaluator identified recurring themes which were recorded in a theme matrix.

Key Findings

Considering the small sample size and brief duration of the trial, readers are cautioned against generalising or interpreting the findings as policy recommendations. However, this evaluation provides important insights into how one type of mobile device, an iPad, was deployed and utilised in primary classrooms and their impact on teaching and learning. It is anticipated that this document will provide evidence-based information and guidance on how to best plan for and implement iPads in NSW DEC primary school contexts and other comparable learning environments. The results of this trial suggest several interesting insights.

Key findings relate to two broad areas:

1.   Teaching and learning implications: teacher planning and preparation, learning content, student learning, pedagogy and parents' concerns and needs; and

2.   Technical and logistical considerations

Teacher planning and preparation

It was acknowledged that the iPad placed additional demands on teachers' planning and preparation time. Significant time was dedicated to evaluating and procuring educational apps, determining relevance to the NSW curriculum and then installing these on individual student devices. The iPads were utilised in a

myriad of ways across most KLAs, but there was a tendency for the teachers to map the use of the iPad to the existing curriculum. This could be regarded as an antiquated approach in some instances.

Learning Content

Scrutiny of the apps utilised in the trial revealed that there was some alignment between the learning content prescribed by NSW syllabus documents and apps available in the iTunes App Store. Examination revealed that 43% were classified as instructive, games-based apps, despite teachers stating that they preferred content-creation, 'productivity' apps. The teachers suggested that the use of instructive games-based apps was suitable for aspects of the curriculum that demanded the rote memorisation of facts such as spelling and multiplication facts. The provision of instant feedback, an element of competition and the ability to prescribe different levels within games-based apps, appealed to both the students and teachers. However, teachers believed that optimal use of the iPads was attained when students used content-creation 'productivity' apps as this developed higher order thinking skills and provided creative and individualised opportunities for students to express their understanding. The content-creation apps also provided opportunities for increased collaboration amongst students. An example of a professional piece of work created by a student from Hovell Public School is showcased in Video 1. This video highlights how a Year 3 student used the iPad and an array of its peripheral technologies and software applications (voice recorder, camera, screen recorder) to create a digital work sample that accurately conveyed her understanding and recall of the text Are we there yet?

Video 1. A student work sample created using the Puppet Pals app, an example of a content-creation app

Student Learning

The pilot study found that many of the design features of the iPad offered learning affordances. Findings indicated that both teachers and students believed the iPads supported and enhanced student learning. These affordances were actualised because of the ways in which the teachers deployed the devices and embedded them in authentic and rich learning experiences, as highlighted in Video 2. In summary, this trial provided evidence to support claims that iPads enhance engagement and motivation, improve face-to-face and online collaboration amongst students, personalise learning and improve learning outcomes. Teachers ascribed these gains to many factors: the portability of the device; teachers' ability to easily differentiate instruction to cater for individual learning needs and preferences; the ease with which students could create

professional and aesthetic digital artefacts and appropriate apps to scaffold and compensate for students' emerging skills, for example, the predictive text function to support spelling skills; a strong sense of student ownership of learning; and the adoption of the metaphor that the iPad was a 'tool for learning'. The integration of a range of peripheral technologies within one device such as still and video camera, voice recorder, internet access, its intuitive design and simple interface and integration of apps, touch screen function and multimedia capabilities were also identified as distinguishing attributes of the iPad that facilitated learning.

Video 2. Students at Hovell Public School used i-nigma and GarageBand apps to engage in authentic learning experiences

The quick start-up, the mobility of the device and the integration of a range of peripheral technologies (still and video camera, Internet access and voice recorder) were sighted as the chief affordances of iPads which distinguished these devices from laptops or computers.

Pedagogy

As elucidated in Video 3, teachers involved in the trial reported that they adopted more student-centred and innovative approaches when using the iPad. There was evidence that teachers used the iPads to modify and redefine student leaning, by employing transformative pedagogical models. They also identified that the synchronous use of a range of peripheral devices such as a video and still camera and voice recording facilities, afforded new opportunities for students to demonstrate their learning by using a range of multimedia. Using the iPad also resulted in an increase in students sharing digital work, via the interactive whiteboard (IWB) in many instances and this provided opportunities for the teacher to provide ongoing, just-in-time feedback and also collect cumulative assessment data. As an intuitive device, the iPad acted as a catalyst for more creative pursuits and exploration of new pedagogical approaches, as identified in Video 3.

Video 3. Teachers explain how they explored more innovative pedagogies when using the iPads

'The iPad is a consumer device: When you get frustrated with how the iPads work in a shared environment, remember that you are shoe horning a device that's designed for a single user into a shared classroom setup. There will be sharing issues, and until Apple addresses them, you will have to work around the issues' (Hasic, 2011, p. 8).

Technical and logistical considerations

This pilot study has provided some important caveats which are particularly relevant when considering the implementation of iPads within NSW DEC contexts, (as exemplified in Video 4.) iPads are primarily designed as a single-consumer device which has significant ramifications for school deployment. These include Internet connectivity with a proxy server, restricted Internet access and exporting student work created on a device. Management time associated with setting up the devices and establishing iTunes accounts were identified as potential barriers to future users.

The trial identified important school infrastructure considerations related to wireless devices, connecting iPads to interactive whiteboards (IWBs) and the purchase of peripheral devices such as protective covers and headphones. Findings also indicate that there are significant decisions to be made regarding the most time efficient methods of installing and updating apps in accordance with iTunes licensing regulations. The trial also illuminated the necessary components for future teacher professional learning regarding the use of mobile devices. As the iPad is an intuitive device, the emphasis needs to be on pedagogical approaches and task design, rather than on the technical aspects of using the device. Further technical and logistical information about deploying iPads in DEC schools can be found in the document 'Sydney Region Apple iPad 2 trial'.

Video 4. Steve, Principal at Hovell Public School, discusses the technical issues associated with deploying iPads at his school

It is important to note that given the transient nature of technology and the rapid pace of advancements, some of the findings in this report may no longer be current at the time of publication, as new operating systems often ameliorate technical and logistical issues. It is also critical to stress that whilst this report focuses on the iPad as a touch device, many of the findings could be equally transferable to other touch or tablet devices, particularly those related to curriculum, planning and preparation and student learning and pedagogy.

Key Recommendations

Key recommendations based on this evaluation are summarised below. These synthesise the recommendations and implications for teaching and learning and further research as detailed in the body of the full report.

School Administration

Schools must make careful decisions about deploying and sharing iPads across classrooms. As they are primarily designed as a single-consumer device and not supported centrally by DEC (at the time of publication of the evaluation), alternative technical and support models need to be considered prior to their implementation.

- Schools must budget for additional costs beyond the initial outlay for iPad devices to ensure they are effectively implemented in the classroom. Infrastructure costs and teacher professional learning are two essential components.

- Schools and administrators need to carefully consider how to store and share student content created on mobile devices.

Teaching and Learning

iPads needs to be considered as an educational tool that can support learning. They have the potential to afford new opportunities for learning if accompanied by student-centred pedagogies and authentic learning experiences. Given the preponderance of apps available in the iTunes App Store, teachers need to make critical and informed decisions when selecting apps.

- An app selection rubric that provides teachers with explicit criteria against which to judge the effectiveness of an app should be developed and disseminated to teachers.

- The development of a dynamic, online app database to provide NSW teachers with current information about educational apps and their relevance for learning could be established.

- A collaborative environment where teachers can comment on each app's educational viability and perhaps suggest how it has been used in a learning context may be helpful.

While this evaluation illuminated the effectiveness of instructive, games-based apps for promoting students' recall of facts, teachers are encouraged to source content-creation 'productivity' apps. Instructive, drill-and-practice game apps should be used sparingly to aid students' recall of facts requiring rote memorisation such as spelling patterns and rules, multiplication tables, addition and subtraction facts. Content-creation apps are characterised by their more open ended design and it is postulated that they foster higher levels of thinking and engagement, than apps with an instructive pedagogical design. Teachers should also consider using iTunes U and the newly released iBooks app to seek educational resources and digital materials rather than relying solely on apps from the iTunes App Store.

The deployment of mobile devices in the classroom demands the overt teaching of 21st century skills, as presently advocated by the National Curriculum.

- The explicit teaching of critical literacy and visual literacy skills is paramount given the periods of time students spend using digital media and their exposure to digital images.

- Students need to develop a comprehensive understanding of copyright regulations, particularly as they pertain to generating and publishing digital content.

Parents

Parents need evidence-based information about the safe and effective use of mobile devices, where to seek quality apps, and suggestions for ways these devices can be used at home to support learning. In particular, parents expressed a need for alternatives to 'game' apps, with a preference for their children to use learning apps. Parents are also looking for information about the impact of these devices on student learning and development.

Professional Learning

As they are an intuitive device, limited technical training is required to implement iPads, apart from explicit instructions on how to set-up the devices and iTunes accounts. However, professional learning should also encourage teachers to consider the pedagogical approaches that best optimise the iPad's use in the classroom. Professional learning opportunities also need to focus on directing teachers how to locate and appraise the educational value of apps.

- Creation of a systematic process for evaluating apps is recommended (as stated previously, the app selection rubric may assist in this process).

- Teacher education on copyright regulations within a digital environment is critical to enabling them to provide students with pertinent 21st century skills.

- Explicit training may be required by DEC curriculum advisors on the best ways to implement iPads in their area of expertise as there is great variation in how the iPads are implemented across the curriculum and the availability of apps for specific subject areas.

Research and Development

Further empirical research is required to quantify the benefits of mobile technologies on student learning outcomes. Longitudinal and empirical data is required to explore the broader educational impact of iPads on student learning. Further trials should be conducted with early years students and secondary students to determine if the findings from this study are replicated with a broader range of students. Given the release of Apple's latest educational offerings in January 2012—iTunes U app, iBooks and iBooks Author—further research is required to examine their effectiveness in a classroom. In particular, the alignment of these devices with student-centred approaches warrants further investigation.

There is a great dire need for apps that go beyond the drill-and-practice and games-based paradigms. Developers need to design apps that are vastly different to the design of 'skill-and-drill' software that currently dominates much of the educational market. Touch devices present unique opportunities for enhancing students' understandings of abstract concepts through the presentation of dynamic representations, opportunities for embodied learning and the inclusion of interactive elements.

- App developers need to consider the design and production of content-creation constructive apps, particularly for schooling contexts. Apps that provide tools for authoring, manipulation and communication are required.

- App developers need to consider piloting apps with students before finalising their design.

- App developers need to design apps which capitalise on the unique functionality and capabilities of an iPad such as the multi-touch gestures feature, sweep-action on-screen, gyroscope and accelerometer.

Glossary

Word	Definition
accelerometer	'With the built-in accelerometer, you can rotate iPad to portrait or landscape or even upside down, and whatever you're watching, reading or seeing adjusts to fit the display." (Apple, 2011, source: http://www. apple.com/au/ipad/features/)
access point	iPads need to connect to a wireless access point (WAP) using WiFi. The WAP usually connects to a router using a wired network and relays data between iPads connected to the network.
airplay	AirPlay allows users the ability to wirelessly stream photos, videos and music from iPads to a television using Apple TV (2nd generation).
apps	An 'app' is an 'application' which is a mini-program that can be downloaded onto an iPad from the iTunes App Store. Some apps are free, while others need to be purchased, costing from $0.99 per app and upwards.
augmented reality	Elements from the real world and physical environment are augmented by sensory input from a device (such as sound or graphics).
blogs	The word 'blog' stands for a 'web log'. Blogs are typically described as an online journal published on the world wide web. They can contain digital work of an individual or a group of people and may include videos, digital work samples and photographs in addition to text. Depending on security settings some blogs allow readers to leave comments.
cloud computing	Cloud computing involves the delivery of computer services via a web browser or app, with data stored on servers in a remote location. Many Web 2.0 tools are examples of 'cloud computing'.
cloud storage	Cloud storage is an online data storage system accessed via the Internet and hosted by a third party. iCloud and DropBox are two popular examples of cloud storage.
constructive apps	*Constructive apps* are characterised by an open-ended design that allows users to create their own content or digital artefact using the app. Musical apps, presentation apps and drawing apps are emblematic of *constructive apps*. They are also referred to as 'productivity' apps.
embodied learning	Embodied learning is an approach to learning developed by cognitive scientists. It is based on the premise that knowledge and thinking processes are inextricably connected to physical interactions with the world (Clark, 1999; Wilson, 2002). Preliminary research indicates that physical interaction with a mobile device may assist students in developing more robust conceptual understandings.
gyroscope	A function of the iPad 2 that senses movement and rotation of the device. It works in tandem with the accelerometer to sense motion. It is useful for movement games and augmented reality.
instructive apps	*Instructive* apps have elements of 'drill-and-practice' design whereby the app delivers a predetermined 'task' which elicits a homogenous response from the user. These apps require minimal cognitive investment on behalf of the learner. Most game apps are classified as *instructive* apps.
iTunes U	iTunes U allows users to access courses from universities and other education institutions throughout the world. It provides free access to educational content. In January 2012, Apple released a free iTunes U app for the iPad.

Word	Definition
manipulable apps	*Manipulable apps* allow for guided discovery and experimentation within a pre-determined context or framework. These apps require more cognitive involvement than *instructive apps* but less than *constructive apps*.
multi-touch gestures	As a 'touch device' the iPad can respond to multiple touches simultaneously. The device transforms a user's taps, swipes, pinches, and flicks into lifelike actions.
peripheral technologies	The iPad has several additional technologies embedded in the device including a digital camera, video camera and voice recorder. No additional cables or software are required for these devices to operate.
podcast	A podcast is a digital media that consists of either audio or video files that are subscribed to and/or downloaded via web syndication (Internet or iTunes).
Posterous spaces	Posterous Spaces is a website that allows users the ability to share and upload their digital data such as photos and videos anywhere, anytime. The website can be accessed via https://posterous.com/ .
QR codes	'QR' is the acronym for 'quick response'. A QR code is similar to a barcode used by retailers. These codes can be read by a camera-enabled smartphone or device (such as an iPad) and link to multimedia content such as a website or text document.
smartphone	A smartphone is a mobile phone based on a computing platform that offers users computer functions and Internet access.
sweep action on-screen	The sweep-action is one of the multi-touch functions that can be used on an iPad.
synching station	A synching station describes the configuration whereby an iPad is connected to a computer or laptop via a USB. There are now commercial synching carts available for purchase, which allow multiple iPads to be stored, charged, synched and transported, similar to using a trolley system.
tablet technologies	'Tablet technologies' is a generic term to describe a variety of different mobile computers that either have a touch-screen or a stylus-enabled interface.
VGA adapter	Video graphics array (VGA) mirrors everything displayed on the iPad2 on a bigger screen: a VGA-equipped TV, monitor or external projector for video mirroring.
Web 2.0 tools	Web 2.0 technologies describe a group of web-based technologies that allow users to not only retrieve information from the Internet (Web 1.0) but also to create and share content and collaborate with other users. Blogs, wikis, podcasts, social media sites (Facebook, Twitter) and video sharing sites (YouTube) are examples of Web 2.0 tools.
wiki	A wiki is a website where users can add, modify and delete content using a web browser. Wikis are typically created collaboratively by multiple users.

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