iPads in higher education—Hype and hope

ARTICLE in BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY · FEBRUARY 2014
Impact Factor: 1.54 · DOI: 10.1111/bjet.12137

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iPads in higher education—Hype and hope

Lemai Nguyen, Siew Mee Barton and Linh Thuy Nguyen

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Abstract
This paper systematically reviews current research on using iPads in the higher education sector. Since the release of iPads by Apple in 2010, this new technology has been quickly adopted everywhere, especially by the younger generation and professionals. We were motivated to find out how iPads have been adopted for use in the higher education sector. We searched for and collected all the peer-reviewed publications in conference proceedings and scholarly journals in EBSCOhost, Scopus, Informit A+ Education, ProQuest Academic Research Library and Google Scholar, and conducted a content analysis of the full-text papers collected. The results show that the reported studies are at an early exploratory stage from both the student and staff perspectives. From the student perspective, the iPad was found to enhance the learning experience but not necessarily lead to better learning outcomes. From the staff perspective, the iPad was found to offer benefits associated with electronic information dissemination, academic administration and professional development support. A finding common to both perspectives is that while the iPad has the potential to offer benefits to the academics and students who were found to be eager adopters of this technology, it is not clear how best to align and integrate it within the academic programmes and workflows, and how best to manage it as a resource within a university’s organisational setting.

Introduction
The iPad is a popular touch screen tablet computer. Since the release of iPads by Apple in 2010, this emerging technology has been quickly adopted all around the world. Gartner research group forecasted that iPad would dominate tablet sales until 2015 despite Android’s and Windows’ entry into the media tablet market (Gartner, 2011). The fast and widespread adoption of iPads triggers many questions for business and service providers, eg, how best to deliver and market their products and services, and how to communicate with their customers using iPads and the applications (apps) running on iPads. This paper specifically looks at the exploration of the uses of iPads rather than other tablet devices such as Surface, Palm, Galaxy and Android-based devices because of the fast and wide uptake of iPads among the younger generation of students and academics in higher education.

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The iPad has been adopted especially by the younger generation and professionals. A survey conducted by Nielsen (2010) showed that iPad owners are skewed towards younger males: 65% of the 400 iPad users are male and 63% are under the age of 35. The demographics of iPad users make it sensible to introduce and integrate iPads in higher education. Since then, many education service providers have started exploring how to use iPads for teaching and learning in this ever-changing digital mobile learning (m-learning) world. m-Learning, as stated by Dorman (2007, p. 6), is an ever-changing digital world in which “knowledge, power, and productive capability will be more dispersed than at any time in our history—a world where value creation will be fast, fluid, and persistently disruptive, a world where only the connected will survive.”

Practitioner Notes
What is already known about this topic

- Mobile learning has the potential to transform higher education through the adoption of mobile devices.
- The popular adoption of iPad, a tablet computer, and its mobile applications among young adults and professionals sparks research in exploring iPad in higher education.
- There is a need for a systematic review of current (up-to-date) research to inform future research in emerging mobile technologies in higher education.

What this paper adds

- This paper reviews the previous research on iPad use in higher education and provides an accumulated understanding of what has been done and highlights areas for further research.
- Current research is still at an early exploratory stage. Many higher education service providers are eager to adopt and are trying the new technology without building a structured, pedagogical approach to aligning its use within their academic programmes.
- Acceptance: students were found to be positive about using iPad, and academics were interested but more sceptical in their initial explorations.
- Lack of maturity: the iPad was used in different ways by different users, mainly as a tool to access course resource and library databases, a note-taking tool, a communication tool, a presentation/projection device and as a device for online assessment. iPad was found to be useful in engaging students with the learning materials, but its association with learning outcome was inconclusive. Academics were not clear about their roles and need a clear pedagogical approach to mobile learning.
- Research shortcomings: longitudinal and large-scale studies (and evaluations) are needed.

Implications for practice and/or policy

- Need for more innovative pedagogical designs of curricula using mobile devices and mobile applications to increase the learning outcome as well as enhancing the students’ experience.
- Need for university policies in regard to motivation, engagement, guidance and technology support for staff and students in their adoption of emerging mobile technologies for education, especially to be proactive in the coming area of cloud learning.
This connected world is not constrained by physical space or time (Ng, Nicholas, Loke & Torabi, 2010). Earlier, O’Malley et al (2003, p. 6) predicted advantages of m-learning as “...the learner is not at a fixed, predetermined location... the learner takes advantage of learning opportunities offered by mobile technologies.” Indeed, m-learning allows students to access education in a flexible and seamless manner, at any time and any place, which substantially enhances their learning experience. Moreover, m-learning offers the potential for significant innovation in the delivery of even greater flexible education by allowing for the personalisation and customisation of the student learning experience (Johnson, Smith, Willis, Levine & Haywood, 2011).

Mobile devices and apps are critical in the provision and adoption of m-learning and could be used across devices (Mang & Wardley, 2012). MobiThinking (2013) summarises findings from various research and consulting companies that Apple has the highest ranking in mobile apps store and apps. In 2012, there are over 20 000 educational apps for all kinds of learners in the App Store (Apple Inc, 2012). Hence, users are already familiar with iOS operating system from using their Apple iPhone and iPad devices. Not surprisingly, there have been many attempts to explore how iPads could be used in the higher education sector around the world, eg, Lindsey (2011) and Brand, Kinash, Mathew and Kordyban (2011). This paper aims to systematically review studies in using iPads in higher education and develop a comprehensive summation and synthesis of the findings.

The paper is structured as follows. The second section describes our research approach. The third section presents the findings. Finally, the fourth section discusses the findings and concludes the paper.

Research approach
Systematic literature review
A systematic literature review (SLR) was chosen for this project because it is relevant to address the research question: What is the current state of research in exploring iPads for use in higher education?

SLR in its own right is a research approach and can be defined as a rigorous, comprehensive and explicit approach to reviewing, identifying, appraising, synthesising and summarising the existing body of the published scholarly work in a specific research topic (Cook, Mulrow & Haynes, 1997; Fink, 2005). This approach is far different from the “traditional” or “conventional” literature review, in which the researchers often take a narrative approach to qualitatively reviewing a section of the literature from a specific perspective to justify their own research. SLR is characterised by a comprehensive scope of sources, an explicit search strategy, criterion-based selection, rigorous and systematic appraisal, and a qualitative summary based on a content analysis (Cook et al, 1997). Therefore, SLR offers potential benefits in the field of information systems (IS) research (Ellis & Levy, 2006; Okoli & Schabram, 2010). Okoli and Schabram (2010) described a step-by-step process of conducting an SRL. The steps include planning (agree on the purpose and protocol), selection (searching for and screening papers), extraction (extract content for analysis) and execution (analysis and reporting).

Previous applications of SLR can be found in IS research. For example, Randell, Mitchell, Dowding, Cullum and Thompson (2007) undertook an SLR to gain an evidence-based understanding of impacts of health ISs. From 7761 papers found on online databases, they selected 9 papers reporting 8 empirical studies for a detailed review. Sparrow, Nguyen and Cybulski (2006) undertook an SLR and identified trends in Requirements Engineering research and mini-paradigm shifts as well as research gaps in the discipline. Kitchenham et al (2009) reviewed 20 applications of SRL in IS development research and recommended this research approach as suitable and effective for aggregating and synthesising findings in evidence-based software engineering.
SLR, therefore, was deemed relevant and enabled the researchers to collect all the research published to date on exploring uses of iPads, with a view to gaining a good understanding of the current state of progress and to inform further research in m-learning and teaching.

Data collection
We followed all the SLR research steps described by Okoli and Schabram (2010). The following databases were searched up to March 2013: EBSCOhost (Academic Search Complete, Communication & Mass Media Complete, e-Journal, Computers & Applied Sciences, Education Research Complete, Education Resources Information Center and Library, Information Science & Technology Abstracts), Scopus, Informit A+ Education, ProQuest Academic Research Library and Google Scholar. Reference lists of included studies were also searched. Keywords included iPad, teaching, learning, m-learning, mobile learning and e-learning. In the first round, the titles and abstracts of all returned results \((n = 2764)\) from these searches were screened for potentially relevant inclusions, with the criteria being English language, journal and conference papers, and iPad use in higher education. Next, the abstracts of these papers were reviewed for the second selection round by all three researchers. Full papers \((n = 91\) in total) were subsequently obtained and reviewed in full text. Each paper was assessed based on the soundness of its content (theoretical background; research method; research results, analysis and discussions). This step identified 2 groups of 30 papers: Group 1—primary papers (20 papers strictly matching these criteria, ie, peer-reviewed empirical completed papers) and Group 2—secondary papers (10 papers that did not provide a full account of the research but insights into the final results; they were completed studies). The 61 excluded papers were also reviewed to identify ongoing projects with potential. According to Okoli and Schabram’s process, only Group 1 is included for this paper (Appendix A). They are described and discussed in details in the next sections. Group 2 and ongoing projects are provided in the Supporting Information Appendices S1 and S2 to inform the interested reader of additional studies. The literature retrieval process is illustrated in Figure 1. Our process is comparable with the searching and screening process reported by Randell \textit{et al} (2007) and Rahimi and Vimarlund (2007).

Data analysis
The full texts of the 20 selected papers in Group 1 were treated as qualitative data for a detailed qualitative data analysis (Kvale, 1996). Data were independently extracted into Excel files by the researchers with details of the studies, including: authors, years, title, research focus, research methods, location, participants, sample and setting, mobile apps, data collection, data analysis, key findings, implications and acknowledged limitations. The content of each selected paper was analysed and summarised into the Excel files independently by at least two researchers. All the analyses were discussed and reviewed by the researchers to resolve any differences and reach consensus. Next, a meta-analysis was conducted to identify the major themes of the iPad research and results by comparing and contrasting the similarities and differences of these studies. This analysis method was adopted in previous SLRs (eg, Kitchenham \textit{et al}, 2009; Okoli & Schabram, 2010; Randell \textit{et al}, 2007). A summary of the data analysis and the major themes is reported in the Results section.

Results
Overview
All 20 papers (Appendix A) reported on research projects using iPads in tertiary environments, and provided conclusions based on empirical data. Two communities of students and academics were studied regarding their use of iPads in teaching, learning and administrative activities:

- Twelve papers involving students only
- Four papers involving academics only
- Four papers involving both students and academics
A majority of the research (16 papers) was conducted in the USA, two in Australia, one in Canada and one in the Philippines. Sample sizes ranged from 21 (Lindsey, 2011) to 30 academics (Yeung & Chung, 2011) and from about 12 students (Alyahya & Gall, 2012) to 224 students (Hargis, Cavanaugh, Kamali & Soto, 2013).

**Overall acceptance**

Students were found to hold a positive attitude about using iPad in their learning (Brand *et al.*, 2011; Kinash, Brand & Mathew, 2012; Perez, Gonzalez, Pitcher & Golding, 2011; Rossing, Miller, Cecil & Stamper, 2012; Wakefield & Smith, 2012). Although iPad was found to motivate students’ learning (Kinash *et al.*, 2012), some resistance was found because it could create a distraction (Wakefield & Smith, 2012). Academics hold more mixed attitudes. In a study involving iPad in 3rd-year medical clerkships, academics were found to be excited about this new device and its mobile apps (Hill, Nuss, Middendorf, Cervero & Gaines, 2012). However, through a series of 22 interviews with academics about using iPad in teaching, a less positive attitude was found (Link, Sintjago & McKay, 2012). In a survey across different universities (Gong & Wallace, 2012), factors affecting the adoption of m-learning were found to include relevancy, symbolic value and experience. According this survey, the first two factors drive iPad initial adoption.

**iPads in students’ learning**

Students’ use of iPad was reported in 16 papers. Four of these involved both students and academics. The iPad was found to highly engage and potentially enhance students’ learning experience (Brand *et al.*, 2011; Diemer, Fernandez & Streepey, 2012; Fontelo, Faustorilla, Gavino...
While students were positive with using iPad in their learning, no evidence was found to associate their iPad use with better learning outcomes. No evidence for impacts of iPad use on students’ final results was found (Perez et al., 2011). In a design-based study, the students were not convinced that iPad made any difference in their learning (Brand et al., 2011). In another study, the use of eTextbook, an iPad app, did not have a negative impact on their academic performance (Sloan, 2012). In contrast, a survey with 209 students found a correlation between high level of engagement with iPads and high level of learning (Diemer et al., 2012). Overall, iPad’s impact on learning outcome is still inconclusive.

iPad was found to be a good tool to provide instant access to rich learning materials and to the Internet resources from YouTube, Google Scholar and Blackboard (Alyahya & Gall, 2012; Fontelo et al., 2012). iPad provided the students with access to the specific learning materials and assessments (Hahn & Bussell, 2012; Robinson, 2012; Rossing et al., 2012; Wakefield & Smith, 2012) and the specific patient information during clerkship (Hill et al., 2012). In addition, students often used iPads for information seeking (Alyahya & Gall, 2012; Geist, 2011; Wakefield & Smith, 2012).

iPad was also used by students to take notes and present their work during class. It was found useful for note taking, highlighting texts or taking pictures (Alyahya & Gall, 2012; Hahn & Bussell, 2012; Mang & Wardley, 2012; Sloan, 2012). Twelve students reported that they used PowerPoint, Prezi, videos and photos to deliver and enhance their presentations (Alyahya & Gall, 2012).

Students found iPad to be a good tool for communication, interactions and collaboration—sharing their group work and receiving feedback from peers and academics (Alyahya & Gall, 2012; Geist, 2011; Hahn & Bussell, 2012; Kinash et al., 2012; Mang & Wardley, 2012; Rossing et al., 2012). The iPad was found to be useful in facilitating more efficient group work in the classroom (Geist, 2011). Students also used iPad time management apps such as calendars, reminders, notes, emails, and found iPad to enable them to be more efficient and productive (Alyahya & Gall, 2012).

A consistent finding across several studies was that iPad could potentially be a distraction because of non-educative usage (Kinash et al., 2012; Robinson, 2012; Rossing et al., 2012; Wakefield & Smith, 2012). Indeed, out of 76 students and academics, 53.9% considered mobile devices to be more for entertainment than education (Gong & Wallace, 2012). However, students in another study claimed that while using iPad for personal interests, they were not detached from the learning purpose (Geist, 2011). This suggests that m-learning should not be adopted independently from curriculum design and student engagement (Brand et al., 2011). Overall, research on iPad use is still exploratory, and little evidence links iPad use outside the class and student learning outcomes.

### iPads in teaching and academic administration

Overall, academics showed their interest in adopting iPad (Hill et al., 2012) and explored ways of using iPad in classrooms (e.g., Hargis et al., 2013; Link et al., 2012; Rossing et al., 2012). Compared with students, academics were found to be more sceptical. Resistance by academics was associated with a number of reasons. For example, academics perceived iPad as a potential distraction as the students could browse the Internet rather than giving full attention to the lecturer (Geist, 2011; Gong & Wallace, 2012). Link et al. (2012) reported additional concerns including: not all their students have iPads and how to use iPad to fit their pedagogical strategies, enhance existing pedagogical convictions and enable pedagogical extension. Therefore, there is a need to define a clear role and space of iPad in classroom to avoid its distractibility.

Academics found iPad to be a good communication tool, a good tool for convenient and fast access to course and library materials during class, for and motivating students’ learning (Gong & Wallace, 2012; Yeung & Chung, 2011). Academics modelled the use iPads for students to support their learning during their clerkship (Hill et al., 2012). iPad social apps were seen to have the potential to foster collaboration between academics (Yeung & Chung, 2011).
A small number of academics reported using iPads in their teaching activities in class: of 30 participants, only 20% used it regularly, 30% used it a few times and 50% had never tried it (Yeung & Chung, 2011). Of 19 participants, only 37% reported using an iPad for teaching (Lindsey, 2011). Academics often used iPad apps for other administrative purposes, e.g., email, calendar, and meeting notes and save printing costs (Lindsey, 2011).

**Mobile apps in teaching and learning**

Previous studies explored various standard iPad apps, e.g., email, web browser, Facebook, iBooks, multimedia, e.g., to view images and video in anatomy classes (Mayfield, Ohara & O’Sullivan, 2012) and to facilitate collaboration using FaceTime (Wakefield & Smith, 2012). Students were also introduced to a number of apps, e.g., collaborative concept mapping, brainstorming, graphing, video analysis and Dropbox (Diemer et al., 2012), and Audio Memos and SpeakIt apps (Robinson, 2012). Students found various writing apps useful and compatible apps with Microsoft Word, and made use of presentation app Prezi (Alyahya & Gall, 2012). A set of education apps were explored in a study with 19 students (Hahn & Bussell, 2012); although they found these apps useful, they also wanted apps designed and customised to address their specific learning needs. Academics in another survey (Yeung & Chung, 2011) expressed that the apps they wished to use were not available. Although mobile apps were explored, they were not formally evaluated.

Few studies investigated apps designed for specific courses. A pilot study explored CourseSmart app (Sloan, 2012), which provided the students with access to the course specific eTextbook. Although the students recommended eTextbook, they still wanted an optional printed textbook. It was also recommended that the course be redesigned to take advantage of this mobile app. Blackboard’s Mobile Learn was used to provide easy access to learning management systems (LMS) (Brand et al., 2011; Geist, 2011; Kinash et al., 2012). While students showed a preference to use a mobile app to access LMS rather than using web-based LMS, they found Mobile Learn to be slow to load and did not like the layout (Kinash et al., 2012).

**Technology opportunities and issues**

iPad was commonly agreed by the students and academics to be easy to use. Students found iPad to be a useful tool to increase flexibility, portability and productivity because it is small in size, easy to use and apps could be loaded (Alyahya & Gall, 2012; Rossing et al., 2012). Although students found it easy and enjoyable to use, they were neutral about using iPads in learning (Sloan, 2012). Academics tend to be more sceptical about the iPad. For example, Yeung and Chung (2011) raised a concern that the technology was still premature for practical use in the classroom, particularly there was a lack of university policy for technology support. Academics in this study reported various challenges and technological issues to switch from their desktop/laptop to an iPad. Academics in later studies also share this view (Link et al., 2012; Rossing et al., 2012). Specific technical issues include unstable apps and connectivity (Rossing et al., 2012).

Both academics and students shared their concerns about the application costs and that the technology becomes outdated quickly (Gong & Wallace, 2012; Rossing et al., 2012; Sloan, 2012). The value was not sufficient to justify the cost of the device and the apps (Sloan, 2012).

A study in Philippines used the iPad as a device for better access to pathological images stored on a local server instead of on the Internet (Fontelo et al., 2012). They found iPad to be a solution to equipment and technical obstacles and could enhance student learning in developing countries.

**Research approaches**

The reported research was rather exploratory (Table 1). Previous studies were commonly designed around a survey and/or interviews with those who borrowed iPads for a short duration,
or an evaluation of using iPads in classroom. A majority of the case studies and experiments were pilots. The focus was on the use of iPads for the on-campus mode of teaching and learning rather than distance mode. The utilised data collection methods include surveys, performance comparisons, interviews, observations and documentation. Nine papers used statistical analysis, seven used qualitative analysis and four used mixed methods including both statistical and qualitative analysis (Appendix A). There was no report of longitudinal studies so far.

Overall, research reported a positive attitude and a growing interest in using iPad and mobile apps. The current state of practice is still in infancy and exploratory. Firstly, most of the studies loaned iPads preloaded with standard apps. Secondly, iPads and mobile apps were not integrated strongly within a curriculum-based design nor connected to the learning outcomes. Academics were confused about using iPads in their teaching.

Discussion and conclusion
This paper reviews the research done to date in exploring the use of iPads in higher education since the release of this tablet computer. We searched and collected the peer-reviewed research papers in dominating public databases and reviewed each paper matching the search criteria. The number of 20 papers published within 2 years of introduction of the technology indicates a fast and intensive research interest in using tablet computers in higher education. So, is iPad hype or hope in higher education? The findings show that the current research is still at an early stage of exploration. Many higher education service providers are quick and eager to adopt this new technology in pilot studies to explore perceptions and different ways of using iPad. Only two large-scale initiatives were reported (Hargis et al., 2013; Link et al., 2012). No established teaching and learning practice was reported, which highlights the need for future large-scale and longitudinal studies.

The use of the iPad is limited and not integrated within a holistic teaching and learning approach including a wide range of areas, such as students’ engagement and experience, academic teaching processes and in the broad picture of developing and delivering teaching services, especially in true m-learning. There were only individual instances of using iPad in the classroom (eg, Perez et al., 2011; Robinson, 2012; Wakefield & Smith, 2012). The reported research findings suggest a high level of technology acceptance by the learner community; however, there is a lack of innovative pedagogical guidelines on how best to use this device to improve academic processes and achievements. Mobile technologies have the potential to become productive learning tools in integrating contents into the social learning environment; however, they have been found only to be an engaging tool to enhance students’ learning experiences. Research has been inconclusive about the relationship between the increasing use of iPads, changing teaching and learning practices and learning outcome.
The studies reviewed in this paper also show how the education service providers want to take advantage of the hype of iPads to respond to the learners’ demands for m-learning. Mobile technologies have the potential to break down geographical boundaries and transform classrooms from the traditional face-to-face environment to a faceless online environment; however, iPad was largely piloted in the classroom environment.

The iPad is an “always connected device” and many downloadable education apps with their capacity for audio/visual learning (eg, game-based learning, assessment, microblogging and social networking apps) were explored in the reviewed papers. However, they were not properly integrated within an online learning management environment to deliver a specific course. Relevant mobile apps are needed for specific courses (Perez et al., 2011). We found no research reported and evaluated a curriculum-based use of specific mobile apps. There is a potential research area to explore and incorporate specific apps within curriculum pedagogical design.

While technology adoption affects both students and academics (Barton, Corbitt & Nguyen, 2009), there has been little concern about engaging academics, motivating them and discussing with them possible changes to their teaching and research processes, or taking into account various social and human factors, such as cultural outlook, preferences and sensitivities of innovators and adopters. Academics were found to be more sceptical about their changing role from the “sage on the stage” to the “guide on the side” (Robinson, 2012).

This paper contributes to IS research in the area of m-learning, especially in regard to exploring and using the iPad. Not only does it provide the community with a comprehensive accumulation, synthesis and assessment of the reported research, hence revealing its shortcomings, but it also shows how the higher education sector tends to react to the external market (ie, the popularity of the iPad) rather than building a sound pedagogical approach to m-learning. This systematic review and an understanding of accumulated research to date help us to reflect upon the present and plan future education.

Educational technology is constantly evolving and expanding, and it is inevitable that this progression will continually offer new innovations in the higher education sector, eg, cloud-based learning. With the rapid pace of technology, this accumulated understanding of where higher education is in its early exploration of iPad use would help this sector be proactive and innovative. With the above findings and suggested research directions, there is hope beyond hype.

References


**Supporting information**

Additional Supporting Information may be found in the online version of this article at the publisher’s web-site:

Appendix S1: Key details of studies providing additional information regarding iPad use in higher education

Appendix S2: Worldwide iPad projects reported in the news
## Appendix A: Analysis of included studies for full review

<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
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<th>Sampling and procedures</th>
<th>Apple apps</th>
<th>Key findings</th>
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<tr>
<td>Perez et al</td>
<td>Work in progress: analysis of mobile technology impact on STEM based courses; specifically, introduction to engineering in the era of the iPad</td>
<td>Experiments</td>
<td>Two cohorts: 28 without iPads and 21 with iPads. Pre- and postsurveys; grades examination</td>
<td>Variety of apps</td>
<td>iPad application can be associated with better students’ classroom performance; however, there is no change in the final grades.</td>
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<tr>
<td>Brand et al</td>
<td>iWant does not equal iWill: correlates of mobile learning with iPads, e-textbooks, BlackBoard Mobile Learn and a blended learning experience</td>
<td>Design-based research</td>
<td>135 undergraduate students. Surveys and quizzes</td>
<td>Preloaded eTextbook; Blackboard Mobile Learn (BML)</td>
<td>Students are positive about mobile technology but not convinced that it makes a difference. Students’ age and attitudes towards self-managed learning correlate with academic success. M-learning is important but not independent from curriculum design and student engagement.</td>
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<tr>
<td>Lindsey</td>
<td>Leading Change: “going green” with iPads</td>
<td>Case study (survey)</td>
<td>18 academics, 1 academic manager and 2 admin staff. A survey after 4 months of use</td>
<td>Variety of apps</td>
<td>A third reported no issues.</td>
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<tr>
<td>Yeung and Chung</td>
<td>iPEP talk: pedagogical conversations from The iPad Exploration Project</td>
<td>Case study (mixed methods)</td>
<td>30 academics. Data collected from users’ blogs, online forums and evaluation survey</td>
<td></td>
<td>Three main uses: instant access to course resources and library databases, as a presentation device, an efficient means for communication. Issues: lack of relevant apps, costs, technical issues and problems in switching from a desktop or laptop to an iPad. iPad was mainly used for administrative and professional development; only one third use iPad in teaching. Time and resource savings.</td>
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<tr>
<td>Kinash et al.</td>
<td>Challenging mobile learning discourse through research: student perceptions of Blackboard Mobile Learn and iPads</td>
<td>Design-based research</td>
<td>135 undergraduate students. Survey and focus groups</td>
<td>BML and various apps</td>
<td>iPad was found to improve students’ learning and efficiency in learning. Many students found apps easy to use and useful. A few found iPad to be a distraction and not useful. Students found BML slow to load and did not like the layout. The concept of learning did not emerge strong. iPad enabled; changes in classroom interactions; instant access to materials; more efficient group work; different media; iBook was easier to access, to search for information; portable touch screen was easy to use. Students were not satisfied with web-based Blackboard’s limited functionality. Academics found iPad to be a distraction. Students contented that they were not distracted. iPad was found to be a possible solution to address the low Internet speed and technical obstacles, and to enhance student learning in developing countries.</td>
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<td>Geist</td>
<td>The game changer: using iPads in college teacher education classes</td>
<td>Case study (mixed methods)</td>
<td>Students used iPads for 10 weeks. Direct observations, students’ weekly blogs, pre- and postsurvey, interviews</td>
<td>Variety of apps</td>
<td></td>
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<tr>
<td>Fontelo et al</td>
<td>Digital pathology—implementation challenges in low-resource countries</td>
<td>Case study (survey)</td>
<td>Surveyed 50 medical students</td>
<td>Standard image viewer</td>
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<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Methodology</td>
<td>Sample Size</td>
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<td>Diemer et al (2012)</td>
<td>Student perceptions of classroom engagement and learning using iPads</td>
<td>Survey</td>
<td>Surveyed 209 undergraduate students; single and multiple classroom activities</td>
<td>Collaborative concept mapping, ear training, video analysis, Dropbox, etc</td>
<td>There were correlations between a level of iPad engagement and level of learning, and between level of comfort with e-learning and level of perceived learning and engagement. No effects due to age, gender or language were found. iPad was found to increase flexibility and portability: affordances, faster and easier access to materials, note taking and taking pictures, time management and presentation tools. Productivity tools for assignments, communication and collaboration.</td>
</tr>
<tr>
<td>Alyahya and Gall (2012)</td>
<td>The use of iPads in education: a case study of graduate students' experience and attitude</td>
<td>Multiple case studies</td>
<td>12 graduate students. Interviews, observations and artefacts created</td>
<td>Prezi, note taking, compatible apps with Microsoft Word, flashcard, etc</td>
<td>Various apps</td>
</tr>
<tr>
<td>Link et al (2012)</td>
<td>&quot;Geeking out&quot; with iPads: undergraduate instructors discuss their experiences during the first year of a large-scale tablet initiative</td>
<td>Case study (interviews)</td>
<td>22 semistructured interviews with academics who received iPads</td>
<td>Variety of apps</td>
<td>Academics showed willingness in innovative teaching; appreciated “apostles of technology” to lead. Academics shared fears and concerns: lack of enthusiasm from students, iPad not available to all students, its distractibility, aligning iPad with pedagogical strategies. Technical knowledge and support is important.</td>
</tr>
<tr>
<td>Hahn and Bussell (2012)</td>
<td>Curricular use of the iPad 2 by a first-year undergraduate learning community. In: Rethinking reference and instruction with tablets</td>
<td>Mixed-methods: survey and focus groups</td>
<td>19 received iPad for 1 week</td>
<td>Voice Memo, Calculator, 3D molecule, etc</td>
<td>Students used iPads for note taking, Internet searching and communication, and expressed their requirements for campus and library apps, eg, customising them to their specific enrolment requirements.</td>
</tr>
<tr>
<td>Hill et al (2012)</td>
<td>Using iPads to enhance teaching and learning in third-year medical clerkships</td>
<td>Multiple case studies</td>
<td>Nine academics and 36 3rd-year medical students</td>
<td>Preloaded apps to access knowledge resources</td>
<td>They benefited from the iPad use: students' access to patient information, academics' model iPad use in patient care and clinical decision making. Usage of iPad aided student engagement, assisted them in achieving goals and enhanced the effectiveness and efficiency of dissection education.</td>
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<tr>
<td>Mayfield et al (2012)</td>
<td>Perceptions of a mobile technology on learning strategies in the anatomy laboratory</td>
<td>Experiments</td>
<td>Video observations of three controlled experimental dissection tables used iPads and three tables served as a control for two identical sessions</td>
<td>Standard apps to view anatomy images and instructions video</td>
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<tr>
<td>Robinson (2012)</td>
<td>Experiential learning in a new millennium: the implications of iPad technology in instructional settings</td>
<td>Case study (qualitative survey)</td>
<td>The iPad was piloted in three of a 12-section course. 50 students participated</td>
<td>Audio Memos, SpeakIt</td>
<td>Advantages: quick accessed to information, promoted experiential learning and developed student technology literacy skills. Disadvantages: distraction, perceived lack of usefulness of iPad in their learning.</td>
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</tbody>
</table>
### Authors (date) Title

<table>
<thead>
<tr>
<th>Authors (date)</th>
<th>Title</th>
<th>Research methods</th>
<th>Sampling and procedures</th>
<th>Apple apps</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rossing et al (2012)</td>
<td>iLearning: the future of higher education? Student perceptions on learning with mobile tablets</td>
<td>Experiments</td>
<td>Eight academics design classroom experiences with the iPads and measure students' perceptions of iPad usage</td>
<td>Variety of apps</td>
<td>Opportunities and limitations were found in five areas of: Access and availability of information; Sharing and collaboration; Novelty; Learning styles and preferences; Convenience and functionality.</td>
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<td>Sloan (2012)</td>
<td>Using an eTextbook and iPad: results of a pilot program</td>
<td>Case study (survey)</td>
<td>26 students from a selected course used eTextbook in iPads</td>
<td>eTextbook</td>
<td>iPads: Easy and enjoyable to use; Usefulness was rather neutral; Not cost justifiable.</td>
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<tr>
<td>Wakefield and Smith (2012)</td>
<td>From Socrates to Satellites: iPad learning in an undergraduate course</td>
<td>Case study</td>
<td>Three classroom observations, interviews with teachers and students, course evaluation comments</td>
<td>Variety of apps</td>
<td>iPads were found to support interactive, collaborative experiential learning and improve problem solving skills. Students were positive about m-learning where they found, evaluated and used information. iPad could be a distraction.</td>
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<tr>
<td>Hargis et al (2013)</td>
<td>A federal higher education iPad mobile learning initiative: triangulation of data to determine early effectiveness</td>
<td>Case study (mixed methods)</td>
<td>Interviews and surveyed 224 academics</td>
<td>Variety of apps</td>
<td>Strengths: high engagement in professional development and adoption, easy to use and accessible apps. Weaknesses: resistance to technology Opportunities to use existing apps or develop new ones Threats: possible misalignment between assessment and teaching. Overall, a positive response was found. Technology success is anticipated. Content management perceived to be a challenge.</td>
</tr>
<tr>
<td>Mang and Wardley (2012)</td>
<td>Effective adoption of tablets in post-secondary education: recommendations based on a trial of iPads in university classes</td>
<td>Experiments</td>
<td>47 students received iPads for 4 to 6 weeks Pre- and postsurveys, researchers' reflections</td>
<td>PDF annotation, quiz, standard and free apps</td>
<td>96% believed that the tablet had enhanced their learning. 91% indicated that they would like to use iPads in the future. iPads were used for note taking, information sharing, collaboration, enriching students' learning experience, engaging them in course content.</td>
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