

# A Federal Higher Education iPad Mobile Learning Initiative: Triangulation of Data to Determine Early Effectiveness

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**Abstract** This article presents faculty perceptions of the first month of iPad deployment in a national college system and a case study describing the integration of mobile learning devices in one college, interpreted within the framework of a SWOT analysis. We include a brief history of the implementation; description of the three-tier structure of infrastructure, pedagogy, and content; faculty perceptions; and pedagogy interview findings. We collected data using 1) case study interviews, 2) a faculty dispositional survey, and 3) iPad lead faculty. Overall, the large-scale deployment of iPad mobile learning devices was associated with high

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faculty engagement in formal and informal professional development activities and adoption of an active student-centered pedagogy. In addition, the program stimulated innovative approaches to technical challenges; and it spurred development and evaluation of new digital content.

**Keywords** Mobile Learning · Active Pedagogy · Faculty Development · E-learning

In April 2012, His Excellency Sheikh Nahayan Mubarak Al Nahayan, the United Arab Emirates (UAE) Minister of Higher Education and Scientific Research and Higher Education Chancellor, inspired the education world in the country by motivating the three federal higher education institutions to create functional, meaningful mobile learning in and outside of the classrooms. The Chancellor emphasized that sound pedagogical principles should guide implementation. UAE higher education leaders chose the Apple iPad as the mobile learning platform. The first wave of implementation was with incoming first year English-language students, who enter a pre-Bachelor Foundations English Language Learner (ELL) program to prepare for degree programs which are delivered in English. The Foundations program also includes basic mathematics courses.

Introducing the iPad into Foundations programs was a natural step in advancing active learning methods, the aim of which is to provide students with the skill and experiences needed in flexible work environments. The iPad is a personal, extensible, cognitive toolbox for authentic, active learning centered on interaction among students, faculty members, and community experts. The iPad has the potential to take higher education aggressively in a flexible, student-centered direction that research has long validated although academe has not achieved (Cavanaugh and Hargis *in press*). Therefore, the objective of our study was to identify faculty perceptions about the effectiveness of early implementation of the iPad, specifically as it related to enhancing the student-centered learning experience. The value of early data is the ability to remediate our program and to disseminate information widely so as to assist those considering a similar large-scale project.

Engaging staff early and often became a necessity from the start of the iPad implementation. In early May 2012, a National Pedagogy Team created and shared a call for proposals to all federal higher educational institutions to nominate individuals as iChampions. Each of the three federal institutions selected ten iChampions, who soon began an extensive training with Apple World Education leaders in mobile learning technologies and active learning techniques in preparation to be the leaders among their colleagues. In this article we focus on one of the three federal institutions, the Higher Colleges of Technology (HCT), which has 17 campuses across the country. In late June of 2012, Apple personnel returned to provide training to all faculty members in the country teaching in college English-language Foundations programs.

As a way to build excitement about the iPad implementation and camaraderie among the federal universities, the iCelebrate Teaching and Learning conference took place in June 2012 at a campus of the Higher Colleges of Technology. Our expectations at this phase of the project were simply to bring together faculty members to discuss their ideas and progress. This conference brought together 450 participants and 68 presenters in 51 sessions to discuss ways to implement the iPad and engage students in active learning. Over the summer, teachers “played” with their new iPads, exploring both the formal and informal ways in which they could engage their students.

In late August, an extensive Challenge Based Learning workshop was offered for an additional 90 iChampions selected and mentored by the original 30 iChampions from each campus. In September, the iPad program officially launched with Foundations program students across the country.

## Program Structure

From the very beginning, three key priority planning and implementation teams were identified and guided by the Technological Pedagogical Content Knowledge model (Koehler and Mishra 2009) that has become familiar in educational technology. The focus areas of the technology infrastructure were to provide robust wireless connectivity for the iPad and supporting learning technologies on campuses, procurement and engagement with hardware partners, and development and management processes for the deployment of iPads.

The Content Knowledge Team focused on a review of current digital content for iPads and training in new content creation software by Apple, Inc. called iBooks Author. In addition, review of publishers' and third party providers' content and future strategies were addressed. The team's work centered on the immediate needs of the Foundations program, with an eye on the 6-month horizon when all Bachelor's level programs would transition to iPad programs. The Pedagogy Team addressed the training of and communication with key educators and technology coaches called, as used above, iChampions; implementation and update of a Learning with iPad website; and professional development activities throughout the UAE to provide awareness and activities to increase iChampion membership.

We will now review what has been done elsewhere with iPads and mobile technology in higher education. Then we will discuss preliminary faculty perceptions about the initial stages of the UAE's national iPad launch, which were drawn from baseline faculty data collection instruments (i.e. levels of adoption, disposition, etc.) and faculty interviews. We conclude with implications for practice.

For the purposes of this study and in keeping with the goals of the UAE higher education system, mobile learning is defined as iPad-based teaching and learning. The objective of the mobile learning program in its initial stage was to "transform the classroom by bringing the world into the classroom and extending the classroom into the world," which depends on "changing some traditional concepts of teaching and learning, firmly aligning them with cutting-edge 21st century learning processes" (Higher Colleges of Technology 2012, n.p.).

## Related Research

The iPad implementation in 2012 centered on the Foundations ELL programs. The hope was that focusing on Foundations would allow the iPad program to migrate into higher education degree programs as well as into secondary and primary schools. This review (1) begins with research on language learning in mobile learning environments and then (2) expands the conversational/collaborative model of learning more broadly to examine impacts of mobile learning environments in education as whole including (3) implications for teaching practice and leadership with attention to (4) the conceptual frameworks guiding the iPad program at this stage. Because mobile learning environments center on a range of networked mobile devices, the research base to date has focused on laptops as well as tablet devices. Both are included in this review in order to be comprehensive.

### Mobile Learning for Language Development

Mobile learning environments increase comprehensible input in the target language by engaging students in frequent and sustained reading and listening during a developmental period of silence before they are asked to produce the new language. The UAE's

Foundations English programs focus on building academic reading, writing, speaking, and listening. One of the largest studies to date of mobile learning to strengthen reading ability suggests that mobile devices have not led to an increase or decline in reading scores but rather have contributed to students “gaining a broader set of skills, knowledge and abilities that in the long run will benefit other aspects of their learning and language development beyond those measured by standardized reading tests” (Warschauer 2009, p. 60). In addition, this study reported changes in the way writing is taught. It documented increases in interdisciplinary, iterative, public, collaborative, purposeful, and authentic writing tasks as well as greater range in the genres of writing used in instruction. The study also suggests that mobile computing leads to increased quality of final products; increased autonomy in the writing process; increased just-in-time, individualized, and in-depth learning; increased empirical investigation related to writing topics; and increased multimedia literacy that demonstrates 21st century ways of representing and constructing knowledge (Warschauer 2009). In another higher education study Thornton and Houser (2004) found mobile language learning systems to be effective and engaging for vocabulary development by encouraging spaced practice. Relevant to the UAE context, research showed that reluctant readers were motivated to read eBooks on mobile devices (Maynard 2010). At higher levels of language development, students appeared to analyze and synthesize texts better when they use iPads with graphic organizer tools than when they use non-technology tools (Garcia 2011).

### Mobile Learning Tools and Practices

An important new affordance in the UAE’s classrooms is the collaborative capacity of the iPad, its digital resources, and the technical infrastructure on the campuses—a combination, which is well suited for language development and broader adult learning. It is accepted in learning theories that multiple forms of conversation, interaction, and collaboration amplify learning, and Zurita and Nussbaum (2004) have shown significant learning gains with mobile collaboration.

In the past decade, large-scale learning technology programs have provided handheld devices or laptop computers to students (Benton 2012; Garcia 2011; Heinrich 2012; Thornton and Houser 2004; Warschauer 2009; Watson 2009; Windschitl and Sahl 2002; Zurita and Nussbaum 2004). However, few of these programs surpassed 10,000 students, included iPads or similar tablets, focused on multiple content areas, included multiple institutions distributed across a broad geographic area, involved Apple Inc., or lasted over a number of years.

A notable exception is the 2004–2011 U.S. federally funded 1–1 (one computer for every student) research conducted in the state of Florida (Cavanaugh et al. 2011; Dawson et al. 2008; Ritzhaupt et al. 2012). Typical 1–1 programs provide one device for every one student. The last years of this longitudinal study included iPads along with laptops; the 2011 study collected data on teaching and learning from over 1,000 teachers and 70,000 students in 150 K–12 schools. The results revealed increases in student learning, teacher confidence and comfort using technology, technology integration practices, advanced uses of technology tools by students, and opportunities for students to use technology as a tool for learning. Specifically, as a result of the first year of using 1–1 technology and participating in professional development, teachers increased their active and constructive teaching practices and assessment by rubrics and performance. The material taught showed significant increases in high cognitive demand. Teachers shifted significantly along the technology integration continuum from Entry and Adoption levels to Adaptation. There was a

significant decrease in paper-based assignments and an accompanying increase in multimedia projects along with decreases in plagiarism. The classroom dynamic changed during the year with significant decreases in teacher-delivered content to increases in student independence and reasoning.

Other smaller studies support these findings. K-20 educators who were studied during a year of iPad teaching reported that the device had a positive impact on student engagement (Benton 2012). A yearlong study of teachers in 1–1 computing classes found that teaching and learning was more student-centered, collaborative, project-oriented, constructivist, and flexible than before (Swan et al. 2007).

Conditions essential for programs that integrate mobile computing devices for each student (1–1 programs) are widely recognized to include a carefully designed professional development effort and technology support available to teachers (Cavanaugh et al. 2011). Professional development targets the preparation of teachers prior to instruction while technology supports teachers during instructional and planning time. The connection between professional development and effective use of classroom technology has been documented in large-scale studies (Ritzhaupt et al. 2012).

Finally, one of the few studies focused specifically on the effectiveness of iPads in education was recently completed by Heinrich (2012) at Longfield Academy in Kent, United Kingdom, who found a significant and positive impact on learning, which indicated that iPads were:

- regularly used in teaching;
- strongly used in English, Math and Science;
- in high demand from students;
- being used for homework and co-curricular activities;
- motivating students to learn;
- increasing the quality and standard of student work;
- enhancing how good a student feels about work;
- increasing the levels of collaborative work; and
- found to be easy to use.

## The Study and Methods

### Setting and Participants

iPad 3's were provided to all Foundations program teachers and students; and a bulk download of 22 apps was included, half of which were free and the other half paid for by the colleges.

In order to ascertain faculty perceptions of the initial implementation of the mobile learning program, three categories of participants were recruited for this study in this first-month of implementation: Case Study of four teachers, Self-Reporting Dispositional Survey of Foundations teachers across the 17 Higher Colleges of Technology campuses, and feedback from 19 of the initial 30 national iChampions.

### Procedures

The IRB request for this study had been approved by the College. The authors conducted the case study interviews with a sample of four out of thirty Foundations faculty members at the

Higher Colleges of Technology (HCT) Abu Dhabi Women's College (ADWC) campus, in Abu Dhabi, UAE. This purposive sample represents early adopters of the iPad, who had eagerly demonstrated their new skills to their colleagues and were asked to volunteer to explain in a video series what their class would look like “before/after” the iPad implementation. These four instructors represent a proportion of English to Math courses. Therefore there was no need to randomize sampling because these faculty members had been fully engaged in the mobile learning program since its inception and could offer a range and depth of perceptions conducive to a SWOT analysis. Results from this case study cannot be generalized; however, the data collected from them will help develop baseline data with which other data can be compared. The demographic data are included in Table 1.

Interviews lasted 30 minutes to an hour and were audio recorded on an iPod Nano. We then listened to the recordings; and, rather than transcribe the interview word for word, we took notes on the major topics and only transcribed excerpts that would be quoted in the report (Weiss 1994). We then read through these notes, giving particular attention to topics about the strengths, weaknesses, opportunities, and threats to the iPad implementation process. Preliminary codes were developed from the notes. The interviews were reviewed again and codes refined. Interview questions for the four Foundations faculty members included the following (modified from Benton 2012)

1. How would you describe your prior experiences using technology in the classroom?
2. How did you feel when you heard that you would be teaching with an iPad?
3. Describe the type of training you had before you implemented the iPad in your classroom?
4. How do you collaborate with colleagues in the use of teaching with the iPad?
5. Describe your experiences with implementing the iPad as an instructional tool.
6. What are some challenges you have had, and how have you overcome them?
7. If I were a student in your class, how would the lesson be different now with an iPad?
8. Describe the planning process required for developing a lesson that integrates an iPad.
9. Share some specific iPad activities in which your students have engaged.
10. Describe the types of student interactions that you have observed when they use the iPad.
11. Describe your beliefs about the impact the iPad will have on student learning and engagement.
12. How would you assist other faculty members into enhancing their active teaching and learning using the iPad?
13. Is there anything else that you would like to share about your experiences using the iPad as an instructional tool that we have not discussed?

Participants for the dispositional survey included all Foundations teachers in the UAE. The data described here represent this faculty group at the Higher Colleges of Technology: 224 out of a possible 325 faculty members (68.9 %) completed the Faculty Attitudes Toward

**Table 1** Demographics of Interview Participants

Discipline	Gender	Years Teaching	Years in UAE
English	Female	11	6
English	Female	8	4
English	Male	18	4
Math	Male	8	6

Technology-Supported Learning Environments (FATSLE) in September 2012. The FATSLE survey was adapted for this study from the Knezek et al. (1999) FAIT (Faculty Attitudes Toward Information Technology) survey that had been adapted and rewritten by Tinnerman (2007) and further adapted for the blended environment by Jordan (2010). This survey focuses broadly on the learning environments in which mobile devices including iPads are used in order to gather information about knowledge and attitudes toward mobile learning environments in the following general categories:

- Attitudes towards technology in education
- Attitudes towards the efficacy of technology-supported learning environments
- Knowledge of various technological tools
- Stages of adoption of technology-infused teaching

The UAE Mobile Learning Assessment Team also included two items adapted from Christensen (1997) to assess faculty stages of adoption of technology and their phase of technology integration. Finally, there were items adapted to reflect the focus on iPads and the adopted apps. This survey provided a baseline from which to guide further faculty development and program scale-up efforts as well as to gauge the degree of change among participants.

Participants for the iChampions feedback included 19 of the original 30 iChampions, who volunteered their feedback on a wiki-based project management website, called BaseCamp, at the end of the first week of iPad implementation. This site had been introduced during an iChampion training, and therefore participants were familiar with it.

## Findings and Results

We present our findings and results, where appropriate, as a SWOT Analysis, i.e., strengths, weaknesses, opportunities, and threats.

### Case Study Interviews

*Strengths* Informal learning increased as teachers engaged in their own research on ways to implement the iPads, searching and finding apps, seeking advice from other teachers and professionals, and exploring what they could do with the iPad. The following strengths emerged.

- There was ample support, which included workshops at federal and institutional levels, dedicated implementation teams, collaborative training team meetings, and teachers opening up their classrooms for input from colleagues.
- There was a repository of apps created within a new college Center for Teaching and Learning and more peer coaching.
- Student engagement was observed to increase as students were more empowered, becoming researchers and more independent learners. Turnaround time for assignments decreased; there was a quicker uptake of ideas; they were quick to help each other; and there was more movement of students around the campus.
- The teacher was seen as a facilitator, which allows more time for teachers to help as opposed to lecturing.
- Games and apps are more accessible and easier to use than on laptops; batteries last all day; safety increases with the absence of electrical cords; and the iPads contain video cameras and voice recorders.

- Individualized learning has become evident for more advanced students vs. those who need more time and help, and with different learning styles.

*Weaknesses* Open discussions were encouraged to identify and critique potential weaknesses. However, these discussions quickly took a positive direction; and the faculty members provided rationale for their perception of weakness for the tool.

- There is a need to overcome student perceptions of school.
- Students are used to being told what to do.
- Some faculty members are not technologically inclined.
- Faculty and students need storage and need training in sending and receiving files.

Although these aspects were identified as weaknesses, participants were quick to point out that they were doing things to overcome these weaknesses.

*Opportunities* The interviewees realized that there were many sources for opportunities for themselves, the students, and persons beyond the academic community. The thoughts that came forward are as follows.

- It is essential to provide support for teachers, a safe environment to exchange ideas, a place to develop professional learning network, and time for more collaboration.
- Faculty members can use options for alternative assessments such as rubrics.
- The faculty members can identify other apps they could use and start developing their own.

*Threats* Only one potential threat to the system was identified although it was major and continues to be discussed and debated. This threat is the misalignment between assessments and teaching.

#### FATSLE Survey

The survey included 10 demographic items that allowed relationships to be examined between attitudes and experience. The scales included an 18-item Skills and Knowledge scale, a 36-item Attitude scale, and two items related to stages of technology adoption and integration. We analyzed the survey items, which included five level Likert choices, in aggregate and by subgroups in order to provide a baseline, as well as correlations among factors. Key findings that indicate the status of faculty development, campus support, administrative support, and current uses of iPads are shown in Table 2.

Of particular interest are the reported levels of technology adoption and integration, which are shown in Table 3. Each scale, technology adoption and technology integration, was comprised of five levels. When asked to choose a baseline level, UAE, Foundations faculty members reported that their technology adoption and integration fell predominantly at the following levels.

- Understanding and application of process - I am beginning to understand the process of using technology and can think of specific tasks in which it might be useful.
- Fusion - I can use more than one application in the creation of a single product. I use technology including iPads in preparation, instruction, and evaluation. My students use a variety of applications regularly in the construction of curriculum-based products.



**Table 2** Key Findings of FATSLE Survey

Statement of Finding (Agree and Strongly Agree)	Case Study Campus
% who are comfortable and confident in their use of iPads	63 %
% who are satisfied with campus technology support	73 %
% who have had adequate training with iPads	64 %
% who feel prepared to use iPads in classrooms	55 %
% who feel that administration actively encourages use of iPads in classrooms	95 %
Most frequently reported uses of classroom technology	Promote student-centered learning; as a communication tool, over 80 %

Stage 3 is a very healthy baseline, and we believe it is one of the reasons that the iPad program was able to show such a rapid and effective start. It is a place from which substantial growth is possible and indicates positive attitudes toward technology as a tool for teaching and learning, as shown in Table 3. The range of faculty members across levels shows that leaders are present at the higher levels who can model and mentor others as the program progresses. Each institution should be mindful of the need for faculty members who are at higher levels of skills and knowledge.

### iChampion Feedback

As explained, the raw, qualitative, descriptive data from 19 iChampions’ feedback during week one was collected via the Basecamp online project management site. We first analyzed the data through a simple Word Distribution visual organizer (Wordle.net); Fig. 1 presents the pictorial representation of the most frequently used words. Next, themes were generated by collating trends such as collaboration between teachers and students, engagement, technology success, dispositions, and the building of a community of practice.

From the data collected from the iChampions at the end of week one on BaseCamp, we provide the SWOT analysis from the teachers directly implementing the iPad initiative:

*Strengths* Engagement was the major goal and subsequently a major strength of the project.

- Most of the students have been quick to get up to speed with their iPads.
- We had a lab for students to use; but it was empty most of the time, and students were using their iPads everywhere else in the campus
- They were registering for their courses, reading course syllabi and materials using iBook, and surfing the Internet; and they rarely seek your help.
- Students do not want to miss one single piece of instruction or any information about how to use a particular app.

**Table 3** Levels of technology adoption and integration

Case Study College: ADOPTION AND INTEGRATION	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Adoption of Technology	0 %	4 %	22 %	29 %	20 %	25 %
Classroom Technology Integration	3 %	30 %	36 %	8 %	23 %	0 %



- Faculty members arrive in their classrooms prepared, flexible, and ready to innovate as far as the iPad technology is concerned. They are enjoying the mobility of the iPad classroom – technology in the classroom is nothing new; but, being able to teach while walking around and still navigate through the technology has been an extra added bonus.
- The rollout was quicker as teachers feel comfortable with the device.
- The faculty feel “empowered” and refreshed by new creative challenges and opportunities.
- Students seem happy with the ability to easily share content with classmates and their instructor.
- With the iPad they feel we are equipping them with needed technology skills and valued English language instruction.

*Weaknesses/Limitations* There were several limitations in this study, and weaknesses of the program were identified. However the attitude was that it was worth their time for the benefit of engagement to the student.

- We only have PDF versions of books.
- One of the challenges we are working on is finding solutions for sharing materials between students and teachers that will fit everyone’s needs.
- The problems seem mostly to be about passwords and emails.
- Students still sometimes revert to speaking Arabic to resolve problems.
- Some stronger students take the iPads off novice users and “do it for them”.

*Opportunities for Success* Faculty members could clearly see the potential gains for their students; and therefore, they selected to engage in the opportunities to help make this initiative a success. Opportunities to continue success included learning about the reading and listening resources that work at the other institutions; engaging in ongoing communications; support and development (iResource Room/iBooks Author); and implementing a process for identifying, recommending, purchasing, and distributing apps further down the line.

*Threats* The threats identified focused on core teaching material; and the faculty members noted that some returning students are not keen on the new tool and need to use the iPad as a creation tool, not just text reader.

## Summary and Conclusion

This study identified faculty perceptions of a recent, large-scale, federal deployment of a mobile learning device – the iPad; and our analysis used the strengths, weaknesses, opportunities and threats (SWOT) framework. The goal of the study was to identify faculty perceptions about the effectiveness of early implementation of the iPad as specifically related to enhancing the student-centered learning experience. This was done in order to understand the immediate effectiveness of the program, both for current confirmation of the project and to help develop further processes to ensure success. Data from the three measurements – interviews, survey, and iChampion feedback – has shown positive results in that perceived strengths appeared to outweigh perceived threats.

The case study interviews revealed an overwhelming positive response to the technology, pedagogy, and content as they existed in the first month of the mobile learning program. The major strengths perceived were that informal learning increased as teachers engaged in their

own to research ways to implement the iPads, a significant amount of academic support for all institutions was reported by teachers, a repository of apps was initiated within a new university Center for Teaching and Learning, and student engagement was perceived as high. There were fewer perceived weaknesses, but these included overcoming student notions of what school is and storage of files created in and for classes. The opportunities focused on providing more support for teachers; a safe environment for teachers to talk and exchange ideas; and developing alternative assessments via qualitative rubrics, e-portfolios, or iBooks. Finally, the major threat perceived was the misalignment between assessments and teaching.

The faculty dispositional baseline survey indicated that faculty members are currently well on the way to high levels of technology adoption and integration. They overwhelmingly reported that their campus administrations actively encourage the use of iPads for teaching and learning. The majority reported that they felt comfortable and confident in using iPads and that they had had adequate training in the initial stage. The most frequent uses of iPads were for student-centered and interactive applications.

The data collected from the iChampions during week one of iPad deployment demonstrated positive use and perceptions as interpreted within the SWOT framework. The major strength was student engagement, which was strongly emphasized from the very beginning of the project. Collaboration was another strength identified. The technology successes were an anticipated strength.

Weaknesses and limitations were much lower in frequency and magnitude than expected for a first-of-its-kind program. The major challenge colleges faced were content management to distribute iBooks and limitation to PDF versions of books. In general, adoption of the iPad as a device with associated pedagogy outpaced development and adaptation of content, materials, and systems.

Opportunities for success focused on the activities prior to the launch. Comprehensive content development and professional development resulted in materials and skills needed for initial success. Opportunities to continue include a request to share technology and management approaches. Major threats included the slow development of teaching materials and a need to explore effective ways to use the iPad as a creation tool and not a text reader only.

In summary, the federal deployment of the iPad mobile learning devices exceeded our expectations in the areas of infrastructure and pedagogy. We have provided tours and shared lessons learned with several administrators from other countries, which will be implementing similar iPad projects. From the point of view of those who may be considering requiring the use of iPads for all incoming freshman students, the early data gathered from the three instruments indicates a favorable environment for success.

The Technology, Pedagogy, and Content Knowledge model area of content is an emphasis in the next stage of our expansion. The goals are to create an efficient way to encourage the faculty to create authentic content and to submit to a cloud-based system for peer review, enhancement, and reuse.

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