Realizing the promise of mobile devices in a one-to-one iPad initiative: Perspectives from a dual-licensure teacher preparation program in Hawaii

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Mobile devices provide a number of compelling features for learning and instruction. Clearly, these devices are becoming more and more popular. Arguably the most popular mobile device for education is the iPad. Multiple one-to-one iPad initiatives are cropping up around the United States. While interest continues to grow rapidly, the research and best practices for using these devices is not becoming available at the same pace. At the University of Hawaii–Manoa, we have implemented a one-to-one iPad initiative in a dual licensure (general/special ed) elementary teacher preparation program. Since Fall, 2013 we have been collecting and analyzing formative evaluation data on the initiative. In this paper we report our findings to date and provide practical guidance and suggestions based on those findings. This descriptive case report provides an insider glimpse into the challenges and opportunities that are coming to light.

Keywords: One-to-one, teacher preparation, dual licensure, technology integration

Introduction

More and more educational institutions are adopting tablets as promising educational technology. However, despite the promise of mobile devices for education often espoused by the popular press (e.g., Brandon, 2011), research on use of these devices in educational settings is still nascent. Best practices for implementation of mobile devices in teaching and learning contexts are just starting to emerge. Still, there is little doubt that these tools hold great promise. From the perspective of ultra-mobility, long battery life, and relative affordability, mobile computing devices are attractive as learning tools because they make it possible to provide each student with computing devices that can be used all day and easily transferred from class to class. In addition to these physical characteristics, educators and researchers see mobile devices as having a number of capabilities that are particularly desirable for enhancing learning. For example, Mueller and colleagues (2012) found that Blackberry devices provided an effective means for university students to communicate and organize tasks and group work, and allowed students to engage in a social support system. Enriquez (2010) argued that, for students at a community college, mobile devices provided for better teacher-student interaction, immediate assessment and feedback capabilities that allowed the instructor to be more responsive to student needs, and better overall student engagement. In their study on university students using iPads at Purdue, Rossing and colleagues (2012) discovered that students had positive perceptions about how these mobile devices afforded access and availability to information, facilitated sharing and collaborating with others, were adaptable to different learning styles, and were convenient and easy to use. Mobile devices provide just-in-time and on-demand access to vast amounts of information. Given this and the potential for mobile devices to positively impact students and instructors' communication, organization, and social interaction, it is hardly surprising that these devices have become so popular.

This popularity is evidenced by the growing number of mobile devices that are being rolled out in educational settings nationwide. In Hwang and Tsai's (2011) review of research trends from articles published between 2001 and 2010 in six major educational technology journals (BJET, C&E, ETS, ETR&D, JCAL, and IETI), significant increases were found in the amount of articles being published on mobile and ubiquitous learning research. In fact, over twice the number of articles (103 vs. 51) were published in the last three years of the authors' review (2008-2010) than in the seven years before that (2001-2007). In addition, a push to establish a "one-to-one" ratio of devices

to students through tablet initiatives is evident nationwide. Recently, the Los Angeles Unified School District announced plans to distribute 640,000 iPads to students by the end of 2014 at an expenditure of one billion dollars (Blume, 2013). In 2012, the San Diego Unified School District rolled out 27,500 iPads to students at a 15 million dollar expenditure (Kucher, 2012). Further, the New York Times reported that every student and teacher in 24 middle schools of Guilford County, North Carolina received an Amplify tablet—15,450 in all (Rotella, 2013). In a report from June, 2014, the Franklin Academy High School in North Carolina reported on the outcomes and impact of a four-year one-to-one iPad initiative in which they have rolled out 475 iPads to all high school students. Their findings indicate increased student engagement, development of 21st Century Skills, and increased efficiency of teaching and learning (Mahaney, 2014). As instructional technologists, we recognize this increasing interest in mobile technologies as an opportunity to impact learning.

The ever-increasing popularity and capabilities of mobile devices have inspired a growing number of research studies looking specifically at using mobile devices to enhance student learning. For example, in a study on a one-to-one initiative in Singapore in which 39 ninth graders used an iPod Touch for one semester, Koh and colleagues (2011) reported that students had overwhelmingly positive perceptions regarding their learning and engagement. In another study that looked at the learning outcomes and student satisfaction of 33 fifth graders in Taiwan using PDAs to learn social studies, Shih and colleagues (2010) found significant improvement in student achievement and high levels of satisfaction, and noted that teachers reported improvements in terms of affect and level of student participation. Further, researchers looking into the impact on learning and instruction of iPads in two upper elementary school classrooms found improvements in student independence and self-efficacy (Reid & Ostashewski, 2011). Hwang and Chang (2011) compared students' performance on test items using a quasi-experimental research design and found significant differences in achievement between the experimental group and control group. The experimental group was provided a specially designed mobile learning environment that ran on Windows Mobile PDAs, and the control group was given PDAs that were equipped with a more traditional e-learning environment. Differences in achievement between the groups were attributed to increased motivation and time-on-task using the specially designed mobile learning environment. Positive outcomes using mobile devices have also been realized in the field of special education. Fernández-López and colleagues (2013) conducted a pre-experimental study in which they investigated the impact of Picaa running on iPad and iTouch devices on development of learning skills for individuals with special education needs. Although limited by the pre-experimental nature of their research, they found that Picaa promoted learning and was suitable for supporting adaptations often needed by children with special needs.

These are but a few examples of studies that connect the use of mobile devices with positive learning outcomes. However, a recurring theme in these and other studies is the maxim that positive impact on learning cannot be attributed to mobile devices alone. Realizing the promise of mobile devices is closely tied to the manner in which the devices are implemented, the instructional strategies used, and the alignment between the capabilities of the mobile devices and identified pedagogy. In the spirit of realizing this promise, we have been working on a one-to-one iPad project for pre-service teachers at the University of Hawaii–Manoa. This descriptive case report outlines our continued progress in implementing and evaluating a deployment of iPad Mini devices to pre-service teachers and faculty members in a dual licensure teacher preparation program. A formative evaluation of our technology integration effort was conducted in the Fall of 2013, the results of which we have reported elsewhere (Schmidt & Ho, 2013). Since then we have performed a series of interviews, a focus group, surveys, and an external evaluation of our technology integration efforts. We report our findings here. Our report will be of value to instructors, technology coordinators, and other stakeholders who are currently considering or are in the process of rolling out a mass mobile device implementation. By generating and sharing practical and theoretical knowledge from our project, we hope to contribute to the small but growing base of literature that explores how mobile devices like the iPad Mini can be used successfully in education.

The Study

The purpose of the current descriptive case study is to report the ongoing formative evaluation of a one-to-one implementation of iPad Mini tablets in a dual licensure (special/general education) teacher prep program at the

University of Hawaii, Manoa. To date, we have collected a variety of formative evaluation data. Our data collection efforts are summarized in Table 1 below.

In Fall, 2013, the University of Hawaii, Manoa rolled out a dual licensure teacher preparation program that provided the opportunity for prospective students to pursue accreditation in both general education and special education. As part of this effort, all students and their teachers were provided an iPad Mini. The iPad Mini was to be used by the students until they completed the program.

Towards the end of the Fall, 2013 semester, a survey was distributed to all teachers and students (pre-service teachers). The survey focused on how students and instructors perceived the use of iPad Minis as an educational tool and the support they received for meaningfully integrating iPad Minis into teaching and instruction. The student survey consisted of four closed-choice and nine open-ended questions that focused on perceptions of usefulness, quality of service and support, and educational impact. The instructor survey consisted of five closed-choice and five open-ended questions that focused on perceptions of quality of service and support and identifying areas where further support might be needed for integrating the iPad Mini meaningfully into curricula.

The surveys for the Fall, 2013 evaluation were developed using Google Forms, after which they were piloted with four faculty members and cleared with exempt status from the campus IRB before being disseminated to teacher candidates and instructors. After piloting and IRB clearance, invitations were sent to teacher candidates and instructors via email. Invitations were sent to 35 teacher candidates and 16 instructors. These invitations were followed one week later with a separate email message reminding participants to fill out the survey forms. Response rate for teacher candidates was 91% (32/35), and for instructors was 50% (8/16). The lower response rate for instructors is attributed to the fact that some of the instructors had not yet begun teaching in the program (they were to begin in the second semester of the program). Other instructors were not classroom instructors, but instead focused on training other merged program instructors in such areas as co-teaching and culturally responsive teaching methods.

In Spring 2014, teachers in the dual-licensure program were asked to complete an evaluation form after each class session. Part of the form asked teachers to report their use of technology in their class, including iPad use. Teachers indicated whether they implicitly modeled or demonstrated technology use, explicitly instructed students in technology use, and whether technology use was embedded in the lesson or required as homework. Of the nine faculty members teaching in the program during Spring 2014, 100% participated in completing the survey. Survey results relating specifically to iPad usage were compiled into a single spreadsheet for analysis.

Also in Spring 2014, a semester-long, in-depth exploratory study in a STEM methods course was conducted. The purpose was to explore methods and processes for meaningfully translating a traditional paper-and-pencil instructional unit into a multimedia-rich, technology-infused unit that used iPad Minis extensively throughout the activity. Data from field notes, open-ended surveys, weekly debriefs, and an external formative evaluation were used to inform progress, identify avenues for improvement, and establish best practices. Participants were 35 undergraduate students enrolled in the teacher preparation program (30 female, 5 male). Ages were between 20 and 25 years old. Data sources included field notes, minutes from weekly debriefs, and surveys. Field notes were created during design meetings and after face-to-face classes. Surveys were delivered using online forms. An external formative evaluation was conducted by 14 students in a graduate-level instructional technology course as well, focusing on: 1) technology tools used, 2) design of materials, and 3) instructional strategies. Formative evaluation results were delivered to the researchers in the form of evaluation reports.

In addition, individual face-to-face interviews and one focus group interview were conducted in Spring 2014. Three students between 19 and 29 years old who were currently enrolled in the program were asked about their perceptions and uses of the iPad Mini as a teaching and learning tool. Two were female, and one was male. Selection was purposive and based on the following criteria: 1) participant was enthusiastic about using iPads in their program, 2) participant nominated his/herself to provide other students support for iPads, and 3) participant showed interest in exploring technology. Each participant was individually interviewed for one hour using a structured interview protocol. Interviews were audio recorded for later analysis. After interview data were reviewed, a one-hour focus

group with all three participants was convened. The focus group followed the format of an "incubator forum." The incubator forum format allowed 10 minutes to present findings, then 5 minutes for the participants to ask clarifying questions. After this, the participants held a discussion about what was presented for 15 minutes, followed by responses to questions and comments made by the participants for 5 minutes. Finally, the participants engaged in back and forth discussion and questions for 10 minutes. During the incubator session, detailed notes were taken as well as an audio recording of the session.

Table 1.
Data collection efforts to date.

Semester	Evaluation type	Evaluation context	Participants
Fall, 2013	Survey (1)	Cross-curricular	32 pre-service teachers
Fall, 2013	Survey (1)	Cross-curricular	8 faculty members
Spring, 2014	Survey (1)	Cross-curricular	9 faculty members
Spring, 2014	Survey (3)	STEM methods class	35 pre-service teachers
Spring, 2014	Individual interviews	Cross-curricular	3 pre-service teachers
Spring, 2014	Focus group	Cross-curricular	3 pre-service teachers
Spring, 2014	Survey	STEM methods class	14 external evaluators

Survey data were analyzed using descriptive statistics for closed-choice responses and open-coding for open-ended responses. Closed-choice responses were input into a spreadsheet from which descriptive statics such as mean, median, standard deviation, etc. were established. Open-ended responses were input into tables in a word processor and reviewed by the authors. Authors' review of the open-ended questions used a simple method of searching for trends and themes among participants' responses, then creating descriptors for those trends and themes, and associating representative firsthand quotes from participants with those descriptors. Following this, the authors got together and discussed their findings. The authors agreed that no formal inter-observer agreement was necessary, given that the focus of this evaluation was on improvements to processes and supports. However, the authors did note remarkable similarity in the trends and themes that were identified.

For the study conducted in the STEM class, data from surveys were analyzed using inductive and deductive axial coding. The survey data were stored in a spreadsheet for sorting and analysis. Preliminary codes for the data were created, researchers reviewed the codes, discussed their definitions and how they should be applied, applied the codes to a subset of the data, identified ambiguous or overlapping codes, and amended them. Data were then individually coded. Researchers established inter-rater reliability by coding each other's data and comparing. Reliability was established using a point-by-point estimate in which agreements (A) were divided by agreements plus disagreements ($A+D$) and then multiplied by 100. The averaged inter-rater reliability was 95%, indicating high agreement between coders. Coded data were categorized, summarized, and finally synthesized into three broad, overarching thematic areas. Representative artifacts from the data sources were identified and reviewed. Themes and excerpts were then organized, summarized and crafted into narrative.

Findings

Findings from early in the one-to-one initiative (Fall, 2013) suggested generally positive perceptions of the iPad Mini as a teaching and learning tool, but also indicated a need for additional support and professional development. There were differences in how students and instructors used the iPad Minis. In general, students were more

comfortable with the iPad Mini and used it more on a day-to-day basis than instructors. Instructors reported that they viewed the iPad Minis as having the potential to engage students and to be useful as an educational tool. They were particularly pleased with the accessibility to information, ability to take notes, and ability to participate in technology-mediated class activities. Students took a positive view of the iPad Mini as an educational tool, reporting that they found using it in the program to be engaging, useful, and innovative. There were some challenges, however. For instance, instructors were unsure as to how to realize the potential of the devices, and tended to use iPads to facilitate their own classes, but did not necessarily instruct students how to use the devices in their own teaching. They also noted the limitations of the device, such as its lack of a keyboard and small screen, and inability to perform the same functions as a fully-featured desktop computer.

Usage reports from Spring, 2014 indicated that teachers were exploring the use of iPads beyond what they had done in Fall, 2013. Reports indicated that teachers were using the iPads for such classroom management activities as calling on students using the Pick Stick app, grouping students using the Group Maker app, and recording and sharing videos with students using built-in software and Google Drive. Teachers were providing tests online that students would take using their iPads. Further, they had students create and share flash cards using the Flashcard+ app. Students would share information in class using the Keynote app. They would take notes using Audionote. In addition, students used the Pearson Digital Library to download and read electronic textbooks that teachers had annotated and highlighted. Google Drive was used widely for sharing multimedia and submitting assignments. Comfort with the iPads and use of iPads from Fall, 2013 to Spring, 2014 increased noticeably. This is reassuring, given reports indicating that instructors felt unprepared to use the iPad Mini as an instructional and learning tool and admitted to not knowing how to implement iPads in their courses.

Results from the interviews conducted in Spring, 2014 indicated that participants believe the iPad can act as an augment to teaching, but should not be used to replace teaching; that support needs to be a focus; and 3) that keeping up with shifting technology trends is a challenge. One participant shared how she used the iPad to introduce a short video and a fun game to get her students interested in the lesson, and then shifted to using more traditional methods to do her main teaching assignment. Participants agreed that a key reason iPads are useful is the apps they let you use. However, since "everyone is so busy, how do you find these good apps? You might have a few minutes here or there but what if the app looks good but isn't free?" Another participant noted, "I don't necessarily use [the iPad] for teaching because I haven't seen how it could actually help me in teaching." This underscores why device support and training within classroom settings is critically important. Finally, participants suggested that successful iPad use is not indicated by "trying to keep on the hamster wheel of technology change and always adding new things because they are new." Instead, one participant suggested that teachers should "Try to master the tools you are given and become a real expert."

The focus group that followed the individual interviews provided additional insights into participants' perceptions. Participants view the iPad as a great way to introduce educational material to students and agree that technology like the iPad is changing teaching and the teacher/student dynamic in many new ways. However, not all of the change is positive. For instance, concerns over cheating and becoming overly reliant on technology (e.g., spell check) were brought up. Conversely, participants were enthusiastic that mundane tasks like looking up vocabulary words can be greatly simplified using the iPad. Participants were also concerned that an over-reliance on technology might adversely impact student relationships, and that too much iPad use in the classroom might have unanticipated social consequences. Overall, participants were cautiously optimistic about the potential of the iPad for teaching and learning. They felt that technologies like the iPad have huge potential with many uses "yet to be discovered"; however, this sentiment was tempered with the observation that traditional teaching methods are equally important and the iPad should not be expected to supplant such teaching. In addition, participants were concerned that iPads may be challenging for older teachers to adopt given their lack of technical knowledge, and that supporting such teachers should not only focus on how to use the technology, but also how to integrate the technology meaningfully into instruction.

The Spring, 2014 exploration of technology use in the STEM class yielded meaningful insights into the multidimensional and challenging nature of technology integration. Participants used technology and applied technology skills extensively, which were generally perceived positively. They commented that they liked practicing

using technology tools and sharing information online. Some found that using iPads was "a different, more engaging way to learn about technology" and facilitated them becoming an "active science learner." However, others were challenged by their lack of technological fluency. Overall, the technology-rich module that was developed for this class received high marks. However, the instructors noted challenges in terms of integrating technology into their instructional design and the methods used to do so. They were also challenged with marrying an inquiry-based pedagogical approach with the significant time and effort required to develop technology-rich materials, instructional processes, and student activities.

Conclusions

In this report, we have introduced our project to integrate mobile technology (iPad Minis) into a dual licensure elementary teacher education program. We provide a review of the literature in which we present an overview of the benefits attributed to mobile devices, along with a discussion of the potential "pitfalls" associated with these devices. In this section, we discuss the implications of those findings and suggest directions for moving forward. Generally speaking, our iPad one-to-one initiative is being well received. However, it is clear that more teacher and student support is needed. Any support will need to have a dual-focus. On the one hand, support should focus on general device usage and software specific training (e.g., apps). On the other hand, support should focus on conceptual/pedagogical training on how to use the iPad Mini as an instructional and learning tool. In addition, support must consider the larger problem of training instructors and teacher candidates to use the iPad effectively and meaningfully as an instructional tool. The challenge is complex, however, as teacher needs differ from student needs. Instructors need support for using the iPad mini for instruction, whereas teacher candidates need support for using the iPad Mini for their own learning, as well as future instruction with actual students.

In this paper, we have presented a number of successes and challenges uncovered through a series of formative evaluations. These issues fall broadly into the categories of supporting instructors in using technology, supporting students, and meaningfully integrating technology. Nowadays, technology is everywhere. However, just using technology is not an integrated experience. Further, not all uses of technology are equally appropriate. Exploring examples of appropriate and inappropriate technology use with both teachers and students might present opportunities to collaboratively develop competencies and to explore strategies for using technology appropriately. This suggestion has ramifications for how we support teachers and students.

Designing any instruction is complex and requires a lot of planning. Integrating technology into that instruction across an entire curriculum increases the complexity and challenge. Compounding this challenge is the significant hype that surrounds iPads in education. Although the iPad is often touted at Apple-sponsored events as "magical" and in the popular press as the silver bullet that is going to "save" education, the reality is much more mundane. The iPad is fundamentally hardware that runs software. What makes them compelling for education is the combination of ultramobility, long battery life, access to information, low-cost applications, a multitude of applications, ease-of-use (and relative difficulty to break), along with a relatively intuitive touchscreen interface. However, these devices are quite limited in many ways. They have no physical keyboard and mouse, and are therefore not ideal content creation devices. Implementing for consumptive learning activities that require reading, watching videos, etc. does not require any particularly creative feats of imagination. However, for activities that require significant writing or media production, iPads seem more appropriate as technology that can augment, but not drive, content creation. And while these devices have the potential to connect students and allow for interesting and useful cases of networked collaboration, realizing this potential is an area that is not yet well understood. Understanding these limitations is key when developing pedagogical interventions that integrate iPads.

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