TABLETS IN COLLEGE TEACHING & LEARNING: REVIEW OF LITERATURE AND DEPLOYMENT RECOMMENDATIONS

Dr. Shanna Jaggars, Director of Student Success Research

Marcos Rivera, Graduate Research Associate, Student Success Research

January 22, 2018

The Digital Flagship University Initiative is an innovative collaboration with Apple to support The Ohio State University's strategic plan. The initiative supports student access and affordability by providing iPads, training programs, and technical support at no cost to all first-year students starting in Autumn 2018. The initiative integrates learning technologies and support throughout the university environment and reinforces the strategic plan's pillars of teaching and learning, research, and creative expression. Through this document, we provide evidence-based suggestions for a successful deployment.

BACKGROUND

We conducted a review of existing research on tablet use and deployment in higher education, focusing on the following key areas of research:

- **Device Configuration**: What kinds of applications or hardware accessories are most useful to include on a mobile device for the purposes of student productivity, collaboration, and deepened learning?
- **Student Fluency**: What kinds of support, resources, and communications are necessary in order for students to use their mobile devices effectively in the service of academic learning?
- **Instructor Integration**: What kinds of support, resources, and communications are necessary in order for most instructors to integrate mobile affordances into their teaching processes?
- **Student Impact**: What types of tablet-based pedagogical approaches will most likely increase student engagement and learning outcomes?

Based on search keywords, we uncovered 74 potentially relevant scholarly articles; we narrowed these down to 27 which were relevant to the use, benefits, and challenges of mobile devices in postsecondary environments (including five particularly useful reviews of the literature in K-12 and/or college settings). Unfortunately, the current research literature is not particularly strong. Most studies focused on short-term outcomes (within a single semester). Quantitative studies typically did not use rigorous methods (e.g., very few were randomized experimental designs), and tended to focus on short-term rote memorization instead of long-term cognitive development. Qualitative studies tended to focus on self-reported perceptions of and tactile experiences with mobile devices. Studies also focused on a limited set of academic disciplines, with language learning, health, and computer science being the primary areas of focus.

While the literature does not provide a robust and rigorous evidence base for practical recommendations, we were able to extract some potentially-useful directions for practice, as synthesized below.

KEY FINDING & PRACTICAL IMPLICATIONS

DEVICE CONFIGURATION

What kinds of applications or hardware accessories are most useful to include on a mobile device for the purposes of student productivity, collaboration, and deepened learning?

Applications and device configuration are integral to the success of mobile technology deployments; for example, studies suggest that physical keyboards and styluses (e.g., Apple Pencil) are necessary to support student usage and learning (Rossing, Miller, Cecil, & Stamper, 2012; Wardley & Mang, 2016). Some research suggests that students' reading comprehension may suffer when using digital texts and long-form documents; however, these challenges are primarily due to: (1) content formatting, and (2) navigation issues associated with scrolling through documents. Both issues can be alleviated with page-flip style navigation and customizable text formatting options including resizable text, zoom functionality, and color inversion (Sanchez & Wiley, 2009; Singer & Alexander, 2017).

Providing a preinstalled background/wallpaper with tips on how to use the iPad, or information on specific apps, may help students use their device effectively (Morris, Lambe, Ciccone, & Swinnerton, 2016). Apps themselves may potentially improve student productivity and learning; however, there is no evidence identifying specific applications. In addition to general productivity applications native to

the iPad (e.g. Calendar, Notes, Reminders), below are *categories* of mobile applications that tend to be useful for college students, along with example app names, if noted in the literature:

- **Notetaking:** cloud uploads, collaboration, handwriting recognition (e.g., Endnote, Onenote; Li, Pow, Wong, & Fung, 2010)
- **Course materials:** digital textbooks, online lectures (e.g., Canvas, Coursera, iBooks, iTunesU; Gidion Capretz, Meadows, & Grosch, 2014)
- **Cloud storage:** access and upload assignments, class notes, and files (e.g., iCloud, Dropbox, Buckeye Box; Diemer Fernandez, & Streepny, 2012)
- **PDF reader:** annotations, custom formatting (e.g., PDF Reader, iAnnotate; Thinley, Geva, & Reye, 2014)
- **Presentation:** class notes from faculty, assignments (e.g., PowerPoint, Keynote, Prezi; Gidion et al., 2014)
- **Word processing:** document creation, editing, collaboration (e.g., Notes, Word, Google Docs; Nguyen, Barton, & Nguyen, 2015)
- **Multimedia:** watch videos, create content, podcasting (e.g., YouTube, VoiceThread, iMovie; Souleles Savva, Watters, Annesley, & Bull, 2015)
- **STEM related:** multiple experiments, 3D models, calculation, graphing (e.g., MedCalc, Epocrates; Thinley et al., 2014)
- **Campus resources:** maps, class schedules, advising, library access, grade tracking (Hahn & Bussell, 2012)

STUDENT FLUENCY

What kinds of support, resources, and communications are necessary in order for students to use their mobile devices effectively in the service of academic learning?

College students generally have positive attitudes toward iPads, and find them particularly useful for instantly accessing Internet-based learning resources (e.g., YouTube, Wikipedia, Google Scholar), enhancing time management and productivity (e.g., through calendars, notes, and reminders), and enhancing collaboration and interaction (e.g., sharing work with a group and receiving feedback, facilitating more efficient group work in the classroom; Nguyen et al., 2015). In order to use the device effectively for academic purposes, however, students need direct and sustained instruction on how to use the iPad in the classroom, including how to use specific apps for different types of assignments, and how to manage in-class digital etiquette. Readily-available and helpful technical support will also

be necessary to keep students engaged with the iPad when they become confused or frustrated with using it in an academic context.

The Digital Flagship implementation should consider the following suggestions to build student fluency and self-efficacy in terms of using mobile devices in an educational context:

- **Integrate iPad demonstrations throughout orientation.** Campus initiatives are more likely to be successful if they leverage collaborative efforts (Kezar, 2006). For example, within orientation, a Career Center representative might provide tips on using the iPad for resume creation; the Dennis Learning Center might highlight study skills apps; ODI might highlight accessing digital support groups on the iPad; and Academic Advising might highlight iPad-based class search and scheduling functions.
- **Utilize iPads during orientation tours**, by highlighting campus resources with location services, creating an iPad-enabled orientation scavenger hunt, or using constellation maps during the Moonlight Tour (Calkins & Bowles-Terry, 2013; Pittarello & Bertani, 2012).
- **Incorporate writing assignments into orientation** (e.g., Letter to future self; Pittarello & Bertani, 2012) using an authoring interface, to encourage early adoption and show ease of use.
- **Offer a iPad-focused "example class" for orientation students and parents** to highlight possible device uses and benefits, while highlighting key features such as "Do Not Disturb" mode to reduce distractions (Churchill & Wang, 2014).
- **Create a monthly newsletter** as a cost-effective tool to disseminate accurate information to students and instructors (Kowalski, 2011); for example, by clarifying policies, offering tips, and including reminders for iPad use in the classroom.
- **Enable push notifications** for student resources during important and challenging times of the year (e.g., personalized reminders of registration windows and financial aid deadlines serving as "nudges"; notifications of tutoring and stress management resources available during midterms; Griffin, 2011).
- **Create and install adaptive tutorials** that assess students' proficiency with key iPad-related tasks and provide hands-on training (Zhang, 2005).
- **Ensure tech support is seamless and responsive,** using a tech support shortcut icon, diagnostics app, off-peak live chat, and online support forums to let students know of multiple avenues of support (Mang & Wardly, 2012; Wardley & Mang, 2016).
- **Incentivize continued learning** with certificate programs, Hackathons, and video contests for students to submit innovative uses of the iPad (Prince, 2004).

INSTRUCTOR CONFIGURATION

What kinds of support, resources, and communications are necessary in order for most instructors to integrate mobile affordances into their teaching processes?

Instructor integration and support are integral aspects of mobile device adoption and integration (Gan, Menkhoff, & Smith, 2015). Faculty are concerned about iPads distracting their students; thus it is critical to familiarize both students and faculty with digital etiquette (such as the use of "Do Not Disturb" mode) and to reinforce digital citizenship messages whenever possible (Chou, Block, & Jesness, 2012). To integrate iPads into their courses, most faculty need concrete ideas and guidelines on how to use them effectively for teaching purposes, particularly in ways that are specific to their own course. Faculty are also frustrated when the most useful/relevant apps for their pedagogical purposes do not exist or are too expensive for students. Asking faculty to "organically" discover uses for the iPad does not seem be effective; and workshop-only methods are insufficient to create broad-scale pedagogical shift (Link, Sintjago, & Mckay, 2012). Appropriate workshops and training sessions could be identified through a needs-based survey assessing instructors' technical ability (Zhang, 2005).

The Office of Distance Education and eLearning is committed to instructor training and support. ODEE has partnered with the University Institute for Teaching and Learning to take a multifaceted approach to proactively construct formal and informal learning opportunities. As a first step, ODEE is working closely with a small cohort of "Digital Flagship Educators" who will teach iPad-required courses in Autumn 2018. Beyond these first adopters, the suggested strategies below could help engage and support the wider population of instructors in the process of integrating iPads into their classrooms:

- **Provide editable templates for syllabi** suggesting clear etiquette and rules of iPad use by students in the classroom (Rossing, Miller, Cecil, & Stamper, 2012).
- **Create Faculty Learning Communities** through the University Center for the Advancement of Teaching UCAT) to encourage cross-disciplinary peer support for faculty and GTAs in terms of iPad integration (Aiyegbayo, 2015).
- **Develop "communities of practice" (COPs)** for specific courses (perhaps beginning with high-enrollment STEM and English courses), facilitated by instructional designers, to provide a framework for instructors' ongoing collaborative inquiry and improvement in terms of iPad integration (Cochrane, 2012, 2014; Bailey, Jaggars, & Jenkins, 2015; Bryk, 2014).
- **Provide COP templates and frameworks** encouraging Colleges to create department-, program-, or course-specific collaborative inquiry groups (Cochrane, 2012, 2014).

- **Develop a grant program** to encourage faculty to organize and lead COPs, create video tutorials of pedagogical implementation, or facilitate workshops for their peers (e.g., Stanford University's iPads for Learning program; Wolcott & Betts, 2007).
- **Create plug-and-play tutorials** for common iPad-related course assignments (i.e., how to make a basic podcast, how to design effective presentations) which can be enabled by instructors in Canvas (Hargis, Kamali, & Soto, 2014).
- **Implement a "train the trainer" model** for departmental IT and ID staff to learn how to support their instructors with iPad integration (Hargis et al., 2014).

STUDENT IMPACT

What types of tablet-based pedagogical approaches will most likely increase student engagement and learning outcomes?

Unfortunately, the literature on the impact of digital devices on college student learning outcomes is neither large nor robust. Studies tend to be small or to lack rigor, and most research focuses on student perceptions of engagement, rather than on measurable learning impacts. Having said that, the literature suggests that tablets and mobile technologies *can* – but do not *necessarily* – improve college students' learning experiences and outcomes (Haßler, Major, & Hennessy, 2016).

- In order to positively influence students' learning outcomes, research suggests the critical importance of supporting the three areas we have discussed thus far (effective device configuration, student fluency, and instructor integration).
- Ideally, classroom integrations of the iPad should focus on moving instruction away from "knowledge transmission" and toward "learning facilitation" techniques (Bailey, Jaggars, & Jenkins, 2015). For example, iPad-enabled assignments which are designed to foster a sense of authorship can be particularly helpful for student engagement and motivation (e.g. blogs, wikis, collaborative editing, multimedia presentations, and media creation such as videos and podcasts; Bontley, Gomez, Kahlil, & Mansour, 2016).
- As students use the iPad more in the classroom to take notes, post on LMS, and conduct group work, they are less likely to be distracted by non-educational uses of the device and more engaged in its educational uses (Raney, 2016).

Overall, in order to create a strong foundation for the Digital Flagship University initiative, during the 2018-2019 academic year ODEE will need to: roll out devices configured to increase productivity; work with units across the college to provide student support within orientation and across the first-year experience; engage a first wave of faculty to thoughtfully integrate student-centered iPad-enabled activities and assignments into their first-level courses; and provide tips, tools, and support for the broader base of faculty. In the subsequent year or two, ODEE will need to design and pursue a more ambitious strategy to actively engage the broader base of faculty in terms of iPad integration.

DIRECTIONS FOR RESEARCH

Based on the research summarized above, ODEE might consider conducting the following types of research under the Digital Flagship initiative. We plan to investigate potential opportunities for external funding in these areas:

- Conducting a longitudinal, mixed-methods study to assess differences in academic disciplines' use and adoption of iPads. This would fill a gap in the literature, given that previous studies have primarily focused on a single discipline (typically language learning, health, or computer science).
- Creating and piloting professional development strategies that effectively encourage non-first-adopter faculty to actively integrate iPads into their courses, in ways that measurably increase the proportion of course activities and assessments that are student- rather than teacher-centered.
- Evaluating the impact of making "plug-and-play" academic skills modules available, by randomly assigning Canvas notifications regarding the modules to students within large-enrollment courses with relevant learning outcomes.
- Evaluating the impact of instructor iPad in-class integration on student learning outcomes, and/or on students' motivation to learn the subject matter or continue study in the discipline. For example, ODEE could work with Department X to design iPad integrations for units 1-12 of their key 1000-level course, and some participating instructors would roll out the integrations only for evenly-numbered units, and others would roll out the integrations only for odd-numbered units.

REFERENCES

Aiyegbayo, O. (2015). How and why academics do and do not use iPads for academic teaching? *British Journal of Educational Technology, 46*(6), 1324-1332. https://doi.org/10.1111/bjet.12202

Bailey, T. R., Jaggars, S. S., & Jenkins, D. (2015). *Redesigning America's Community Colleges: A Clearer Path to Student Success.* Cambridge, MA: Harvard University Press. ISBN-10: 0674368282.

Bontly, S. W., Gomez, C., Khalil, S., & Mansour, T. (2016). Impact of technology on post-secondary classroom culture. *Proceedings of Society for Information Technology & Teacher Education International Conference 2016, 1*(1), 1862-1870. https://doi.org/10.13140/RG.2.1.2070.9522

Bryk, A. S. (2015). Accelerating how we learn to improve. *Educational Researcher, 44*(9), 467-477. https://doi.org/10.3102/0013189X15621543

Calkins, K., & Bowles-Terry, M. (2013). Mixed methods, mixed results: A study of engagement among students using iPads in library instruction. *Imagine, Innovate, Inspire: The Proceedings of the ACRL 2013 Conference,* 423–428.

Chou, C. C., Block, L., & Jesness, R. (2012). A case study of mobile learning pilot project in k-12 schools. *Journal of Educational Technology Development & Exchange, 5*(2), 11–26.

Churchill, D., & Wang, T. (2014). Teacher's use of iPads in higher education. *Educational Media International, 51*(3), 214–225. https://doi.org/10.1080/09523987.2014.968444

Cochrane, T. (2012). Secrets of mlearning failures: Confronting reality. *Research in Learning Technology, 20*(SUPPL), 123–134. https://doi.org/10.3402/rlt.v20i0.19186

Cochrane, T. D. (2014). Critical success factors for transforming pedagogy with mobile Web 2.0. *British Journal of Educational Technology, 45*(1), 65–82. https://doi.org/10.1111/j.1467-8535.2012.01384.x

Diemer, T. T., Fernandez, E., & Streepny, J. W. (2012). Student perceptions of classroom engagement and learning using iPads. *Journal of Teaching and Learning with Technology, 1*(2), 13–25.

Gan, B., Menkhoff, T., & Smith, R. (2015). Enhancing students' learning process through interactive digital media: New opportunities for collaborative learning. *Computers in Human Behavior, 51*, 652–663. https://doi.org/10.1016/j.chb.2014.12.048

Gidion, G., Capretz, L. F., Meadows, K. N., & Grosch, M. (2014). Media usage in post-secondary education and implications for teaching and learning. *ICST Transactions on E-Education and E-Learning*, *1*(4), e3. https://doi.org/10.4108/el.1.4.e3

Griffin, D. (2011). Nudging students' creative problem-solving skills. *PS: Political Science & Politics*, *44*(2), 425-427.

Hahn, J., & Bussell, H. (2012). Curricular use of the iPad 2 by a first-year undergraduate learning community. *Library Technology Reports*, *48*(8), 42–47.

Hargis, J., Cavanaugh, C., Kamali, T., & Soto, M. (2014). A federal higher education ipad mobile learning initiative: Triangulation of data to determine early effectiveness. *Innovative Higher Education, 39*(1), 45–57. https://doi.org/10.1007/s10755-013-9259-y

Haßler, B., Major, L., & Hennessy, S. (2016). Tablet use in schools: A critical review of the evidence for learning outcomes. *Journal of Computer Assisted Learning, 32*(2), 139–156. https://doi.org/10.1111/jcal.12123

Kezar, A. J. (2006). Redesigning for collaboration in learning initiatives: An examination of four highly collaborative campuses. *The Journal of Higher Education, 77*(5), 804–838. doi:10.1353/jhe.2006.0043

Kowalski, T. J. (Ed). (2004). *Public relations in schools* (3rd ed.). Upper Saddle River, NJ: Pearson

Li, S. C., Pow, J. W., Wong, E. M., & Fung, A. C. (2010). Empowering student learning through Tablet PCs: A case study. *Education and Information Technologies, 15*(3), 171–180. doi:10.1007/s10639-009-9103-2

Link, A., Sintjago, A. & McKay, M. (2012). *"Geeking out" with iPads: undergraduate instructors discuss their experiences during the first year of a large-scale tablet initiative.* Paper presented at theWorld Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education.

Mang, C. F., & Wardley, L. J. (2012). Effective adoption of tablets in post-secondary education: recommendations based on a trial of ipads in university classes. *Journal of Information Technology Education: Innovations in Practice, 11*, 17. Retrieved from http://jite.org/documents/Vol11/JITEv11IIPp301-317Mang1138.pdf

Morris, N. P., Lambe, J., Ciccone, J., & Swinnerton, B. (2016). Mobile technology: students perceived benefits of apps for learning neuroanatomy. Journal of Computer Assisted Learning, 32(5), 430–442. https://doi.org/10.1111/jcal.12144

Mueller, P. A., & Oppenheimer, D. M. (2014). The pen is mightier than the keyboard. *Psychological Science, 25*(6), 1159–1168. https://doi.org/10.1177/0956797614524581

Nguyen, L., Barton, S. M., & Nguyen, L. T. (2015). IPads in higher education - Hype and hope. *British Journal of Educational Technology, 46*(1), 190–203. https://doi.org/10.1111/bjet.12137

Pimmer, C., Mateescu, M., & Gröhbiel, U. (2016). Mobile and ubiquitous learning in higher education settings. A systematic review of empirical studies. *Computers in Human Behavior, 63*, 490–501. https://doi.org/10.1016/j.chb.2016.05.057

Pittarello, F., & Bertani, L. (2012). CASTOR: Learning to create context-sensitive and emotionally engaging narrations in-situ. *In Proceedings of the 11th International Conference on Interaction Design and Children* (pp. 1–10). New York, NY, USA: ACM. https://doi.org/10.1145/2307096.2307098

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223–231. doi:10.1002/j.2168-9830.2004.tb00809.x

Raney, M. A. (2016). Dose- and time-dependent benefits of iPad technology in an undergraduate human anatomy course. *Anatomical Sciences Education, 9*(4), 367–377. https://doi.org/10.1002/ase.1581

Reid, D., & Pechenkina, E. (2016). *Bring-your-own-device or prescribed mobile technology? Investigating student device preferences for mobile learning*. (L. E. Dyson, W. Ng, & J. Fergusson, Eds.), *Mobile learning futures – Sustaining quality research and practice in mobile learning*.

Rossing, J. P., Miller, W. M., Cecil, A. K., & Stamper, S. E. (2012). iLearning: The future of higher education? Student perceptions on learning with mobile tablets. *Journal of the Scholarship of Teaching and Learning, 12*(2), 1–26. https://doi.org/FC55086F-5A96-4456-B917-A50C5ED529BD

Sanchez, C. a., & Wiley, J. (2009). To scroll or not to scroll: Scrolling, working memory capacity, and comprehending complex texts. *Human Factors, 51*(5), 730–738. https://doi.org/10.1177/0018720809352788

Schmid, R. F., Bernard, R. M., Borokhovski, E., Tamim, R. M., Abrami, P. C., Surkes, M. A., et al. (2014). The effects of technology use in postsecondary education: A meta-analysis of classroom applications. *Computers & Education, 72*, 271–291. doi: 10.1016/j.compedu.2013.11.002

Singer, L. M., & Alexander, P. A. (2017). Reading on paper and digitally: What the past decades of empirical research reveal. *Review of Educational Research, 1*–35. https://doi.org/10.3102/0034654317722961

Souleles, N., Savva, S., Watters, H., Annesley, A., & Bull, B. (2015). A phenomenographic investigation on the use of iPads among undergraduate art and design students. *British Journal of Educational Technology, 46*(1), 131–141. https://doi.org/10.1111/bjet.12132

Thinley, P., Geva, S., & Reye, J. (2014). Tablets (iPad) for m-learning in the context of social constructivism to institute an effective learning environment. *International Journal of Interactive Mobile Technologies (iJIM)*, *8*(1), 16. https://doi.org/10.3991/ijim.v8i1.3452

Wardley, L. J., & Mang, C. F. (2016). Student observations: Introducing iPads into university classrooms. *Education and Information Technologies*, *21*(6), 1715–1732. https://doi.org/10.1007/s10639-015-9414-4

Wolcott, L., & Betts, K. (2007). What's in it for me? Incentives for faculty participation in distance education. *International Journal of E-Learning & Distance Education*, *14*(2), 34-49.

Wu, W. H., Jim Wu, Y. C., Chen, C. Y., Kao, H. Y., Lin, C. H., & Huang, S. H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers and Education, 59*(2), 817–827. https://doi.org/10.1016/j.compedu.2012.03.016

Zhang, Y. (2005). Collaborative professional development model: Focusing on universal design for technology utilization. *ERS Spectrum, 23*(3), 31–38.