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Student Perceptions of Classroom Engagement and Learning using iPads

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Abstract**:** *Many colleges and universities have launched iPad initiatives in an effort to enhance student learning. Despite their rapid adoption, the extent to which iPads increase student engagement and learning is not well understood. This paper reports on a multidisciplinary assessment of student perceptions of engagement and learning using iPads. Student reactions following single and multiple classroom activities using iPads were measured via a survey asking them to rate their learning and engagement using a 5-point Likert scale. Responses to the questions were grouped into thematic categories of Perceived Learning and Perceived Engagement. Students who reported a high level of engagement while using iPads reported a high level of learning as well. No effects due to age, gender, or language were found. Students who characterized themselves as comfortable with modes of e-learning reported significantly greater levels of perception of learning and engagement. Those who reported being comfortable were more likely to use iPads for learning and professional development in the future. Furthermore, a number of students who initially described themselves as somewhat uncomfortable with e-learning technology also reported interest in continuing to use iPads.*

Keywords: iPads, e-learning technology, learning and engagement, student perceptions

I. Introduction.

Within two days after their initial launch in April 2010, iPads were sold out or scarce at Apple stores worldwide. Before 60 days had passed, Apple had sold 2 million iPads (Kane, 2010). The *Wall Street Journal* (Sherr, 2011) reported in mid August 2011 that Apple had sold 28.7 million iPads since the April 2010 launch. Since then several colleges and universities, including Stanford, Notre Dame, and Pepperdine universities, Oberlin and Reed colleges (Fischman & Keller, 2011; Rice, 2011; Wieder, 2011) have launched iPad initiatives in an effort to enhance student learning. Despite the rapid adoption of iPads for educational and professional purposes, the extent to which this technology enhances student engagement and learning in the classroom is not well understood. However, when other instructional technology has been thoughtfully deployed in the classroom, studies (Chen, Lambert, & Guidry, 2010; Nelson Laird & Kuh, 2005) have found positive correlations between the use of educational technology and student

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engagement, notably in the form of active and collaborative learning and student-faculty interaction.

Assessments of student perceptions of learning and engagement have traditionally been used for gauging the success of new instructional technology (Alavi, 1994). Such assessments are especially practical when the breadth of the impact of novel technology spans multiple disciplines and no single tool can be used to directly measure learning outcomes. While it is generally believed that students would prefer classroom sessions that utilize iPads (Wieder, 2011), no studies to date have explored factors that may contribute to student perceptions of learning or engagement.

The IUPUI Center for Teaching and Learning along with its University Information Technology Services convened a faculty learning community to explore the benefits and problems associated with the introduction of iPads into the classroom. This learning community, comprised of faculty from multiple disciplines, was given access to 40 iPads to deploy in their classrooms in single or multiple sessions over the length of a 16-week semester. We expected that iPad activities would promote *active and collaborative learning*, a defining component of student engagement (Kuh, 2005) associated with positive learning outcomes (Harper & Quaye, 2009; Kinzie, 2010; Prince; 2004).

II. Background.

Prince (2004) defined *active learning* as activities introduced into classrooms and *collaborative learning* as students working together on an assigned task. Pike, Kuh, and McCormick (2008) described "active and collaborative learning" as activity that requires students "to work with other students to solve problems and master difficult material" (p. 7). The iPad features numerous physical characteristics (such as a large screen, motion sensors, and portability) and an expansive selection of inexpensive software that instructors can use to accommodate active and collaborative learning in the classroom. For example, by using the iPad's motion sensors students can push, pull, and lift their iPads to gain a better understanding of the physics of movement; or by using collaborative software students can make concept maps that appear on multiple iPad screens so that each collaborator can contribute to the design of the map. The present study examines student response to the use of iPads as the catalyst for active and collaborative learning.

Prince (2004) summarized research on student engagement and described near consensus that student engagement is associated with positive learning outcomes. Prince further cited several meta-studies to show that collaborative-learning activities, compared to individual assignments, improved academic performance. Kinzie (2010) also explained that student engagement, as defined and measured by National Survey of Student Engagment, is associated with a wide array of desired outcomes. Kinzie further described the link between student engagement and academic success:

> A substantial body of research indicates that once students start college or university a key factor as to whether they will survive and thrive is the extent to which they take part in educationally purposeful activities…Quite simply, to ensure that all students graduate and make the most of their undergraduate education, universities must first ensure the learning environment provides rich and educationally meaningful opportunities and then focus squarely on increasing student engagement (p. 140).

Carini, Kuh, and Klein (2006) described general agreement that student engagement is associated with improved learning. Harper and Quaye (2009) suggested a connection between student engagement and academic success, explaining that students who are actively engaged in educationally purposeful activities inside and outside the classroom show higher retention rates and higher graduation rates. Aston (as cited in Axelson & Flick, 2011) further suggested a direct connection between the amount of engagement and the amount of learning. Kuh (2005) described the benefits of collaborative learning: "... when students collaborate with others in solving problems or mastering difficult material, they acquire valuable skills that prepare them to deal with the messy, unscripted problems that they will encounter daily during and after college" (p. 193).

The purpose of this study is to explore student experiences with iPads to determine their perceptions of learning and engagement and to describe factors that may shape student attitudes towards the use of iPad in the classroom. For this study, a multidisciplinary assessment of student perceptions was conducted following single and multiple activities using iPad. Specifically, the authors examined how factors, such as age, gender, ownership, and overall acceptance of instructional technology among others, impacted student perceptions of learning and their engagement in active and collaborative learning during iPad-centered activities.

III. Methodology.

A. Subjects.

IUPUI is an urban institution with an annual enrollment of approximately 30,000 undergraduate, graduate, and professional students seeking degrees from Indiana University and Purdue University programs. In total, 209 undergraduate students from several degree programs participated in the study by enrolling in a course for which iPads had been selected for deployment (see Table 1). Course selection was determined by the Center for Teaching and Learning and University Information Technology Services from proposals written by the course instructors detailing how iPads could help achieve course outcomes. All data collection and analysis procedures were performed in accordance with the university Institutional Review Board.

B. iPad Activities.

Prior to an iPad activity, class instructors requested specific apps to be installed on the iPads. These iPads were picked up by the instructor and brought to the classroom. At the beginning of each activity, each student was issued an iPad to use for the class period. If required, the students were given instruction for connecting the iPad to the Internet and setting up email. The class was then given an activity that was intended to promote engagement through active and collaborative learning. Activities included the use of collaborative concept mapping, brainstorming, graphing apps using the built-in accelerometer, ear training apps, and mobile access to library resources. Using the iPads, the students were free to move about the room and/or pass the iPads around to view each other's work. Following the activity, the students submitted their work to the instructor through email or a file-sharing application such as Dropbox. The iPads were then collected by the instructor and returned to the administrator who reset the iPads to remove all student work and login information and prepared the iPads for use in the next class. Over the

course of the semester, students used the iPads from 1- 7 times depending on the class in which they were enrolled (see Table 1).

C. Assessment.

At the end of the semester or, in the case of the Library class, at the end of a single session, the students were given a survey asking them to rate their perceptions of learning and engagement through ten questions using a 5-point Likert scale with possible responses ranging from *strongly agree* to *strongly disagree* (see Table 2).

Table 1. Courses & iPad activities used in the study.

Department	Course(s)	iPad Activities	Number of Activities Per Course
Tourism, Convention, and Event Management	Global Tourism Seminar; Mechanics of Meeting Planning	Evaluation of tourism applications; view virtual venue tours, select meeting sites, design meeting rooms, plan menus, and create staffing grids.	3
Organizational Leadership and Supervision	Leadership for a Global Workforce	Creating and accessing open source learning modules.	1
Music	Musicianship 2; Musicianship 4	Train musicians to measure intervals and hear the differences between two notes sounding together or in part.	3
Communication Studies	Introduction to Communication Theory	Demonstrate connections between communication theory and real-life scenarios with mapping applications; exploration of news apps and websites.	7
English	Communication Skills for International Teaching Assistants; English for Academic Purposes	Help international students improve English competency through active learning	2 and 4, respectively
Physical Education	Biomechanics	Measure human movement using the iPads' native accelerometers and video analysis apps.	7
Library	Computer Methods for Journalism	Improve academic honesty by teaching when and how to cite another's work.	1

In addition, all students were asked to answer questions about their age and gender as well as questions about their level of comfort with technology (*pre-comfort*), their future use of mobile devices (*post-use*), their attitude toward e-learning (*e-learning*), and their current ownership of mobile technology (*ownership*, see Table 3).

Table 2. Survey questions provided to the students.

Questions about Students' Perceptions of Learning
The iPad activity helped me apply course content to solve problems.
The iPad activity helped me learn the course content.
The iPad activity helped me connect ideas in new ways.
The iPad activity helped me participate in the course activity in ways that enhanced my learning.
The iPad activity helped me develop confidence in the subject area.
The iPad activity helped me develop skills that apply to my academic career and/or professional life.
Questions about Students' Perceptions of Engagement
The iPad activities motivated me to learn the course material more than class activities that did not use the iPad.
I participated more in class during the iPad activities than during activities that did not use the iPad.
My attention to the task(s) was greater using the iPad.
It was easier to work in a group using the iPad than in other group activities.

D. Analysis.

Survey responses were manually scored (strongly agree = 5, agree =4, neutral =3, disagree = 2, strongly disagree = 1) and entered into an Excel spreadsheet. Responses to the questions were then grouped into thematic categories of *perceived learning* and *perceived engagement* (see Table 2) and were averaged to create *perceived learning* and *perceived engagement* variables. Any case with a missing value for any question was not included in the average calculation. A Pearson correlation coefficient was then calculated for the relationship between participants' reported levels of engagement and reported levels of learning using iPads.

Two of the courses included in the study were for students for whom English is not a first language. For analysis purposes, we created two groups: one with responses from these two courses and another with all other courses. This was done to allow comparisons between exclusively non-native English speakers and primarily native English speakers. A 2 x 2 x 2 (Age x Gender x Language) between-subjects factorial ANOVA was used to compare *perceived learning* and *perceived engagement* among the three factors.

To test whether using iPads in the classroom affected students' likelihood of using iPads in the future for e-learning or professional development, a chi-square test of independence was conducted comparing *pre-comfort* to *post-use* likelihood. To meet the minimum expected cell count requirement, the pre-comfort 'Not at all comfortable' and 'Not very comfortable' responses were combined into 'Not Comfortable'. On the post-use variable, the responses for 'Not Likely', 'Somewhat Likely' and 'Unsure' were combined into 'Not or Low Likely'.

To test the relationship between students' e-learning preference and their perceived learning and perceived engagement, Spearman rank correlations were used. For this test, subjects with missing or "No preference" responses were dropped from the analysis, leaving only subjects whose preference for e-learning technology ranged from "little or no use" to "moderate amount" to "extensive use." A one-way ANOVA with Bonferoni post-hoc t-tests was used to examine whether those who had "no preference" for e-learning technology differed from the groups.

To test whether the frequency of iPad usage affected student reporting of learning and engagement, one-way ANOVAs were computed comparing perceived learning and perceived engagement to number of iPad activities used.

Table 3. Survey of student attitudes toward mobile technology and e-learning.

Question	Possible Response
Before using iPads in this class, what was your comfort level using handheld mobile computing devices? *(pre-comfort***)**	[ ] Not at all comfortable [ ] Not very comfortable [ ] Fairly comfortable [ ] Very comfortable
After using iPads in this class, how likely are you to use a handheld mobile computing device for e-learning or professional development? (*post-use***)**	[ ] Not likely [ ] Somewhat likely [ ] Unsure [ ] Likely [ ] Extremely likely
Considering face-to-face classes that use e-learning technology [such as handheld devices, online research guides, Oncourse, or other course management systems] in the classroom which of the following best fits your preference? (e-*learning***)**	[ ] Classes that make little or no use of e-learning technology. [ ] Classes that use a moderate amount of e-learning technology. [ ] Classes that make extensive use of e-learning technology. [ ] No preference.
Do you own a handheld mobile computing device that is capable of accessing the Internet (whether or not you use that capability)? Examples include iPhone, BlackBerry, other Internet-capable cell phone, iPod touch, PDA, iPad, Kindle, etc. (o*wnership***)**	[ ] No, and I don't plan to purchase one in the next 12 months. [ ] No, and I plan to purchase one in the next 12 months. [ ] Yes. [ ] Don't know

IV. Results.

Surveys were collected from 209 students in nine undergraduate courses. Table 4 shows the distribution by course. Of the 209 students, 91 were female (43.5%), 107 male (51.2%) with 11 (5.3%) declining to answer. The vast majority (82.8%) of the students were aged 19-28 with 26 (12.4%) aged 29-44 and 10 (4.8%) declining to answer. Most students (73.7%) owned a mobile device with Internet access; 9.6% planned to purchase one within 12 months; 9.1% did not own one and had no plans to purchase one; and 7.7% either did not know or did not answer.

Table 4. Number of students by course.

Course	Frequency	Percent
Intro to Communication Theory	36	17.2
English for Academic Purposes	55	26.3
Communication Skills for International Teaching Assistants	18	8.6
Biomechanics	32	15.3
Computer Methods of Journalism	23	11.0
Musicianship 2	9	4.3
Musicianship 4	11	5.3
Leadership for a Global Workforce	10	4.8
Global Tourism Seminar: Mechanics of Meeting Planning	15	7.2
Total	209	100.0

A large number of students (83.7%) reported high comfort levels with using handheld mobile computing devices prior to using iPads in the classroom. A large percentage (85.1%) of students also reported a preference for moderate or extensive use of e-learning technology in the classroom. Tables 5 and 6 provide further details.

Table 5. Student comfort levels with handheld devices.

Response	Frequency	Percent	Cumulative Percent
Very comfortable	103	49.3	49.3
Fairly comfortable	72	34.4	83.7
Not very comfortable	25	12.0	95.7
Not at all comfortable	5	2.4	98.1
Missing	4	1.9	100.0
Total	209	100.0	

Table 6. Student preferences for e-learning technology.

Response	Frequency	Percent	Cumulative Percent
Extensive use	63	30.1	30.1
Moderate amount	115	55.0	85.1
Little or no use	7	3.3	88.4
No preference	18	8.6	97.0
Missing	6	2.9	100.00
Total	209	100.0	

Students, on average, reported high levels of perceived learning and moderate levels of perceived engagement (see Table 7).

Table 7. Descriptive statistics for perceived learning and perceived engagement.

Variable	N	Min	Max	Mean	Std. Error	Std. Deviation
Perceived Learning	192	1.67	5.00	4.13	.049	.683
Perceived Engagement	206	1.00	5.00	3.65	.063	.904

A moderate positive correlation was found between reported levels of engagement and reported levels of learning using iPads ($r(192) = .684$, $p < .001$; Figure 2). Students who reported a high level of engagement while using iPads reported a high level of learning as well.

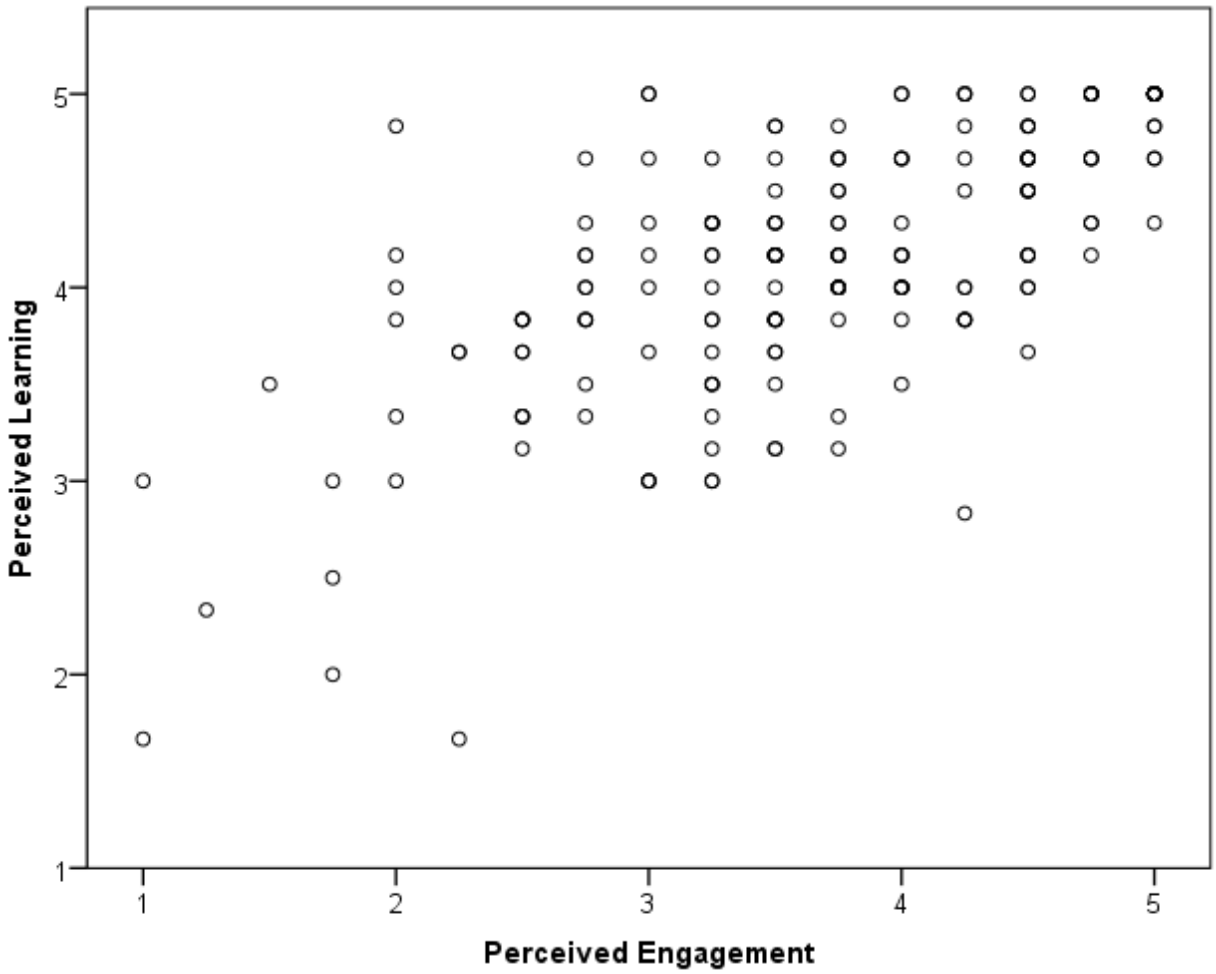

Figure 2. Relationship between perceived learning and perceived engagement.

A 2 (age range) x 2 (gender) x 2 (language) between-subjects factorial ANOVA was used to compare perceived learning and perceived engagement among the three factors. No main effects or interaction effects were significant ($p > .05$). None of age, gender, or use of English as a foreign language had a significant effect on self-reported learning or engagement.

A chi-square test of independence found that post-use likelihood was dependent on pre-comfort level ($\chi 2(4) = 12.50$, $p < .05$; Table 8). Note that approximately 2/3 of the students who

reported *Not Comfortable* before using iPads reported post-comfort levels of *Likely* and *Extremely Likely*.

Table 8. Cross tab of pre-comfort and post use levels.

	Post Use Level			
Pre-Comfort Level	Not or Low Likely	Likely	Extremely Likely	Total
Not comfortable	9	13	8	30
Fairly Comfortable	22	31	19	72
Very Comfortable	14	40	48	102
Total	45	84	75	204

Spearman rank correlations found a positive relationship between students' e-learning preference and their perceived learning ($\rho(170) = 0.30$, $p < 0.0001$) and perceived engagement ($\rho\ (180) = 0.32$, $p < 0.0001$). Students who preferred extensive use of e-learning technology also reported more perceived learning and engagement. For those students with no e-learning preference, significant main effects for e-learning on perceived learning ($F(3,182) = 6.87$, $p = 0.0002$) and perceived engagement ($F(3,195) = 6.21$, $p = 0.0005$) did not lead to discovery of significant differences between the "no preference" group and the groups who expressed the extent of their preference for e-learning.

One-way ANOVAs comparing perceived learning and perceived engagement to number of iPad activities found significance differences for perceived learning ($F(4,187) = 2.85$, $p < .05$). Tukey's HSD was used to determine the nature of the differences. Students who used iPads 7 times reported higher levels of learning ($m = 4.26$, $sd = .563$) than those who used iPads just once ($m = 3.86$, $sd = .776$).

V. Discussion.

As the Apple iPad becomes increasingly common on college campuses (Fischman & Keller, 2011; Rice, 2011; Wieder, 2011), exploration of its impact on instruction and learning is just being established. Writing about iPads for the *Chronicle of Higher Education*, Rice (2011) reported preliminary findings from several universities.

> The most noticeable difference was how students in the iPad classes moved around the classroom more and seemed to be more engaged in the material... iPads increase engagement and collaboration, acting as a facilitator for more easily sharing information. (para. 3-4).

Wieder (2011) pointed to early analyses showing that iPads promote active learning, collaboration, and student engagement. Wieder quoted a Pepperdine University administrator who reported that

> Students using iPads for group assignments in a math class were more in sync than were students in a section not using iPads. The iPad-equipped students worked at the same pace as one another and shared their screens to help one another solve tough problems. (p. A22).

The present study provides a measure of student perceptions of learning and engagement and describes factors that may affect those perceptions. The study involved iPad-centered

activities, conducted among multiple academic disciplines, during single or multiple classroom sessions, and a subsequent assessment of student perceptions of learning and engagement. Age, gender, and language did not affect students' perceptions of learning and their engagement in the form of active and collaborative learning. However, students who characterized themselves as comfortable with modes of e-learning reported significantly greater levels of perception of learning and engagement. Those who reported being comfortable with mobile technology prior to the iPad activities were also more likely to use iPads for learning and professional development in the future. Furthermore, a number of students who initially described themselves as somewhat uncomfortable with e-learning technology also reported interest in continuing to use iPad in coming semesters.

Parker, Bianchi, and Cheah (2008) explained that a link between use of instructional technology and increased student engagement is strongly supported in the literature. Noting a lack of evidence that the increased student engagement resulted in higher grades or higher exam scores, the authors reasoned that the clearest benefit of instructional technology may be its ability to promote collaboration. As noted earlier, Kuh (2005) is among those who asserted that collaborative learning helps students to develop valuable skills that have long-term benefit.

Mobile devices such as the iPad hold the potential to promote student engagement in the form of active and collaborative learning. Positive learning outcomes are likely to accompany use of iPads within university classrooms if the device effectively increases the level of student engagement. Though the classroom use of the iPad in the present study varied across disciplines and by instructor, students reported not only a perception of increased engagement (active and collaborative learning), but also a positive effect on their learning. However, evidence of increased learning through exams or course grades is beyond the scope of the present study.

Age, gender, and the use of English as a first language had little influence on students' perceptions of learning and engagement. This comes as no surprise. Research does not support a stereotype that older students are more resistant to instructional technology or that they are relatively novice in computer use compared to what Prensky (2001) called *digital natives*. Data from the Pew Internet Research Project (Jones & Fox, 2009) show no dramatic difference in Internet use between users in their 20s compared to older generations. Rizzuto and Mohammed (as cited in Githens, 2007) found that older employees in an industrial setting were in fact more willing to adapt to instructional technology for training programs than were younger employees.

Like age, gender also had no impact on perceived outcomes. Research in this area has primarily focused on studying gender in online courses with mixed results. Yukselturk and Bulut (2009) reported no gender difference in learning in an online computer programming course. On the other hand, in Chyung's (2007) study of graduate students in an instructional technology course, female students scored significantly higher on the final exam than did male students. In a study involving 12 online graduate education courses, Rovai and Baker (2005) found women reported learning more than their male peers. Parker, Bianchi, and Cheah (2008) showed that female students were more favorable toward instructional technology than were male students. Results were mixed in the one study we found that did look at mobile learning (Wang, Wu, & Wang, 2009). No gender difference was found for performance expectancy (finding mobile learning useful) but the effect of social influence on the intention to use mobile learning (*post-use*) was significant for men, but insignificant for women. Obviously, more work is needed in this area.

Research on resistance to e-learning provides some insight into how university students might receive the iPad as another component of e-learning technology (Annansingh & Bright,

2010; Thompson & Lynch, 2003). Students in the present study who were comfortable with e-learning and mobile technologies reported more learning and a greater likelihood to use iPads as instructional technology in the future. Research had shown that students who, in contrast, perceived themselves as inadequate or who reported low self-efficacy were generally reluctant to embrace technology in the classroom (Annansingh & Bright, 2010; Thompson & Lynch, 2003). The current study showed that it was possible, however, to overcome this resistance through repeated exposure to the iPad. Students in the present study reported higher levels of learning when given iPad activities multiple times over the semester. Tallent-Runnels et al. (2006) explained that a student's perception of self efficacy when faced with new instructional technology is a function of previous experience. The greater a student's experience with instructional technology, the more likely he or she is to accept new applications. Though the iPad is billed as an easy-to-use technology, students with poor attitude toward e-learning and instructional technology would likely benefit from multiple exposures to improve their self-efficacy and heighten their perceptions of learning and engagement.

The present study is an initial attempt to describe factors influencing the positive impact of iPad activities on perceptions of student learning and engagement. Though we believe that the iPad is generally effective in promoting active and collaborative learning, we did not assess the learning styles of our students prior to this analysis. In future studies, learning styles should be measured and the students should be asked directed questions about whether the iPad satisfied their ability to learn using different sensory modalities (visual, aural, kinesthetic). Furthermore, while measures of student perceptions are generally indicative of positive student success, we did not directly measure discipline-specific student learning. Future quantification of objective, discipline-specific student learning outcomes could further justify the use of the iPad in the classroom.

By design, the study was not narrowly focused on repetition of the same activity in multiple sections of the same academic course. Instead, the study focused widely among a range of academic disciplines, and each instructor used different iPad software. A controlled study with a single repeating iPad activity across several sections of the same course would provide a different perspective on the effect of iPad on engagement and learning.

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