



Full Length Article

An evaluation of medical residents utilization of tablet computers

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ABSTRACT

Today's medical students are digital natives who, for their entire life, have been surrounded by digital technology. Our research focuses on a tablet computer's usability in medical education, and the subsequent transfer from the classroom to the work environment. For a period of three years, all incoming pediatric residents at a large southeastern university were provided an iPad. At the end of the 3-year program, we surveyed the residents measuring perceptions of iPad use and satisfaction. Fifty-six (60%) of the residents responded to the survey. A statistically significant number reported an increased amount of time spent with the tablet throughout their medical education. Similarly, a significant difference exists between those who believe the device to be a necessary part of medical education versus those stating it would be nice but not necessary. We present figures detailing how three conceptual areas: *receiving information*, *inputting information*, and *collaboration* (consisting of ten different facets of the tablet's use) impacted their medical education. Residents throughout their medical education use the tablet extensively. There is variance in the areas where the tablet is the preferred tool versus a smartphone or computer. A clear majority of students expect to transition the tablet into their workplace upon completing residency. We argue a tablet is a useful tool for graduate medical education and later medical practice.

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1. Introduction

Digital technology is increasingly implemented into today's workplace. The medical office evolved from one where rotary telephones and typewriters were commonplace, to the current environment containing powerful computers, smartphones, and video conferencing equipment. This technology is responsible for many advances in production, efficiency, and convenience (Thatcher & Oliver, 2001). In the not too distant past, the cost of acquiring new technology was an obstacle that forced many small and mid-sized medical practices to avoid implementing new information technology. Our research focuses on the implementation of technology in graduate medical education and expectations about its adoption in the medical workplace.

Much like the workplace, technology had a similar impact in the classroom. Where students once carried heavy textbooks, they now have laptops, smartphones, and tablet computers available to assist them with note taking and other aspects of student life. The majority of students currently attending higher education are considered Millennials (Koeller, 2012), those born between 1980 and 2002. The student today, a Millennial, is considered to be a digital native. A digital native is a person who grew up in an

era where the Internet and digital media are a normal part of everyday life. Students born before this generation are digital immigrants, a person who possibly adapted to the permeation of digital technology in society, but grew up in a time where social media and the Internet were not a part of their upbringing (Prensky, 2001).

In 1995, a time when college students were still digital immigrants, researchers (Rowe, Ryan, Therrien, & Mulloy, 1995) conducted a study examining computer use among 433 first-year medical residents. They found only 56 (13%) of the medical residents to be very comfortable using a computer. The students were not "technophobic"; only 69 (16%) lacked an interest in using computers. However, 367 (85%) of the medical residents felt they needed more computer training and 308 (71%) felt computer training is a necessary component of their program.

Comparing those numbers from digital immigrants with those of digital natives, researchers (Keengwe, 2007) surveyed 800 college students at a Midwestern university in 2007 and found less than 1% of participants felt incompetent at four computerized activities: using the internet, emailing, word processing, and Windows/Mac operating systems. During a Reed College iPad study (Marmarelli & Ringle, 2011) in 2010, faculty gave only minor technical instruction when the students first received the device, and the professor teaching the course found it necessary to provide only minimal instruction throughout the semester. The students of

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today are showing an aptitude in computers and digital media, and an acceptance of using these technologies in the classroom.

1.1. Technology in medical education

A recent study (Gormley, Collins, Boohan, Bickle, & Stevenson, 2009) of undergraduate medical students found they prefer online learning to the traditional classroom lecture. Additionally, training for medical students at Southern Illinois University (Han, Nelson, & Wetter, 2014) included using electronic health records, multimedia tools, and other recent technologies, and the students found the instruction to be useful.

After Apple launched the iPad, it did not take long before medical educators (Tanaka, Hawrylyshyn, & Macario, 2012) realized iPads could be harnessed to improve medical education. These researchers studied how iPads could help teach anesthesiology in an orthopedic rotation. The first semester, the entering 11 orthopedic residents at Stanford University received their curriculum in a binder with the syllabus and articles printed on paper. The second semester, the nine incoming residents received their curriculum pre-loaded on an iPad. The researchers administered anonymous surveys at the end of each semester to measure the students' satisfaction level with teaching. The iPad users' opinion of the training was substantially higher than the perception of those who used the paper binder. The results demonstrate an improvement in satisfaction toward learning with the iPad. However, with a sample size of only 20 total students, this study is limited in scope. Additionally, a confound exists in that not all of the incoming students received an iPad. Our research alleviates these concerns by providing to all incoming residents over a three year period an iPad for use in their graduate medical studies.

2. Method

2.1. Participants

The *Office of Children's Health* in the College of Public Health and the *Department of Pediatrics* in the College of Medicine at a large university in the southeastern United States combined to provide iPads to first year residents who were training in Pediatrics and Medicine-Pediatrics. Residents received the tablets as part of their initial orientation and this occurred for three successive incoming classes (2010–2013). A total of 94 residents in the two programs received the device. Each incoming class received the most current iPad. The specifics of the population are as follows. Of the 94 recipients, 75 were in the Pediatric and 19 were in the Medicine-Pediatric residency programs. The demographics roughly followed the national norm in Pediatric residency programs in that 72 are female and 16 male, with 6 preferring not to respond. Their ages upon entering the residency range from 24 to 40 with the majority (79%) being between 25 and 30 years old.

All iPads given to the residents were installed with Up-To-Date (a leading bedside-information app), Medline, and Formulary. In addition to providing the tablets free of charge, residents were also given a gift card for use to purchase software for the device. Besides the three aforementioned apps, the students could install whatever software they felt best met their needs.

2.2. Survey to assess the tablets utility and use

2.2.1. Development

We developed a survey to determine impact and use of the tablet technology on areas of graduate medical education. Experts in medicine and the technology field reviewed the instrument for content validity.

The survey asked about several distinct areas associated with time spent using the tablet during their residency. These include: general perceptions of technologies, a focus on specific aspects of medical education, hindrances to the adoption of technologies, and intentions to use the device in their own practice upon completion of residency.

2.2.2. Administration

Upon graduation, all Pediatric and Medicine-Pediatric residents received an email that described the nature of the research project and the survey. Subsequently, an informed consent form was sent electronically to the residents. The *Qualtrics Internet* software was utilized to deliver the survey.

3. Results

After the initial and two follow on requests, we received 56 completed surveys for a return rate of 60%. For each program the return rates were $N = 43$, (57%) for Pediatrics and $N = 13$, (68%) for Medicine-Pediatrics, respectively. Ten males and 46 females completed to the survey.

3.1. General usage

Several items asked the residents to provide general perceptions about the device. The first asked about their usage as a trend. That is, throughout their residency did they find their time spent using the tablet: increase, decrease or remain the same. A clear majority, 73%, reported an increasing amount of time spent with the tablet, 18% reported it remained the same, while 9% indicated it decreased. This difference in usage trend is significant, $\chi^2(2) = 40.75$, $p < .001$. Furthermore, 55.4% report personally purchasing medically related applications for the tablet. This is above and beyond what was spent from the money provided on the gift card.

A second item asked about perceptions of the device as a necessary part of medical training. Seventy percent believed it to be a necessary component while 30% reported it would be nice to have, but not necessary. This difference is significant, $\chi^2(1) = 8.63$, $p < .003$, so residents clearly see the need for a tablet in their training.

The focus of a third question centered on the nature of access to frequently used resources such as handbooks and papers. Only 20% of individuals report carrying those resources on their person with the remaining 80% accessing them electronically, either from a server (e.g., via Moodle) (46%), or from a website (e.g., Merck manual) (34%). This difference is significant, $\chi^2(1) = 6.03$, $p < .05$, indicating residents access digital information, so a tool should be provided that facilitated this task.

3.2. Usage of technology in graduate medical education

There are several areas in which technology such as the tablet may be used during graduate medical education. We identified ten facets and asked about each. This is not an exhaustive list, but we believe it covers many of the focal areas. For clarity of presentation, we group the findings of results into three conceptual areas: (1) *Receiving information*: reading, studying, researching, viewing presentations, and watching videos; (2) *Inputting information*: note-taking, making annotations; and (3) *collaboration*: sharing documents, video chat, and utilizing a learning management system (LMS e.g., Blackboard). For each of the ten facets, individuals responded to how much time *per week* was spent per activity on the following scale: *Greater than 3 h, 2–3 h, 1–2 h, 30–60 min, less than 30 min, I do not use the iPad for this activity.*

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