

# TEACHER PRACTICES WITH MOBILE TECHNOLOGY INTEGRATING TABLET COMPUTERS INTO THE EARLY CHILDHOOD CLASSROOM

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## ABSTRACT

The current study responds to the increased interest in tablet computers by schools across the country by using Orlikowski's duality of technology framework to examine the dynamic relationship between school institutions, teachers, and technology in early childhood classrooms with iPads. Results from 53 hours of observations and 9 teacher interviews from four suburban Midwest schools show positive beliefs in technology to aid student learning and unique affordances of iPads, such as anywhere/anytime learning and an increase in the home-school connection; however, a lack of training and support along with technological difficulties and personal attitudes and concerns about the appropriateness of technology with young children prohibited changes in teacher practices and attitudes. Rather, teachers incorporated the iPad into their curriculum in ways that matched their own teaching philosophies. Overall, the study suggests teachers would benefit from increased training and structured support that not only demonstrates how to more effectively incorporate tablets into their curriculum but that works to shift their mindsets to more student-centered philosophies in order to leverage the potentials of tablet computers. As one of the first studies to investigate how tablet computers are being used in early childhood education, the current study provides novel insight and a starting place for more quantitative investigations into the impact of tablet computers on young children's learning.

## INTRODUCTION

Historically, technology has been seen as a potential solution to increase educational attainment. In 1913, Thomas Edison proposed that film would replace books in schools within ten years, and while Edison's prediction failed to materialize, his sentiment has remained in the minds of educators and policymakers alike. From television and computers to laptops and now tablet devices, each new technology brings the potential to revolutionize the education system (Wartella & Jennings, 2000). Since 1996, the federal government has spent

over ten billion dollars on computer technology for education (O'Dwyer, Russell, Bebell, & Tucker-Seeley, 2005), and most recently, the U.S. Department of Education (2010) released the National Education Technology Plan to promote student-centered learning with technology as a way to improve academic achievement.

This interest in technology to support student-centered learning practices, as well as a push by policymakers, interest groups, and economists for Americans to be well-versed in technology and media literacy, is at odds with the current American education environment. Built on a factory model of education from the 19<sup>th</sup> century, where the intention was to educate the masses, the current system is outdated and focuses on skill and drill practices (Peterson, 2011). While policymakers and developmental theorists have provided evidence that student-centered practices, as opposed to the traditional didactic model, may promote student learning and engagement (e.g., Dewey, 1902; Katz, 1988; Bredekamp & Copple, 1997; Vygotsky, 1978), the education system has been resistant to change and has not universally adopted this way of teaching and learning.

Indeed, schools often remain resistant to technology integration as technology tends to disrupt traditional classrooms practices (Collins & Halverson, 2009). A survey of 35,525 K-12 teachers by Project Tomorrow (2011) showed that the most frequent use of technology is for homework and practice (58%), suggesting educators do not leverage the potential of technology for unique purposes but rather try to fit it into their already set curriculum to use in didactic ways. Research also shows teachers play an important role in whether and how much technology is used in the classroom (Ertmer, 1999; Penuel, 2006), and given that many teachers were trained in traditional teaching pedagogy, this often stands in the face of technology integration in the classroom (Parette, Quesenberry, and Blum, 2009; Sheingold, 1991). Further, technology itself may have unique features that influence its use, sometimes making classroom practices easier but at other times creating more difficulties than using the technology is worth.

These affordances and barriers to technology integration are further highlighted in early childhood education, where debate reigns on the appropriateness of using technology with young children. While the National Association for the Education of Young Children (NAEYC; 2012) promotes the developmentally appropriate use of technology in early education, other organizations, such as the American Academy of Pediatrics (2001; 2011; 2013), caution against screen time for young children. Drawing on Orlikowski's (1992) duality of technology theory, the current study investigates this unique early childhood education environment to better understand how institutional, personal, and technological characteristics influence how teachers integrate tablet computers into their classrooms.

## **TECHNOLOGY IN EDUCATION**

Every new technology provides the potential to both transform the education environment and upset the status quo in the classroom (Wartella & Jennings, 2000). On the one hand, technology has been noted to promote student-centered learning practices, which developmental theorists and policymakers support for early childhood education above more didactic teaching styles (e.g., Burns, Griffin, & Snow, 1999; Clements, Sarama, & DiBiase, 2003; Katz, 1988; Bredekamp & Copple, 1997). As Means and Olsen (1997) describe, technology "promotes student learning through collaborative involvement in authentic,

challenging, multidisciplinary tasks by providing realistic complex environments for student inquiry, furnishing information and tools to support investigation, [and] linking classrooms for joint investigations” (p. 9). Additionally, student-centered practices focus on motivating and engaging learning activities that relate to children’s real lives (Vygotsky, 1978; Wood, Bruner, & Ross, 1976). Thus, technology in general, and tablets more specifically, could alter classroom practices and have implications for teaching and learning.

On the other hand, there is often resistance by schools and teachers to integrate technology in order to maintain current teaching practices (Collins & Halverson, 2009; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Despite increased access to technology, studies still report the underuse of technology in the classroom, especially in early childhood education (Blackwell, Lauricella, Wartella, Robb, & Schomburg, 2013; Gray, Thomas, & Lewis, 2010). In general, results are inconclusive over whether technology advances educational attainment (e.g., Cheung & Slavin, 2013), and no technology thus far has ubiquitously altered the education landscape to change teaching and learning practices on the large scale. As Buckingham (2007) noted, previous promises of a technological revolution in education have failed to produce much change.

Despite the debate over whether technology can or will transform the American education sector, support for integrating technology into the classroom has come from policymakers, economists, and developmental theorists alike, including NAEYC (2012), whose recent position statement supported the developmentally-appropriate use of technology in early childhood education. Indeed, across the country schools are integrating newer mobile technologies at increasing rates. In 2013, Apple reported 4.5 million iPads in American educational institutions, triple the amount reported just a year earlier in 2012 (Paczkowski, 2013). Further, in the 2013-2014 school year, Los Angeles, CA—the second largest school system in the nation—rolled out over 31,000 iPads to serve all K-12 students in the district at a costly price of \$30 million (Svensson, 2013). Despite these staggering numbers, little is known about the effects of tablet computers on teaching and learning.

## **Tablet Computers**

The enthusiasm over iPads is in part due to anecdotal evidence on mobile technology showing promising influences on learning outcomes. Mobile technologies are highly motivating and more engaging than traditional classroom tools (Henderson & Yeow, 2012; Mouza, 2005; Peters, 2009). Tablet computers, specifically, can be used anywhere/anytime and foster individualized learning, such that teachers can use the devices as tools for scaffolding student learning (Lemke, Coughlin, & Reifsneider, 2009; Melhuish & Falloon, 2010). Additionally, tablets offer a unique home-school connection by providing students with a classroom experience that relates to the technology-saturated real world, and tablets can decrease the digital divide by providing low-income and minority students with exposure to the devices (Lemke et al., 2009; Melhuish & Falloon, 2010). Touch screens allow for direct manipulation and are intuitive to learn because there is no mouse (Buxton, Hill, & Rowley, 1985), making them cognitively simpler than computers (Geist, 2012). Thus, teachers may choose to use tablets more often than they previously chose to use desktop or laptop computers. Additionally, from a cost standpoint, tablets are significantly cheaper than laptop computers. Finally, tablets provide users with access to a myriad of software choices due to

the high volume of apps available, with over 500,000 apps in the Apple iTunes store and 72% of iTunes educational apps targeting preschool and elementary aged children (Shuler, 2012). While little evidence exists on how tablet computers are being integrated into the classroom and how this integration is changing or reinforcing current teaching practices, these unique features provide evidence that tablet computers *could* enact such changes in the education environment.

### **School Resistance**

Historically, the institutional structure of the American education system has been resistant to change of any kind, technology or otherwise (Buckingham, 2007; Collins & Halverson, 2009). As Chubb and Moe (1990) argued, this resistance stems from the over-bureaucratization within the education system that is bound by hierarchy, rules, and politics that reinforce and protect the current structure, including traditional teaching practices focused on didactic methods. Schools themselves reinforce these traditional practices with technology integration, such that schools promote the norms, rules, and regulations that go along with such traditional methods (Buckingham, 2007; Collins & Halverson, 2009). In doing so, schools create barriers to effective technology integration through a lack of training, support, professional development, time, and access to sufficient hardware and software, all of which can prevent teachers from successfully integrating technology into their classrooms (e.g., Ertmer, 1999; Mueller, Wood, Willoughby, Ross, & Specht, 2008). As Russell and colleagues (2003) note, many teacher education programs fail to provide teachers with adequate training to effectively integrate technology into their practices. Indeed, Parette and colleagues (2009) argued that schools need to provide more support by showing teachers how they can integrate technology into their curriculum if it is to be used effectively.

### **Teacher Attitudes**

Despite increased access to technology (Gray et al., 2010), studies continually report the under-use of technology in schools across all grade levels (National Education Association, 2008), suggesting even schools with access to devices face challenges in actually integrating them into the curriculum. In addition to institutional constraints, teachers encounter personal barriers, including teaching philosophies, attitudes and beliefs, perceived value of technology, comfort with technology, and personal use, which may be more difficult to change and play a more important role in the actual use of technology in the classroom than institutional barriers (Ertmer, Addison, Lane, Ross, & Woods, 1999; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Zhao, Pugh, Sheldon, & Byers, 2002).

Given that the majority of teachers are trained in the traditional model of learning, it is important to note that this internalization of the norms, rules, and regulations that go along with such teaching methods likely influences how they use technology (Sheingold, 1991; Russell, 2003). Ertmer and colleagues (2012) found that teacher attitudes and beliefs closely aligned with their classroom practices with technology, a finding supported by Blackwell and colleagues (2013) who found that early childhood educators who held more positive beliefs about the potential of technology to aid student learning also used a variety of technologies

more often than their peers with more negative attitudes. Similarly, Tondeur, Hermans, van Braak, and Valcke (2008) showed that teachers who held more student-centered learning beliefs used computers in different ways and more often than teachers with more traditional beliefs.

## DUALITY OF TECHNOLOGY IN EDUCATION

Given the unique affordances of tablets, school resistance to technology, and teacher barriers to technology integration, the current study uses Orlikowski's (1992) duality of technology model as a framework for explaining how tablets are being integrated into early childhood education and the influences the devices have on teacher attitudes and practices. Prior research on computers in early childhood education has used this approach to help explain computer integration (Lindahl & Folkesson, 2012).

Applying Giddens' (1984) structuration theory to technology use within organizations, Orlikowski (1992) posited the duality of technology to explain the dynamic relationship between technology, agents, and institutions. In Giddens' (1984) theory, agents appropriate the rules, resources, and social norms imparted by the larger societal institution, and in doing so, reproduce as well as have the power to re-appropriate the institutional structures through individual actions. Orlikowski (1992) expanded this model to a three-part system, where institutional structures still influence agentive action, but technology is an additional factor that has built-in capabilities that can be used or re-appropriated in novel ways by agents. According to Orlikowski (1992), it is through this dynamic relationship between agent and technology that larger institutional structures can be changed.

Applying Orlikowski's (1992) model to technology integration in education could be achieved at different levels of analysis, but for the purposes of this study, schools will be the institutional structures, teachers the agents, and tablet computers the technology. On the grand scale, the change (or lack thereof) in teacher practices and attitudes influenced by the integration of technology into the classroom will ultimately affect the institution, either reinforcing or altering those preexisting structures, such as the traditional didactic model of education.

## CURRENT STUDY

The current study draws on classroom observations and teacher interviews to explore the relationship between institutional, personal, and technological characteristics that influence teacher practices with and attitudes toward iPads. The focus on early childhood educators is important given the historical debate over the place of technology in the lives of young children, with some suggesting children learn from technology (e.g., Huston, Anderson, Wright, Linebarger, & Schmitt, 2001; NAEYC, 2012; Linebarger, 2011; Penuel et al., 2012) and others positing potential negative effects on cognitive and social development (e.g. American Academy of Pediatrics, 2001; 2011; 2013; Zimmerman & Christakis, 2007). Further, research on institutional barriers and teacher attitudes have focused on K-12 teachers more generally, leaving much unknown about early childhood educators, who may pose different concerns and face different barriers to technology integration. Indeed, research

shows that early childhood education settings use technology less than primary and secondary schools (Vockley & Lang, 2011), thereby providing a unique environment to explore the technology, institution, and agent relationship. The main research questions are:

1. How do tablet computers afford or limit teacher practices in the classroom?
2. How does the institutional structure of the school afford or limit teachers in their integration and use of tablet computers in the classroom?
3. How do teacher attitudes and teaching pedagogies afford or limit the integration and use of tablet computers in the classroom?

## **METHOD & PROCEDURE**

The current study uses a qualitative research design of 53 hours of classroom observations and 9 20- to 30-minute semi-structured teacher interviews to explore how iPads are being used in early childhood education classrooms. A qualitative design was suitable for this research for three reasons: first, the observations allowed for a richer understanding of what actually goes on in preschool and kindergarten classrooms with iPads, which is currently absent from the present research literature; second, the teacher interviews empowered teachers, who, as Buckingham (2007) notes, are often left out of technology decisions in a top-down approach to integration; and third, the sample was necessarily small provided the limited schools using iPads with such young children, such that quantitative measures would not be valid.

### **Participants**

Sampling was restricted due to the limited amount of early childhood classrooms in the researcher's vicinity using iPads. Indeed, while iPad use in education is currently on the rise (Paczowski, 2013), there are still a limited number of schools using iPads with such young children.

Thus, random sampling was not viable since a requirement of participating in the study was teaching in a preschool or kindergarten classroom using iPads. Convenience sampling was necessary to find participants and was limited by time and resource constraints to schools within 90-minutes driving distance from the researcher's university. I searched online for schools with iPads to initially find participants, and then cold-called and emailed principals and school administrators at these schools, who in one case provided additional contact information for a school in a nearby district using iPads that did not come up in my online search. I had no prior affiliation or contact with any of the schools or teachers who worked there. After discussing the potential project with five school leaders, four agreed to participate, with the one abstaining due to another project going on at her school. All four schools were at various stages of iPad pilot programs in an effort to test out the devices with their students to see if the technology was worth scaling up to more students and more devices.

**Table 1. Description of participants and their iPad pilot programs**

School	Teacher(s)	Grade	Experience and Qualifications	Observation time	Description of iPad program	Description of iPad Use
Willard	Ms. Clark	Kindergarten	30 years teaching experience, 5 years as a technology facilitator, and a Master's degree in educational technology	Eight weeks, 20 hours	Second year of using iPads, but first year using a 1:1 student to iPad ratio	Structured activities with few app games
Norwood	Ms. Phillips and 5 additional teachers	Preschool	First year of teaching and a Master's degree in special education; All additional teachers had a Master's degree in education	Seven weeks, 17.5 hours	First full year of using iPads with a 7:1 student to iPad ratio in a blended classroom (i.e., low-income students, students with special needs, and tuition-paying students); Other teachers worked in blended classrooms and in classrooms with low-functioning autistic children	Free-play with all app games
Hardy	Ms. Gonzalez	Kindergarten	1 year of teaching experience, a Master's degree in education, and pursuing an Ed.D. in school leadership and principal certification	Six weeks, 15 hours	Second year with a 1:1 iPad program in a bilingual kindergarten classroom with several at-risk Hispanic students	Structured and unstructured activities with a mix of app games and non-app lessons
Springdale	Mrs. Roberts	Kindergarten	20 years of teaching experience in kindergarten, a Master's degree in education	Three weeks, 7.5 hours	Second month of a 4:1 iPad pilot program	Academic center independent play with all app games

School leaders at each school selected one teacher to participate in classroom observations based on teachers who showed interest in the project and would feel comfortable having an observer in the room and participating in a subsequent interview. School leaders also either provided contact information for other teachers at the school using iPads or spoke with other teachers directly to recruit them to participate in voluntary interviews. This resulted in five additional participating teachers from the same school where the principal gave them leave time from their classrooms while they participated in the interviews. While several other teachers did respond, the most frequent answer for not being able to participate was that they were too busy. In Table 1, I present information for each school, the number of teachers who participated, and a description of the school's iPad pilot program.

## **Procedure**

I observed four classrooms, three kindergarten and one preschool, for 2.5 hours at a time for three to seven weeks depending on the classroom. The variation in time spent was due to the timing of participant availability as well as one school not starting its iPad program until later in the study. The importance of conducting research across four different schools and across different age groups was to provide environmental triangulation (Guion, Deihl, & McDonald, 2011) given that technology integration differs across school contexts. In this way, having even one more classroom, even for three weeks, increased the validity of findings and added an additional layer of complexity by providing data on a fourth school in a different district at a different point in its iPad implementation program with a different student-to-iPad ratio compared to other classrooms in the study. Additionally, each teacher had a slightly different way of using the iPads, from structured activities, free play, and academic-based center time play, which helped triangulate the data across different settings.

During observations, I sat at a table or on the carpet with the children as they engaged with the iPad, and I took detailed field notes about what the children were doing on the iPad (e.g., apps played), how they were interacting with it (e.g., Did they understand how to use it?, Could they perform the activity the teacher asked them to? Were they just mindlessly tapping the screen? Were they staying on task?), and how teachers interacted with students around the iPad (e.g., Were they present during the child's use? Did they offer technical or conceptual guidance to complete tasks?). No individually identifying information was collected on the children in the field notes, as pseudonyms were used to describe them. Field notes were subsequently transcribed on a word processor.

I conducted semi-structured interviews with the four teachers who participated in observations in addition to five teachers at the preschool. All interviews were audio-recorded with written informed consent of participants, with the exception of one preschool teacher who consented to participating but opted out of recording. In this case, the researcher took detailed notes directly following the interview. I conducted interviews at each teacher's school, either in her classroom or in a conference room, at an agreed upon time that worked with the teacher's schedule.

Interview questions were developed based on the three branches of Orlikowski's (1992) model—institutional structure, agent, and technology—and addressed how each of these strands benefited or limited teachers and their practices with technology.



In Table 2, I provide an example of questions asked during the interview. The semi-structured nature allowed for follow-up questions and for development and refinement of questions throughout the research.

**Table 2. Examples of predetermined interview questions**

What is your primary reason for using iPads?
How did you originally feel about using iPads in your classroom? Has that changed?
How would you describe your experience using the iPads with your students?
What types of benefits of iPads, if any, have you encountered when using them in your classroom?
What types of limitations or difficulties, if any, have encountered when using iPads in your classroom?
What type of professional development or upfront training on the iPads did your school offer, if any?
How could your professional development experience be improved to help you use iPads more effectively?

**Table 3. Coding Scheme for field notes and interview transcripts**

Code	Meaning
Technology	
Unique features	Expressions of how the iPad provided unique affordances to classroom practices above other resources
Structural difficulties	Expressions of how the technology made classroom practices more difficult
Content difficulties	Expressions of teachers' difficulties in finding appropriate content that met their needs and their students' needs
Institution	
Training	Expressions of teachers' lack of prior and in-service training
Support	Expressions of a desire for support when none is present
Agent	
Value to learning	Expressions of positive attitudes of iPads benefiting student learning
Appropriateness	Expressions of the appropriateness of using iPads in Early Childhood Education
Technology beliefs	Expressions of teachers' personal beliefs about using technology in the classroom
Traditional practices	Expressions of how teachers used iPads in more traditional skill and drill practices
Student-centered practices	Expressions of how teachers used iPads in more student-centered practices

## Coding

Analysis of the field notes and interview transcripts were guided by the three groups of Orlikowski's (1992) duality of technology model. First, I conducted a close read of the transcripts where I made notes and engaged in constant comparison (Glaser & Strauss, 1967) in relation to Orlikowski's (1992) model and prior research on teacher attitudes, including positive and negative attitudes toward the use of technology in the classroom, perceived personal and institutional barriers teachers felt when trying to use technology, and whether or how technology influenced teachers' classroom practices (e.g., Ertmer, 1999). I used open-coding (Strauss & Corbin, 1998) to annotate transcripts in addition to an Excel spreadsheet to organize data into categories reflecting relevant themes that showed up within and across transcripts. During this process, I refined the coding scheme as new trends emerged and re-coded for updated categories. In Table 3, I provide the final set of codes and their meanings.

## RESULTS

Results are organized by Orlikowski's (1992) model as coding was guided by the notions of technology, institution, and agent. Within each of these larger categories, sub-themes are described with both direct quotes from teachers and descriptions from the classroom observations. Teachers are noted by their school and grade level.

### Technology/Tablet Computers

According to Orlikowski's (1992) theory, a technological device has innate design characteristics, and agents can use these features as the creators intended or re-appropriate the technology and use it in unintended and innovative ways. While teachers were able to embrace the unique features of iPads, they also encountered difficulties with the structural components and available content.

**Unique features.** A frequent comment by teachers was the ease of using the iPad, especially for young students who may not have developed the motor skills necessary for using a computer mouse. This was especially apparent with the preschool teachers, and one noted,

It's more child-friendly...Because before when we had regular computers with a mouse, it was a really difficult skill for the kids to understand how to use a mouse and understand how to control what was going on on the screen. So I think having it be a touch screen makes it a lot easier for kids at different levels to access it.

Teachers also noted the devices motivated students and kept them more engaged in learning activities compared to traditional classroom tools. At Springdale, Mrs. Roberts noted, "They really get engaged with technology...They just get so excited. I could be teaching them the exact same thing, and they're much more excited about it when they're using technology," a sentiment shared by the other educators in the study. Indeed, during observations across all classrooms, children showed enthusiasm and excitement when they used the iPad. During one instance in Ms. Clark's class when a student played *Montessori*

*Crosswords*, she exclaimed, “I’m awesome at this!” after getting the right word in the puzzle. Similarly, at Norwood in Ms. Phillips class, when a student correctly connected all the dots in the *Monkey Preschool Lunchbox* game, she exclaimed, “I did it correct!” and then clapped her hands in excitement. Perhaps the five words from one student at Springdale sum up the excitement felt by all the students when using the iPad: “iPads are the coolest thing!”

In addition to the ease of using iPads and the technology’s ability to motivate students, teachers also remarked on the unique mobility of the technology that enabled students to learn anywhere—both in the classroom and out—as well as anytime during the day. At Willard and Hardy, where children could take the iPads home with them, the mobility became a way to strengthen home-school connections by promoting parent involvement in student activities. Ms. Clark at Willard had parents go on a shape hunt with their children to find everyday objects that represent all different kinds of shapes and take pictures of those objects with the iPad. In class, students used the *SMART Notebook* app, which enabled them to create multimedia digital scrapbooks where they uploaded their shape pictures and recorded their voices describing the objects and shapes they found. In Ms. Gonzalez’s class, taking the iPads home was a unique opportunity because, as she explained,

Many of my students come from homes where their parents are not highly educated and often times are unsure of how to help them with their academic success. With the iPad, we can provide them with books, practice applications, and other ways in which they are getting the information in a correct way.

Thus, for Ms. Clark, devices fostered student-centered learning practices by enabling children to use the devices as individualized construction tools while for Ms. Gonzalez, the iPads became a way to support low-income, minority families. In schools without 1:1 iPads, teachers still remarked that the exposure to tablets created a home-school connection by providing a school environment that mimicked the home environment and media saturated world in which children live. As Ms. Phillips noted, one of her main reasons for using the technology is “to expand those real experiences they have using technology...Our world is just becoming this way with technology and they need the exposure to it.”

The mobility of the iPad also allowed students to take the devices on field trips. In Ms. Clark’s class at Willard, students took them to a nature preserve, where they took pictures and then labeled different objects in the picture once back in the classroom. Ms. Gonzalez noted that on a one-hour bus ride for a fieldtrip, children brought their iPads and worked on educational learning apps. She also used iPads during transition times, remarking,

Time is not wasted during transitions or other short times, such as when students are finishing at different times. I can so easily tell students to get their iPads when they have finished something and do another specific thing to continue to practice and reinforce a skill.

Finally, iPads also saved essential classroom time compared to laptops, where children had to wait for the computer to turn on and needed to log in with a unique password. At Hardy, Ms. Gonzalez discussed the efficiency of iPads, noting, “While at the beginning it does take extra time to learn the device, it ultimately saves so much time in allowing students to just quickly grab the iPad immediately and get to work.”

**Structural Difficulties.** Teachers frequently named the unreliability of technology as a major drawback to using the iPad, which often led to unneeded anxiety and frustration for teachers. As Ms. Clark at Willard remarked,

There are certainly some days that I get really frustrated...We're dealing with glitches and new apps and updates and trying to figure out the best way. Or you know, we had six of them when they did the new update and they got wiped out, like all the kids' work is gone. Just gone.

Indeed, during observations in Ms. Clark's classroom, I observed numerous technical challenges, including apps not working and inconsistent Internet connection. Additionally, several teachers noted the lack of flash capability as a limitation to using the device because this limited students' ability to stream educational animations and videos.

Physically managing all of the iPads within a classroom was also a frequent challenge noted by teachers. iPads had to be individually updated in many cases, and as Ms. Clark exclaimed in reference to updates, "Do I have to touch 42 iPads *again*?" Additionally, in many classrooms, iPads often lost power because children never turned them off during the day, and teachers did not always remember to plug them in overnight, such that sometimes devices needed to be recharged during class time when students were supposed to be using them. Mrs. Roberts at Springdale also encountered issues in managing the sound levels of the devices. Every app seemed to have a different sound level, such that children needed help adjusting the volume, and without headphones, the iPads often got loud and distracting to other students in the room.

**Content Difficulties.** Teachers expressed two types of difficulties when it came to content, namely finding appropriate material for their students and finding material that allowed them to track student progress. First, in light of a recent report that 72% of the top-selling educational apps are being targeted at preschool and elementary aged children (Shuler, 2012), teachers reported difficulties in finding and selecting iPad apps for their students to use, especially for teachers with special student populations. In general, teachers had a say in what material got uploaded to the iPads, and each school had a technology committee, yet teachers continually reported difficulty in finding specific apps as well as unhappiness with what they could find. While Ms. Gonzalez at Hardy believed "there are so many possibilities" with the iPad, she noted,

As a teacher of such a specific thing (bilingual kindergarten) it is hard because I need to find things that are accessible in Spanish. There is a limited Spanish content for apps, which is challenging and can be frustrating because I see all of the amazing things being done in English.

Similarly, a special education teacher at Norwood expressed the difficulty in finding quality apps for students with special needs. For Mrs. Roberts at Springdale, the issue was distinguishing quality learning content as she reported, "We're noticing certain games aren't working or activities are a higher level or they weren't the version we wanted." Thus, while teachers acknowledged the potentials of iPads, they often felt limited by the available content, and while many teachers desired to explore and find more suitable options, they did not necessarily have resources or the time to do so.

Second, teachers noted the difficulty in assessing how much their students actually learned from the technology itself and sometimes desired a way to be able to track student progress in specific apps. This was especially pertinent with the app driven classrooms of Mrs. Roberts at Springdale and Ms. Phillips at Norwood, where students played educational apps independent of teacher guidance. While some apps on the market do have an assessment feature (e.g., *Nearpod*, *Raz-Kids*), many of the teachers were not aware of them. As Mrs. Roberts noted,

It doesn't always allow me to check up and see if they're understanding the concept, though. So that's one of the things I'd like to look into more, how I can check up and see if they're getting the concept or not. I don't know unless I'm sitting there watching them.

Additionally, a teacher at Norwood longed for an app that would help assess children's learning, remarking, "If there's any data-recording that would be available through [the iPad], that would be nice."

Through observing students using the apps, I had difficulty knowing whether they had just become good at a specific game or if they actually learned and understood the content. In numerous cases, it was clear that the children did not understand the educational content, especially for the preschoolers. For example, during one observation in Ms. Phillips class at Norwood, a three-year-old boy discovered that the arrow made the *Finding Nemo* storybook pages move forward, and he continued to just tap the arrow and enjoy the changing screen instead of the content. As Ms. Phillips noted, "For him, he's not really doing anything with it." While the teacher desired to spend more time introducing the basic functions of the iPad and working with students, she noted, "I knew that there wouldn't always be time for someone sitting with them and it can go from purposeful to non-functional very quickly." In an effort to avoid such meaningless play, some teachers at Norwood put locks on the home button to deter children from spending their time on the iPad simply logging in and out of apps instead of engaging with the educational content of an individual app. While this did deter students from engaging in non-functional iPad use, teachers still faced the inability to measure how much students learned uniquely from the iPad software.

## **Institution/School**

The duality of technology framework (Orlikowski, 1992) posits that institutional norms, resources, and rules influence agents, such that access to technology, training, support, and professional development influence if and how teachers use technology. As such, teachers remarked on the lack of upfront training to integrate the iPad, which led them to feel unprepared in using the device with their students and desiring more structured support.

**Training.** One of the main themes that emerged when talking with teachers was how ill-prepared they felt to use iPads in the classroom upon initially receiving the devices. Teachers at Norwood and Springdale who were in their first full year of iPad implementation expressed the most concern over a lack of training with the iPad. At Norwood, Ms. Phillips remarked, "It was, it's your first day of school. Here's your iPads, and if you need any help, let us know." Similarly, at Springdale, while the school had a summer "tech week" where teachers

could go on their own time to school-sponsored workshops, Mrs. Roberts noted, “The iPad itself, I did not get much training on at all.”

This lack of initial training led teachers to feel unprepared in not only how to use the technology device itself but how to integrate the iPad into their teaching practices. As Mrs. Roberts remarked, “I was a little nervous, to be honest, because...I still had to learn myself before I could incorporate it as a teacher.” Additionally, a preschool teacher at Norwood noted, “I personally didn’t know a whole lot about it, and I still don’t know a whole lot about it other than turn it on, open and close the programs.” Thus, while these teachers had basic skills to use the iPad, they did not feel they knew enough about how to specifically use it for educational purposes and integrate it into their curricula in innovative ways.

**Support.** Due to a lack training and subsequent lack of comfort using the technology, multiple teachers expressed a desire for the administration to help them to successfully integrate the iPads into their classrooms. At Norwood, Ms. Phillips noted,

Yes we should be incorporating technology but how we do it is kind of on our own. So I think it would be nice to know what exactly are on [the iPads]. Do [technology facilitators] have suggestions on how to introduce it to a group? Could someone come in and introduce it to the group?

Further, she remarked that while she feels comfortable using the technology because of her own personal use on the device, she feels that she would benefit from the technology department showing her how to use the iPads specifically with students. Thus, she knew how to use the iPad in intended ways as a personal entertainment tool but did not know how to integrate the device in more innovative ways appropriate for an educational environment.

Unlike Springdale and Norwood, where teachers were in the first several months of their iPad pilot programs, Ms. Clark at Willard and Ms. Gonzalez at Hardy, whose schools were in the same district, had used iPads for at least a year prior to observations, and they expressed more favorable reactions to their current support structure. Despite offering little upfront training, the technology committee in this district had since established a quality support structure with technology facilitators on hand throughout the day to help with iPad implementation. As Ms. Gonzalez noted,

Our tech facilitator meets with me regularly to help plan the use of the tool in my classroom, which has been extremely helpful. She and I often sit and brainstorm what I am doing in the upcoming week and then look at how we can appropriately incorporate the iPads.

In Ms. Clark’s classroom, a technology facilitator provided on-going support by leading activities on the iPad during class time so that Ms. Clark could focus her attention on other students in the classroom. Thus, for those schools and teachers who had more experience using the iPads in the classroom, they had developed better training and more structured support to help ameliorate earlier issues teachers faced when initially incorporating the iPad into their classrooms.

## Agent/Teacher

In Orlikowski's (1992) model, agents are at the center, influenced by both the institutional structures and by technology. It is through the agent's relationship with technology that changes to the institutional structure can be made. While teachers found value in iPads for student learning, they held concerns over the appropriateness of the device for educating young children, and the technology itself did little to influence their teaching practices.

**Value to learning.** The potential for student academic learning was the main priority for teachers when it came to reasons for integrating the iPad into the classroom. The specific activities and apps that children engaged with on the devices were uniformly academic concepts, especially math and literacy. For example, Mrs. Roberts at Springdale only allowed children to play academic apps, with files on the devices differentiating literacy and math apps. In Ms. Clark's classroom where apps were not her focus, she re-appropriated the device to use it for academic learning but through more innovative endeavors, such as activities where children typed sentences to describe pictures they took in *SMART Notebook* or where children traced shapes in *Doodle Buddy*, a drawing app, and labeled indices and sides of the shapes in addition to recording themselves saying what the shape was and how many indices and sides it had.

Many teachers also believed the iPad could facilitate the development and practice of executive functioning skills, even if this was not the focus of the actual software or activity with which the children were engaged. In this way, teachers also re-appropriated the technology, as iPads were originally intended to be used by one person. In Ms. Phillips classroom where children shared the iPad, she noted, the iPad "sets up opportunities for turn taking and requesting the use of an item." Indeed, since the beginning of the year, Ms. Phillips had seen improvements in sharing, and during the 7-week observation period, students learned to use their words instead of just grabbing the iPad, often using the classroom's turn-taking mantra, "my turn, your turn" to facilitate sharing. Other teachers at Norwood used video modeling techniques to improve the social skills of children with special needs. Videos modeled appropriate and inappropriate play as well as self-help routines, such as hand washing. Even in the kindergarten classrooms, where children were perhaps more advanced in their executive functioning skills, teachers recognized how the iPad could be used to develop social skills. Ms. Gonzalez at Hardy noted that the iPad allowed children to take on a leadership role where they could teach other children who may be less familiar with the technology, noting, "The working together piece is huge."

In addition to academic and social learning, teachers valued the ability to use the iPad as a documentation tool to assess general learning. While some teachers encountered limitations in software capabilities for assessments, both Ms. Clark at Willard and Ms. Gonzalez at Hardy re-appropriated the technology to help them assess learning not from the iPad specifically but learning more generally. For Ms. Clark, the ability to document work using the camera, video, and audio recorder allowed children to reflect on and improve their learning. She focused on student-centered learning practices to empower students and give them ownership and responsibility for their learning by having them independently use all of these functions once they were shown how. Ms. Gonzalez also used the iPad for documentation of children's expository writing skills. Every month, students were asked to write on a certain topic in a text box on their iPad, which automatically uploaded to a unique

Google spreadsheet for each individual child. Ms. Gonzalez had face-to-face conferences with students to hear what they meant to write so that she could record this in the spreadsheet and compare it to what the students actually wrote. Since students began in September, Ms. Gonzalez witnessed a change in their writing skills with more in-depth phrases and sentences, all made easier to track by using the iPad. Additionally, she noted, on the iPad,

I can see what kids are actually writing because they electronically submit it versus in a journal, which I never may see. The iPad allows me to keep track of what they are doing and make sure they are staying on track. It also allows for immediate feedback or to call them out for not doing an activity.

While the iPad was not designed for student documentation processes, both of these teachers found unique ways to leverage the capabilities of the device to aid their teaching practices.

***Appropriateness.*** Despite positive attitudes toward iPads fostering student learning, teachers expressed fears and concerns over the appropriate use of iPads in the classroom with young children. As one teacher at Norwood remarked, “my big concern is that I’m using them for a good purpose.” Other teachers at Norwood expressed concern over the children’s exposure to screen media in the home and how that related to media in the schools. As one teacher noted,

I know there are some that spend a lot of time in front of screen, not necessarily an iPad but games or TV or whatever, and I certainly want the short amount of time we have them here to be quality time.

Teachers also expressed how technology was not the focus of their classrooms because they believed children still needed traditional social interactions and communication with others through real play with functional objects. One teacher at Norwood strongly believed that screens should not replace reading and expressed concern that children will spend too much time with technology instead of traditional learning activities. Many teachers at Norwood limited the amount of time children spent using the iPads to 10-20 minutes a day to ensure that students engaged in other classroom activities as well. At Springdale, Mrs. Roberts, who also worried about her kindergarten students developing key human communication skills, reflected this sentiment. She described how children often got “wild and egocentric” and were not able to share or interact in socially appropriate ways with others when they were using the iPads, leading her to be concerned over the development of their social skills and interactions growing up. Indeed, during the observations at Springdale, students often got loud during iPad use and started competing against one another to see who could get the most points in the *Wings* math app instead of focusing on the math concepts of the game. In another instance where two boys were sharing a device in Mrs. Roberts classroom, they struggled over the device and fought over whose turn it was. Even when they agreed on turn-taking, they still tried to touch the screen and take control over the app when it was not their turn. As the fighting escalated, Mrs. Roberts had to step in and remove one student from the situation to calm him down. Thus, while in some cases teachers felt the iPad could foster social interactions, in other cases the iPads led to less socially-appropriate engagement and brought up concerns over whether the technology could foster social skills.



**Technology Beliefs.** Teachers across schools and grade levels viewed the iPad as another tool to use in the classroom, in addition to traditional resources. This was apparent as iPads were generally used during station times, where children might be working with traditional classroom objects to complete an activity but also might be using the iPad. Ms. Clark at Willard noted that she does not place technology above other classroom resources:

I think you have to spend some time looking at each of the apps and making some decisions about what's really gonna be valuable for the kids and your time. Is there something else in the classroom that would be easier? Or even though the iPad is always motivating for the kids to use but is there another way you could do it in the classroom without having the app?

To make decisions about what resource to use, Ms. Clark began with her learning objective and then structured her classroom activities around that objective, whether this meant using the iPad or choosing traditional resources. Other teachers held similar beliefs, including Ms. Phillips at Norwood, who remarked, "It's just another avenue for them to practice [a] concept," and Mrs. Roberts at Springdale, who said, "I kind of see it as...another component to helping us teach these goals" of academic learning. Additionally, teachers believed in the potential for the iPad to become just another resource that students would be able to choose from on their own.

**Traditional Practices.** Despite believing in the iPad as another classroom resource and the positive potentials of tablet computers for student learning, several teachers incorporated the device in traditional, skill and drill ways without necessarily leveraging the unique potentials of the iPad to support student-centered learning. This was most apparent in the app driven classrooms of Norwood and Springdale, where children only used the iPads to play educational apps with little teacher guidance. While the independent use of the iPads at first may appear as more student-driven learning, children only engaged in apps focused on traditional educational concepts in a digital skill and drill format. For example, in *Monkey Preschool Lunchbox*, children had to complete a number line while in *Cimo Spelling*, children worked on sight words and spelling. As Ms. Phillips at Norwood noted, "[the iPad] is just another way of practicing those basic skills," such that the technology became a skill and drill device reflecting traditional teaching practices. iPads were a substitution for other non-digital activities that could accomplish the same task.

Even at Hardy with 1:1 iPads and a limited amount of apps, some of the activities Ms. Gonzalez used primarily focused on skill and drill. During literacy time, the teacher would say a letter and children wrote the letter in *Doodle Buddy* on their iPads just as they would on a piece of paper. Similarly, during math time, the teacher might project a picture of a certain number of objects on the SmartBoard and the children would write the number in *Doodle Buddy*. Thus, the iPad was used as electronic paper to support traditional teaching methods.

**Student-Centered Practices.** As opposed to traditional skill and drill teaching methods with the iPad, Ms. Clark at Willard focused on utilizing more features of the iPad to enhance her student-centered philosophy. She noted that her use of the iPad aligned with her educational philosophy more generally:

Another huge [reason for using the iPads is] student responsibility and student ownership... It goes along with...the way I run my classroom, the whole idea of having

portfolios for children, them reflecting on their learning, being more responsible for their work.

Indeed, Ms. Clark's iPad activities focused on the video, audio, and photo features, such that children often recorded and documented their work versus just completing academic activities that could be reproduced with more traditional classroom resources. She heavily relied on the *SMART Notebook* app, which allowed students to create their own digital scrapbooks where they could upload pictures, write sentences, and make audio recordings. Additionally, Ms. Clark used this app to create digital books for children that included text and audio recordings so that they could read and listen along to poems and short texts by themselves. Further, with the help of the ESL teacher, Ms. Clark developed an interactive *SMART Notebook* activity where children could practice phonics. Each page of this digital notebook included a different activity, from singing along to the Jolly Phonics jingles, to dragging lowercase letters to match their uppercase counterparts on the other side of the screen. Ms. Clark also used the iPads throughout the day for longer periods of time than any other teacher. Thus, for Ms. Clark, she integrated iPads to fit with her pre-existing teaching philosophy of student-centered learning. Indeed, when discussing technology integration, she described the need for higher-level mindset change in teaching and learning in order to utilize technology effectively. She noted, "The training needs to be about mindset change and how you're teaching instructionally," and she suggested that the ideal mindset would be more student-centered teaching in order to leverage the unique potentials of technology to promote this type of learning. She continued,

It's really hard to teach in a traditional way and have an iPad... You're gonna be down at kind of that base level and substituting and probably being frustrated with it if you're not changing some of your instructional methods basically and looking differently at what you're trying to get out of it for kids.

Ms. Clark believed that much of the current teacher education practices with technology lacked any cohesive link to teaching methods and philosophies more generally, which may have prevented other teachers from leveraging the unique capabilities of the iPad to foster more student-centered learning.

## DISCUSSION

The current study sought to uncover how tablet computers influence teacher attitudes and practices in early childhood education. Using Orlikowski's (1992) duality of technology, the study showed that while the technology itself had unique features and was believed to enhance student learning, teachers ultimately faced both institutional and personal barriers in the integration of the device.

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## **Technology/Tablet Computers**

The iPad had unique features that made it a desirable device and was an advance over prior technologies teachers had in their classrooms, such as desktop or laptop computers. While teachers remarked on difficulties from the unreliability of the technology and in finding appropriate content, results from the current study supported prior research that suggests tablet computers can provide anywhere/anytime learning, create a home-school connection, and increase student engagement and motivation (Lemke et al., 2009; Melhuish & Falloon, 2010). Indeed, teachers utilized the mobility function by allowing students to use them anywhere in the classroom versus tied to a desktop computer in a specific location, in addition to field trips and in some cases at home. All teachers remarked that the iPad was more engaging and motivating than traditional resources, which was supported by observations of children engaging with the devices. Additionally, teachers found that the iPad provided time savings in class that laptops were unable to do, and they valued the touchscreen for young children who did not necessarily have the motor skills to use a computer mouse. Overall, the iPad was viewed as a unique tool for strengthening the learning environment for young children.

## **Institution/Schools**

While prior research suggests that institutional barriers limit actual use (e.g., Ertmer, 1999), this study showed a unique pathway between the institution and agent, such that the lack of training and support directly influenced the teacher's self-efficacy and comfort using technology in the classroom. Additionally, while institutional barriers were still problematic for many teachers, results showed that there are ways of ameliorating these barriers. Teachers desired more structured training and support to help them effectively use the device with students, and those teachers who had adequate support were less likely to report feeling limited by institutional barriers. Ms. Clark at Willard and Ms. Gonzalez at Hardy had over a year to experiment with the device in their classroom prior to the study, such that experience with the technology likely made these teachers feel more comfortable and able to use it in innovative ways compared to Mrs. Roberts at Springdale and Ms. Phillips at Norwood, who only had the devices for a couple of months. Further, the district where Ms. Clark and Ms. Gonzalez taught had developed a strong support system, with technology facilitators on hand daily to provide lesson planning and even help with executing learning activities with the iPad. Thus, experience and structured support could help decrease institutional barriers and increase more effective iPad integration practices.

## **Agents/Teachers**

Findings from this study aligned with prior research showing personal attitudes and teaching philosophies influence technology integration (e.g., Blackwell et al., 2013; Ertmer et al., 2012; Mueller et al., 2008; Parette et al., 2009). Teachers shared sentiments that iPads could aid learning in more engaging and motivating ways than traditional classroom resources, though some held concerns over the appropriateness of using technology with

young children, especially for children's social and emotional development. Teachers also remarked that the iPad was just another classroom resource to aid learning and could be incorporated into the current curriculum versus disrupt current teaching methods. Thus, preexisting teaching philosophies and attitudes influenced whether the teachers appropriated or re-appropriated tablets in their classrooms.

Ms. Phillips at Norwood and Mrs. Roberts at Springdale primarily used tablets in traditional teaching methods in ways the technology was designed to be used. Students only engaged in playing educational apps that focused on basic early math and literacy concepts, and these teachers even remarked that they were not sure how much their students were actually learning from the device. While Ms. Phillips re-appropriated tablets to promote executive functioning skills through sharing devices, this was only because the school lacked enough devices for each student rather than an intentional use of the technology. Further, while other preschool teachers at Norwood used video modeling techniques for special needs students, the students themselves were not actively engaged in this re-appropriation of the device. In both of these examples, the actual re-appropriation did little to promote student-centered learning practices or shift the typical classroom dynamics, instead supporting traditional curriculum of developing social emotional skills. Indeed, Lindahl and Folkesson (2012) found computers were integrated into traditional preschool activities, such as pretend play, or in activities that embodied traditional preschool values, such as child-centeredness, but teachers had difficulty re-interpreting the technology to use in more innovative practices.

Alternatively, Ms. Clark at Willard and Ms. Gonzalez at Hardy did more to re-appropriate tablet computers. Ms. Clark integrated technology in student-centered learning practices by promoting student independence and individualized learning on the iPad where students were given the tools necessary to understand how to use the device but were given leave to use the devices as creation and reflection tools. Ms. Clark heavily relied on *SMART Notebook* to empower students to create digital workbooks by taking and uploading pictures along with making video and audio recordings, which enabled them to listen to themselves speak and reflect on their learning. Further, Ms. Clark created workbooks in *SMART Notebook* that children could use on their own without an adult present, such as listening and following along to poems or working on the interactive phonics workbook. Ms. Gonzalez also re-appropriated the device in her unique documentation of learning practices, where the iPad enabled her to get real-time updates and feedback on children's expository writing skills.

While one possible explanation for differences in iPad implementation practices are preexisting teacher philosophies, timing may have also played a part in how teachers used the devices, with those who had more experience incorporating them in more innovative ways. Indeed, it was the teachers who had more experience with the technology who were able to re-appropriate and use the iPads more innovatively. However, research shows that even over extended time periods with technology, there are limited changes in teachers' approaches to teaching and learning as a result of having technology in the classroom (Lindahl & Folkesson, 2012; Tondeur et al., 2008), suggesting that technology itself may not necessarily shift early childhood educators' internalized teaching practices and philosophies.

Given the plausibility of a lack of change in teacher practices from technology integration, one can infer the possible effects of using tablets in the classroom. Results on the effects of technology on student achievement are inconclusive (Cheung & Slavin, 2013), with few large-scale studies finding overwhelming positive outcomes. One plausible reason for this is supported by evidence in the current study that shows teachers do not really change

their teaching practices and philosophies just because they have a new technology to use with their students. Apart from institutional barriers, teachers do not adjust their pedagogical beliefs and actions to match the potential of technology to foster more untraditional, student-centered classroom practices. As technology is seen to increase educational attainment through its ability to foster student-centered practices, the fact that teachers are limited by their attitudes and philosophies to leverage the unique affordances of technology is significant.

In light of Orlikowski's model where agents' re-appropriation of technology is the mechanism to change institutional structures, the current study provides little evidence that this may be the case for tablets in early childhood education. Even for the teachers who re-appropriated the devices and used them in more student-centered learning, the technology itself did not present a shift in thinking, but rather teachers used their current innovative philosophy and applied it to the technology. Thus, in order for larger institutional change, it is not necessarily the addition of technology that will foster this, but rather shifting teachers' mindsets about teaching and learning first before incorporating technology. Indeed, Ms. Clark noted that training needs to be about more than just teaching teachers how to use technology, but rather about mindset change on teaching and learning more generally to foster student-centered practices.

## LIMITATIONS

The current study provides evidence on the dynamic relationship between schools, teachers, and technology, but it is important to point out several limitations to the work. First, random sampling was not viable since a requirement of participating in the study was teaching in a preschool or kindergarten classroom using iPads, and there were limited schools with such status in the researcher's local area. This also restricted the number of schools and teachers able to participate, resulting in a small sample. However, the breadth and depth of observations and interviews across four different settings at different stages of an iPad pilot program provide some generalizability, especially given many similarities found across teachers, such as the lack of up-front training, positive attitudes in the potential of the devices to aid student learning, and concerns over the appropriateness of using technology with young children. Given the dearth of research on teachers using iPads in early childhood education, the current study provides novel preliminary information to exploring the topic in more depth in future work.

## CONCLUSION

Drawing on Orlikowski's (1992) duality of technology, the current study showed important relationships between school institutions, teachers, and technology that help explain how teachers integrate iPads into their classroom. While the technology itself provided important advanced features that prior technologies could not, institutional barriers of training and support still prohibited some teachers from effectively integrating the device into the classroom. Further, teacher attitudes and philosophies about teaching and learning stood in the way of more student-centered practices. While Ertmer and Ottenbreit-Leftwich (2010)

argued that teachers need to change their mindset specifically regarding technology, the evidence from this study shows that teachers will not succeed by just embracing the idea that technology will benefit student learning. Instead, more general teaching philosophies and practices must be examined to focus less on traditional classroom environments and more on student-centered learning.

On the large-scale, changing the foundation of the American education system to foster student-centered learning will be a long, slow process, but on the small scale, three practical considerations should be noted given findings from this study. First, iPads are an advance over prior technologies and offer unique features that could foster student-centered learning environments, especially for younger children. While finding content posed difficulties for some teachers, others were able to overcome the available content by having students create their own using the specific design features (e.g., video, audio, and photo capabilities) of the technology as a way to enhance student learning and engagement. Second, and relatedly, while the technology itself may not change ingrained teacher attitudes and philosophies, pre- and in-service training and support structures could help teachers by focusing on how to reflect, revise, and rework their general teaching practices to embrace the full potentials that technology has to offer. Finally, more immediate and concrete ways to enhance teacher practices with the iPad could come from providing teachers with examples of how to incorporate the technology in innovative and creative ways for fostering learning, some of which have been presented here. Having examples of best-practices will help teachers learn more than just the basic skills of the technology, but rather become versed in how they can leverage the unique features of the iPad to effectively enhance the learning environment.

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