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Deep Dive
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Touch Screens in Education

Introduction

The touch screen is quickly becoming the input method of choice for consumer electronics. Many people have fallen under the spell of its unique mix of compact form factor and usability. With its success in the commercial sector and the increasing ubiquity of these devices, it was only a matter of time until educators begin to utilize them, or at least examine their viability. But, do they succeed? Almost, and there's potential for greater use. This potential stems from the affordability of the devices and the more natural interaction mappings for users. These two points show that the technology itself is deserving of a chance to be tried in education. Motivational, collaborative, and real-world uses are explored, both in the classroom and in educational situations with special-needs students. The touch screen isn't perfect, but no technology is. Touch screens offers a unique experience that can allow people to do better learning and has the potential to do even more.

Background

In just the first 7 months on the market, the Apple iPad sold through 7.5 million units. Apple's iPhone 4, in only 5 months, sold 14.1 million units (Apple, 2010). Google estimates that 65,000 phones running the Android Operating System, one that primarily uses touch for input, are sold daily (AFP, 2010). Sales of these devices have been increasing ever since their introduction to the market. And it's not just smartphones or tablet PCs that are experiencing growth. Many other devices that utilize a touch screen are also available such as the Apple iPod Touch, Interactive White Boards, and devices such as the Microsoft Surface which is a table with a touch screen tabletop.

Affordability

The first area to look at is the affordability of the technology. Because of the rise in popularity, prices for these devices have fallen. The Apple iPod Touch, for example, can be purchased for $200. This is considerably less than even the cheapest of computers that usually cost about $600 (Wilcox, 2009). In addition to the low barrier cost-of-entry, software for these devices is ever more available. Apple's App Store, Google's App Marketplace, and others all offer easy access to software. Currently, Apple's App Store has more than 21,000 applications in their education section. These applications are downloaded directly on the device from the marketplace and most are either free or cost less than ten dollars. While many of these applications may not be meant for teaching and learning, it still demonstrates the large market for such apps and how easily they can be acquired. This isn't to say that all touch screen devices are inexpensive, the Kno Tablet Textbook can cost as much as $899 and Interactive White Boards (IWBs) can cost thousands of dollars. Yet still they remain accessible to many different markets with smartphones and tablets for individuals, IWBs directed to schools, and devices like the Kno in between.

Touch Screen Usability

Usability is also important because if something isn't easy to use, it won't get used at all. Studies have shown mixed results with regard to touch screens. A study comparing the use of a mouse and touch screen with children, aged 4-6, revealed that for each exercise, less time was needed to complete on the touch screen than with the mouse. The study also showed that more mistakes were made when using the mouse. This was due to the fact that most children needed to use two hands to operate the mouse; one to move it and the other to hold down the button. The only significant error caused with by the touch screen occurred in the event that more than one finger touched the screen. It was also noted that the item being dragged on the touch screen occasionally lagged behind the child's finger causing

confusion. The child would then lift their finger and have to start again. (Chengdong Lu, 1992) It's worth noting that some of these issues wouldn't be a problem today as there is technology that can account for multiple fingers, palms, and multiple users and the issue of lag has also been diminished as processing power improves (3M, 2010).

A more recent study however shows that children, age 3-7, "had difficulty selecting, dragging, and generally moving around the touch-screen using their finger as a pointing device. (Romeo, 2003)" The study postulates that this is because of underdeveloped perceptual-motor skills at that age. When asked, the children identified mouse as their preferred input method over the touch screen. This result is not necessarily a negative for the touch screen however. Most of the students in the study were described as "accomplished mouse users" before the study began. Because the students were already used to that type of input, it seems natural that they preferred the method they were better and more familiar with. This highlights the fact that the touch screen isn't perfect and isn't always a good replacement for the mouse and keyboard. But, with the right implementation, the touch screen can be a more effective way to interact with a computer.

Particularly effective is the fact that gestures and different types of finger presses can be used to interact with touch screens. Swiping, pinching, tapping, double-tapping, and sliding are all different gestures and means of interacting with touch screens. Often times, these gestures can more naturally map to the intended action than the mouse and keyboard can (Agostini, 2010). An example is changing the page of a book. In the real world, we physically turn pages. Similar to this, touch screens allow us to swipe our finger across the screen as if to turn the page.

Motivation

Educators are looking to leverage the technology that students already have, use, and are familiar with. Touch screen devices are the perfect target because of the growth of the touch screen and "App" industry. Stories are popping up around the country praising the integration of iPods and other touch screen devices into the classroom. One teacher had this to say about the new devices, "They're so engaged. Suddenly, it's not horrifying to study your facts tables. It is like a game. What would be tedious with paper and pencil is no longer so with bright colors and things moving around. (Ojeda-Zapata, 2010)" While this doesn't sound particularly impressive, being just a fancy way of doing traditional learning, it doesn't change the fact that students *are* more engaged. Richard Clark agues however, that "the increased attention paid by students sometimes results in increased effort or persistence, which yields achievement gains" because of a "novelty effect" (Clark, 1983). In order to stay engaging and outlast the "novelty effect," better applications and uses that take advantage of the devices should and are being developed.

Collaboration

Collaboration is one such engaging activity that touch screens should be used for. One study explored the creation of a presentation using a multi-touch table. Students gathered materials first together, two students to one standard PC and then put their materials together to create a presentation on the multi-touch table. The students noted that "when using a mouse one person controls the whole collaboration while the multi-touch setup did not impose such leadership (Schneider, 2010)." The multi-touch table enabled the students to share their ideas and work together to create a presentation. This research alone isn't enough to proclaim definitively that touch screens promote better collaboration and learning but it's a start. Dropping the input methods of the mouse and keyboard opens up the collaboration to

everyone. More research here can expand upon the idea that large touch screens make collaboration and learning between students easier.

Classroom Use

A lot of the classroom uses for iPods and other handheld touch screen devices are just starting to get the research they demand. One area that has been researched is the Interactive White Board (IWB). IWBs are beginning to see more widespread use in the classroom and studies on their use in the classroom have been performed. One particular study looked at their use and whether or not IWBs actually fit the "educational needs of children better than existing educational tools (Gillen, 2007)." The uses the researchers saw were all fairly standard ways of interaction that could have been done without the IWB such as showing a video, having a student match words to pictures, and making lecture more interactive. The researchers argue that it's transformative, that "it is known to meet the professional needs of teachers and the educational needs of children better than existing educational tools," because "it clearly enabled teachers to use a combination of innovative styles of presentation and the rapid succession of different kinds of multimodal information." (Gillen, 2007) However, the IWB doesn't seem to really be transformative because of its "touch" abilities. What makes the IWB interesting is its combination of technologies.

Disabilities

One particularly encouraging area of use for touch screen devices is in helping students with disabilities. One particular disability has benefitted greatly from touch screens. Autistic people are receiving help like never before. A story in the San Francisco Weekly documents the story of an autistic boy, Leo, and his mother's journey to helping him. Leo is entranced by the Apple iPad. He can use it to play games,

videos, and express himself. Leo's mother has used the iPad to increase his attention span, teach him table manners, and increase his ability to problem-solve. There is mostly just anecdotal evidence currently, but research on this topic has already around the country at places like the Autism Center of Pittsburg and in other countries like Australia and Canada. (Harrell, 2010)

Conclusion

We haven't found a magical technology that cures our educational woes and the touch screen certainly isn't it either. It's in the application of the touch screen that it becomes useful. The ease of use for touch screens makes it promising. Already, apps have been developed to take advantage of this. It's getting students excited to use technology they already use in the real world and be able to learn from it. It's helping Autistic children and other students with disabilities function in the world with less assistance from others. Is the touch screen transformative? It's safe to say there are transformative aspects of the touch screen, but without proper application, as with any technology, it is just another technology.

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