The History of Ed Tech Shows It's Not About the Device

In a companion piece to a popular article on the history of educational technology, we trace the trends of the present and look to the future, all with an eye toward helping districts find the right device for their classrooms.

By David D Thornburg, 07/24/14

In June 1997, THE Journal *published an article called "Computers in Education: A Brief History." That article is still one of the most popular on our website, but — to put it mildly — a lot has changed in ed tech since then. This is less a sequel to that article than a companion piece that dips back into the past, traces the trends of the present and looks to the future, all with an eye toward helping districts find the right device for their classrooms.*

When thinking about the role of technology in education, the logical starting point is exploring why the connection between computers and education was ever made in the first place. My starting point is Logo, an educational programming language designed in 1967 at Bolt Beranek and Newman (BBN) by Danny Bobrow, Wally Feurzeig, MIT professor Seymour Papert and Cynthia Solomon. This language was a derivative of the AI programming language LISP, and ran on the PDP-1 computers from Digital Equipment Corp. Seymour Papert had studied with constructivist pioneer Jean Piaget, and felt that computers could help students learn more by constructing their own knowledge and understanding by working firsthand with mathematical concepts, as opposed to being taught these concepts in a more

directed way.

In 1973 the Xerox Palo Alto Research Center introduced the Alto computer, designed as the world's first personal computer. At Xerox, Papert's push to turn kids into programmers led to the development of Smalltalk — the first extensible, object-oriented programming language — under the direction of Alan Kay. Because these early computers were captive in the research lab, local students were brought in to explore their own designs.

Another path to educational technology began that same year, when the Minnesota Educational Computing Consortium (MECC) was started in an old warehouse in Minneapolis. Part of the state's educational software push, the original programs were simulations designed for a timeshare system running on a mainframe, with terminals placed in schools. Using this system, students could take a simulated journey along the Oregon Trail, for example, and learn about the importance of budgeting resources and other challenges that faced the early pioneers. Another simulation let the students run a virtual lemonade stand. Years later, the MECC software was rewritten for early personal computers.

In the early days, educational computing was focused on the development of higher-order thinking skills. Drill-and-practice software only became commonplace much later, with the release of inexpensive personal computers. By the late 1970s, personal computers came to market and started showing up in schools. These included the Commodore PET (1977) and Radio Shack TRS-80 (1977), among many other systems. But the computer that ended up having the greatest impact on schools at the time was the Apple II, also introduced in 1977. One characteristic of the Apple II was that it used floppy disks instead of cassette tapes for storing programs and also supported a graphical display, albeit at a low level. The first generation of computers in schools was not accompanied by very much software, though. The customer base

was not yet big enough to justify the investment.

The Uses of Ed Tech, Past and Present

In 1980, Robert Taylor wrote a book, *The Computer in the School: Tutor, Tool, Tutee*. The underlying idea in this book was that students could use computers in three different ways: 1) As a tutor running simulations or math practice, for example; 2) as a tool for tasks like word processing; or 3) as a tutee, meaning the student teaches the computer to do something by writing a program in Logo or BASIC. This model touches on several pedagogical models, spanning from filling the mind with information to kindling the fire of curiosity. Even though technologies have advanced tremendously in the intervening years, this model still has some validity, and some contemporary technologies are better suited for some pedagogies than others.

After decades of desktop and laptop computers, we have added a host of new tools: smartphones, tablets and Chromebooks, to name just a few. The long-time dream of 1-to-1 computing seems to be coming true in schools all over the world, and is even being eclipsed by those who have more than one computing device. For example, I travel with a laptop, tablet, smartphone and Chromebook. While my case may be a bit extreme, many kids have two or three devices in their backpacks.

The problem that arises is when schools or districts decide to choose a single technology for large-scale adoption in a traditional 1-to-1 program. With so many options on the table, the desire to grab hold of the next shiny thing has pushed some deeper questions into the background. For decades, I have argued that the process of choosing computers for school use needs to be driven by the answers to these questions: 1) What is the educational objective? 2) What software meets that objective? 3) What platform(s) run the desired software?

In other words, educators need to start at the beginning — the

things teachers hope to accomplish in schools — and then move to thinking about technology, with software driving hardware selections. There are two reasons that this process is important: First, these tools are expensive and schools need to get as much use out of them as possible. Second, time in the classroom is a scarce commodity, and it needs to be used wisely.

Choosing the Right Device

With all the new devices on the market today, choosing just one can appear overwhelming, but there is a process that brings some order to the task. The tool I will use is the SWOT diagram, which lays out strengths, weaknesses, opportunities and threats. SWOT was originally designed for analyzing companies, but it works for our purposes as well.

The basic idea is that there are external forces (strengths and weaknesses) as well as internal forces (opportunities and threats) that apply to every technology you're considering for school use. While cost and trendiness are two factors influencing device purchases today, these are really secondary to the core issue: How will these devices be used to improve education in your school or district?

I will provide a brief SWOT analysis for four kinds of computing devices found in schools today, but this analysis is purely for demonstration purposes. Parts of the process are subjective, so you will need to create your own analyses, and not just rely on what I provide. The real power comes when this process happens in a school or district setting and includes teachers, technology coordinators, administrators and, in some cases, students. The devices we will look at include: laptops, smartphones, tablets and Chromebooks, with the understanding that, as new technologies come to market, the same process should be used with them.

Laptop Strengths

1.Runs a wide variety of software
2.Easy to connect to printers and other devices
3.Supports all pedagogical models

Laptop Weaknesses

1.Low battery life
2.Heavy
3.Can be expensive

Laptop Opportunities

1.At least some laptop or desktop computer access is required to use 3D and normal classroom printers.
2.Laptops are needed for most legacy software.

Laptop Threats

1.Bad operating system experiences drive people to other platforms.
2.4 to 5% of computer sales in business were Chromebooks in 2013.

Smartphone Strengths

1.Highly portable
2.Inexpensive

Smartphone Weaknesses

1.Small screen
2.Difficulties in working with text
3.Very limiting for some pedagogical models

Smartphone Opportunities

1.Can lead to “phablets” with larger screens
2.Still pocket-sized

Smartphone Threats

1.Constant change in phone designs and features
2.The need to address multiple platforms in a school setting

Tablet Strengths

1.Long battery life
2.Can hold many self-contained applications
3.Competition among many vendors means that prices continue to fall as features improve.

Tablet Weaknesses

1.Mechanical keyboard usually not included
2.Designed as a single-user consumer device
3.Limited use for some pedagogical models

Tablet Opportunities

1.Kindle Fire and Samsung tablets provide pressure to reduce price in this category of device.
2.Apple's share of the tablet business dropped to 36% in 2013.

Tablet Threats

1.Other technologies may be superior to tablets in education at the same or lower prices.

Chromebook Strengths

1.Long battery life
2."Real" keyboard
3.Some applications (such as Google Docs) can run offline
4.Inexpensive
5.No viruses
6.Easy to transfer content to a different machine

Chromebook Weaknesses

1.Printers are hard to set up.
2.Can't run legacy software.
3.Requires reliable broadband for cloud-based applications.

Chromebook Opportunities

1.Rapid growth of educational applications
2.Real keyboard and trackpad meet statewide mandates for online testing.
3.Chromebooks support multiple pedagogies.

Chromebook Threats

1. While Chromebooks eclipsed netbooks, they may be vulnerable to other competing devices in the future.
2. Apple may decide to build a "Safaribook" to compete in this category.

Looking Toward the Future

The world of educational computing devices is far from static. Today's tech community is paying a lot of attention to wearable technologies, some of which communicate with other tools we might have, like smartphones.

One of the most prominent devices in this new market is Google Glass, which mounts on glasses, accepts voice commands and has a small (but high-resolution) display positioned over one eye. While it is hard to see how this device can address educational needs, it has the advantage of letting the user look forward to see both the real and computer-based world at the same time. Perhaps, for example, while a teacher was giving a presentation on the history of the Middle Ages, students with Google Glass could, while watching the presentation, also be bringing up online resources on the topic.

Smartwatches are also proliferating. These may start out being seen as more of a distraction than as a positive tool, since they deflect students' eyes and ears from the classroom to a small device that functions as a watch, music player, messaging tool and even as a portal to the Web. As new wearable technologies are introduced, including bracelets or even "smart" rings, educators are likely to see these devices as distractions, too. This is a logical conclusion to reach right now — but it doesn't change the fact that someday, a wearable device might prove to be a hugely useful educational tool.

This all brings us back to the beginning, with the ideas of Seymour Papert and his colleagues who saw computers as tools that

students could use to explore rich topics through their own constructions. While technologies have advanced tremendously since the 1960s, our pedagogical models have not. With the rise of new standards that support more constructivist models of education, we can help our students most by applying the old ideas to the new tools, something that most technologies used in schools today are capable of doing. We make a big mistake when we think the new tools, by themselves, impact learning. The coolest tools are those that let students learn in ways that result in lifelong intellectual development.