How Networks Arrived in Schools

In the United States, desktop computers arrived in classrooms beginning in the late 1970's and early 1980's, which is when they arrived on the consumer market as well. If you walked into a classroom where there were those first desktop computers were installed, you probably would have seen one or two computers on the margins of the classroom; nearby, there would have been a box of disks with applications and data were stored on them. To start a word processing program, for example, one would insert the disk with the application, then boot the computer. Another disk was inserted to load a document. To use another application, the user powered the computer down, then inserted different disks and rebooted the computer. For these computers, network security was not a concern, but viruses on the disks used to load applications and data were.

Even before those desktop computers arrived in schools, some public schools connected to mainframe computers located at colleges and universities. Students, teachers, and other users entered data on teletype terminals in schools to write programs. Commands entered in the teletypes were sent over plain old telephone system connections to the mainframes where they were executed, and the results sent back to be displayed on the terminal. One of the largest expensed associated with these efforts was the cost of long-distance telephones charges. These localized efforts were centered near colleges in New Hampshire (where BASIC was developed), Minnesota (which contributed the *Oregon Trail* to generations of students), and Illinois (where PLATO included many tools that were later central to the Internet). The institutions hosting those systems were recognized as early leaders in computer science research and education. While there is a rich narrative that the technology gurus in Silicon Valley were the innovators who built the computer revolution, historian Joy Lisi Rankin claimed the teletypes users in schools were as important in laying the foundations of our current computing landscape in the 2018 book *The People's History of Computing in the United States*.

> First-hand account: I graduated from high school in 1983. My New England school had a book storage room that had been converted into a "computer lab" where there were six desktop computers. Two were standalone computers with programs loaded from 5 ¼ inch floppy disks. The others were connected to Dartmouth College's shared time computer for high schools. I used the standalone machines a few times, and watched others scroll through screens filled with green text to accomplish something, but I am not sure what, on those connected to the college.

Eventually, the teletype systems were abandoned, and one-computer classrooms were abandoned as well. As demand for computer courses increase, larger numbers of desktop computers were installed. Rather than placing them in individual classrooms, technology leaders

installed them in “computer labs” which was the dominant model of computer-based education until the early 2000’s. In elementary schools, classroom teachers took all their students there at once for special instruction at regularly scheduled times, and in high schools, students enrolled in computer literacy or programming courses as electives, or teachers took students there for special lessons or projects. The computer lab model of technology-based teaching generally found all students doing the same type of work during their time in the space.

Late in the 1990’s, two programs supported by the federal government increased the computing infrastructure in schools in the United States. *Technology Literacy Challenge* (TLC) grants provided funds to purchase computers and support professional development for teachers. The *Schools and Libraries Program of the Universal Service Fund* (eRate) provided financial support for local area network (LAN) infrastructure and to defray to costs of Internet access. Schools have largely assumed responsibility for purchasing devices and teaching teachers, while eRate funds continue to support internet access in schools. IT professionals are usually assigned the task of preparing and submitting the schools’ eRate application. Another effort, led by local activists, called NetDays found volunteers installing the cabling necessary to connect the new computers purchased with TLC funds to Internet connections supported by eRate. This was necessary because the schools were built before computer networks were necessary, and few budgets allowed for the considerable capital expenses of installing network cables throughout buildings. Such amateur endeavors are no longer common in public schools, but the fact they were once common is an interesting reality of the history of computers in school.

At about the same time, the findings from Apple’s Classrooms of Tomorrow project were influencing many educational technology initiatives. One of the important observations was that access to computers was not sufficient for teachers to create effective lessons. They needed help understanding how to use computers in their teaching as well as training in how to operate them. This explains, in part, the inclusion of support for professional development in the projects that were awarded TLC funds. Even today, IT professionals are involved with training teachers and others to use IT systems and in some cases teach with the systems that they manage.

As computers arrived in schools that had high speed Internet access in each instructional space, and as teachers began to gain experience teaching with them, there was increasing interest in moving computers back into classrooms. It was reasoned that teaching with computers required they be in classroom so they would be available when students were engaged with all classroom activities and materials. More frequent access to computers in classrooms allows for easier technology integration, which is a popular model of organizing technology-rich teaching (see page x).

Since about 2010, one-to-one computing and cloud-based computing has come to dominate school computing. In many schools, students carry *Chromebooks* with them, and sometimes they take them home. (While the market share of educational computing devices is difficult to ascertain, estimates are that *Chromebooks* represent over 60% of the devices purchased for school users.) Some schools do continue to maintain computer rooms for special functions, and computers with full operating systems for administrative staff, but in many

schools, *Chromebooks* are the only devices maintained by IT professionals, which can be a less than optimal situation for many educators. *Google Workspaces* provide most students with productivity applications, and student information systems (including grade books), library card catalogs, and learning management systems are web-based, so students access them from home and school. Because those systems are based in the cloud, robust, reliable, and secure networks are essential to school functions.

While the move to cloud-based computing has many benefits for students, teachers, and IT professionals, it has introduced inequity into education. The "digital divide" has been used to describe the inequitable access to digital learning for generations. Originally, it was used to describe the fact that marginalized populations attended schools with fewer computing devices. It has also been used to describe inequitable access to high-quality instruction with digital tools. As cloud-computing became ubiquitous it described inequitable access to network connections to use those resources away from the school. The problem was particularly acute during the remote teaching necessitated by the pandemic in 2020.

> In March 2020, I was discussing the inability of families to access high-speed Internet in the town with a superintendent of schools. We agreed that "Internet access in the town isn't really our problem, but it is our problem." That leader recognized that teachers were increasingly assuming access to digital networks away from school, but that access may not exist for some students.