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2. INNOVATION IN SCHOOL REFORM

Technology and the Impact on Curriculum and Teaching

This chapter addresses the important role that technology has played in school reform work over two decades in two realms: the use of technology to support the reform itself, and technological advances for curriculum and classroom instruction and the research on student achievement. The viability of such innovation in high-need, low-achieving schools is reviewed with some recommendations for technology's reform in reform initiatives.

Over the past twenty years we have seen growth in both the use of computerized technologies and the support of educational reform efforts in high-need, low-achieving schools, yet the question remains, "Is it enough?" Is the technology divide growing in our schools and as a result, will reform efforts continue to fail as our children fall further behind in apartheid settings (Kozol, 2006)? Is there subliminal intent to maintain the class system that feeds lower-level "drill and kill" technology skills to children in high-need, low-achieving schools while feeding higher-level cognitive challenges to children in more affluent and oftentimes racially segregated schools? The issues of equity, not solely in providing technology as a resource, but in the ways in which machines are utilized to support instruction, beg the question of whether computers and other computerized technologies have spearheaded educational reform or whether they have been used to maintain the status quo of segregation and classism within our public school systems.

As witnessed during my tenure as an educator, serving as a change agent in-high need, low-achieving schools,[1] the infusion of computer-based technology purported to support effective instruction has followed a different path from other technologies such as radio programming, television broadcasts, filmstrips, and videos. These technologies also were purported to revolutionize schools, but failed to achieve permanency as instructional supports in classrooms. The poem "Antiquated," written anonymously in 1920, bore witness to the zeal with which these technologies were embraced as portents of the future teacher-less school environment (Cuban, 1986).

"Antiquated"

Mr. Edison says
That the radio will supplant the teacher.
Already one may learn languages by means of Victrola records.

D. Thornburg & A. M. Mungai (Eds.), High-Need Schools, 19–36.

The moving picture will visualize
What the radio fails to get across.
Teachers will be relegated to the backwoods,
With fire-horses,
And long-haired women;
Or, perhaps shown in museums.
Education will become a matter
Of pressing the button.
Perhaps I can get a position at the switchboard.

(Anonymous Teacher, 1920)

The history of the personal computer and related computerized technologies as integral tools considered part of school-reform efforts has been dramatically different from that of its predecessors.

Although I can remember introducing Personal Electronic Transactor (PET) Disk Operating System (DOS) based computers into classrooms thirty years ago to reinforce basic skills, these early tools were novelty worksheets on a screen, requiring more effort than intended to decipher and negotiate successfully (Edwards, 2015; The Commodore PET, 2011; Anderson, L., circa 1980). Although politely named "drill and practice" instead of the vernacular "drill and kill" programs, the software closely modeled the core binary code of computer programming, asking students to respond either 1 or 0, on or off, and yes or no (Cohen, 1987; Ascher, 1996; Niederhauser & Stoddart, 2001). The software generated Pavlovian responses rooted in lower-level questioning and failed to stimulate higher-order thinking skills (Marzano & Kendall, 2006; Munzanmaier & Rubin, 2013).

The past twenty years have seen the advent of the PC with Windows and access to the World Wide Web (Internet), adding entirely new dimensions to the ways in which instructional reform could be supported by technology. This chapter provides insights into the ways in which technology was intended to be used as a means to support educational reform in working with students, parents, teachers, and administrators, along with some recommendations for the future.

SUPPORTING TEACHERS AND STUDENTS—THE COMPUTER IN EVERY CLASSROOM

As Windows-based operating systems replaced the DOS-based systems, a computer was placed in every classroom as a symbol of technology infusion. In the district calendar, pictures of children seated in front of computers proudly showcased the initiative (Hempstead Public Schools, 2004; Edwards, 2015). A document signed by the then-superintendent of schools concluded with, "O.K., computers in each classroom" as the directive for action and a symbol of reform, change, and innovation (Watkins,1994; David, 1991). Getting the hardware was providing a tool, but the information provided by the machine's software and the way in which the information was used needed to be more closely examined. Cuban (1986) proposed

that this was analogous to purchasing a book but not being concerned about its contents and how the contents were to be used, or getting a radio set and not noting the program played or how it supported instruction.

Students were given the opportunity to "play" computer games that reinforced basic literacy and numeracy skills. Unfortunately, at this point in many classrooms, computer time was seen as a reward for completing "real" classwork and not as true instructional time (Yelland, 1999; Pillar, 1992). Yelland (1999) described this use of the computer as an add-on to a curriculum "composed of activities that act as a reward for finishing traditional work ahead of schedule, usually with software that reinforces content in a mechanistic way." The computer was essentially seen as a novel behavioral-management tool as opposed to an essential resource for instruction.

Many instructional programs were worksheets on a screen with little innovation; however, some programs demonstrated true creativity that fully engaged young users in the teaching and learning process. This was a move away from the Pavlovian-based software toward a more constructivist approach to supporting learning. The software required greater degrees of higher-order thinking skills with the potential to bolster true learning. Teachers prone to using a didactic approach to instruction appeared to use the "drill and kill"-designed software, while those who were more constructivist in their methodologies used more open-ended software (Russell, 1989; Lovell & Phillips, 2009; Sheingold & Tucker, 1990; Yelland, 1999; Niederhauser & Stoddart, 2001). *Reader Rabbit* and *Writer Rabbit* took young children through a series of interactive screens that fostered a solid foundation for English language arts (ELA) development. *The Oregon Trail* reinforced map skills, ELA, and history as children imagined themselves as pioneers moving Westward as settlers in the United States of America. *Where in the World is Carmen San Diego?* fostered the use of higher-order thinking skills while in the role of a detective. The goal was to hunt down a crime suspect while using map skills, historical facts, drawing conclusions, inferencing, and logic. Software programs with a constructivist design were not used as often in classrooms because they frequently required more attention to the student and the interactive thought patterns. As Niederhauser and Stoddart noted (2001), "Computer technology in and of itself does not embody a specific pedagogical orientation.… Interactive, exploratory and tool software can support teachers as they implement reform-oriented constructivist practices." In many classrooms, interaction with computer-based learning was still regarded as "play", and not as a tool to encourage critical thinking (Papert, 1980); but the role of computers was set to change as legislation signed into place by President Clinton, the Educate America Act – Goals 2000, began to impact reform efforts.

In New York, the *New Compact for Learning* reform effort had provided a curriculum framework for mathematics, science, and technology that sought to change the landscape of how learning took place in classrooms. The New York State Education Department published the following, "By focusing on curriculum, teaching and learning, and assessment, and by identifying how technology can help to support change toward a restructured classroom, we can take advantage of

this powerful support vehicle (the computer). I would assert that the failure of our schools to be successful in preparing our students to function as world citizens, and our failure to effectively use technology to change teaching and learning are closely interrelated" (Radlick, 1994). The passage of Goals 2000 added federal leverage and proverbial "teeth" to the reform efforts already begun at the state and local levels (Schwartz & Robinson, 2000).

The New York State Education Department Board of Cooperative Educational Services (BOCES) opened a Division of Computer and Communications Technology with a full-time supervisor and support staff who focused on support for hardware purchase, installation and maintenance; software review, selection, purchase, and installation; as well as professional development for the effective integration of computers with instruction (Burton, 1994). Conferences with workshops on the effective integration of technology in classrooms were in demand, such as the 29th Annual Conference of the New York State Association for Computers and Technologies in Education, Thresholds '94. As the conference chair stated, "…we are indeed on the threshold of a new age, one that will dramatically change the learning place we call school (Huff, 1994)." The New York State Education Department partnered with the New York State United Teachers union to sponsor the fourteenth annual statewide conference entitled Teaching and Learning- Vision becoming Reality at which the keynote speaker, Michael Cohen, was Senior Advisor to the Secretary of Education and manager of the Goals 2000 program for the United States Department of Education (NYSED & NYSUT, 1994). Federal, state, and union partnerships were clearly evident and focused on the use of the computer as a means of educational reform.

Information about statewide public-television broadcasts such as *Learning by Design: The Technology Connection* were distributed via the *School Executive's Bulletin,* a publication of the Office of Elementary, Middle, Secondary and Continuing Education at the New York State Education Department, and Technology Long Range Plans were written to identify funding streams to purchase computers and software, while inventorying their placement in classrooms or labs (Vaughn-Shavuo, 1994). Every effort was made to use grant funding to support the reform since the general fund was unable to do so in this "high-need" district. Although the plan was thorough in its detail, it failed to address the need for professional development in constructivist approaches in working with these classroom tools. In fact, the tidal wave of the accountability movement of Goals 2000 redirected the focus of the role of the computer. The move was toward more didactic approaches in support of assessment and accountability through computer assisted instruction (CAI) (Ascher, 1996; Pillar, 1992; Cohen, 1987).

Computers moved from isolated stand-alones in a center within classrooms and into labs that became a focus for CAI. Many hours were spent in a deliberate effort to build skills necessary to close the achievement gap between Whites and non-White students in schools by having students interact with software that would adjust skill

level based upon responses registered (Ascher, 1996; Pillar, 1992; Cohen, 1987; Seltzer, 1971).

Diagnostic assessments provided by the software were administered to all students, and as an academic intervention service, every low-functioning student was scheduled for CAI lab support on an A-B schedule, meaning every other day the student went into the lab. Most districts used this model as it dovetailed with the scheduling needs of pairing a class with another A-B class that was scheduled, such as Home and Careers or Physical Education. Students' efforts were tracked diligently to log the time on task and the units completed in the student-directed instruction. A teaching assistant would circulate to provide some measure of support for students, but for the most part the computer was the teacher, with software adjusting for the errors made and patiently providing students with material determined to be instructionally appropriate (Seltzer, 1971; Suppes, 1967).

Business leaders became the role models, seen as expert in designing reform efforts for academic growth, particularly in high-need schools. Presentations from businesses promising improved outcomes, such as the Edison project and Success for All, were commonplace (Ascher, 1996; Tyack & Cuban, 1995; Carl, 1994; Kozol, 1992). "In most cases, the companies relied on teaching machines and/or programmed materials, individual diagnosis and prescription of learning, and extrinsic incentives" (Tyack & Cuban, 1995). Representatives were professional and warm, materials were organized and plentiful, but like the child in the classic folktale "*The Emperor's New Clothes*", no one wanted to ask aloud, "Why are you here in a low-performing minority district but not in a high-resource, largely Caucasian district? If all ships rise when the tide comes in, wouldn't all children benefit from these materials and approaches?" The unspoken kernel of truth was that the "drill and kill" software and scripted teacher dialogues for interacting with students wouldn't be tolerated in wealthier districts (Tyack & Cuban, 1995). Teachers' complaints of "prepackaging of learning robbing them of the chance to exercise their own professional knowledge and discretion" would be attended to rather than dismissed (Tyack & Cuban, 1995).

Nominal gains were documented, but the achievement gap was not closed using the CAI approach (Seltzer, 1971; Suppes, 1967). As the Hawthorne effect (positive attention creating positive results) created by the novelty of working on the computer wore off, students would begin to choose any keystroke to answer the multiple-choice passages out of frustration or boredom. Most students needed more direct teacher guidance and interaction in utilizing reading strategies to complete the instructional material, and lacking this direction they would perform poorly with the multiple-choice format. While some students followed the routine of entering the lab, getting out their folder, checking to see which level they needed to access for the day, and signing on to the software, something was lost at this point and the promised gains in the academic reform effort were not realized (Pillar, 1992; Cohen, 1987; Seltzer, 1971; Suppes, 1967).

For the most part, teachers who remained uncomfortable with the introduction of computers and whose definition of instructional technology was taking students to the CAI lab made limited or no attempts to expand upon usage of "the machines" to support learning. Some exceptions occurred when first adopters, usually the more technology-enthused teachers, curious about using these tools to communicate with other school communities, took the initiative to infuse technology into their lessons, making teaching and learning an exciting, constructivist experience (Rogers, 1995). One example is the middle school social studies teacher who after the September 9–11, 1994 Hurricane Debby hit Antigua, West Indies, started a unit of study and school drive to support relief efforts. As many of his students had family on the island, he infused technology to help his students use the Internet to research the cause of these events, to track the damage caused, and to communicate via e-mail with students in the country to get firsthand accounts of the events overseas. This memorable school activity would not have been feasible without the infusion of technology to support teaching and learning. Not only did Mr. Harris teach content, but he also built community by demonstrating how to use technology to allay the fears and concerns about family and friends that were keeping his students from learning. In a constructivist approach to learning, Mr. Harris became an example of how to effectively use technology in the classroom to motivate students, address their needs, and to stimulate learning (Harris, 1994). This was an example of how "to connect computer education to students' lives and aspirations. More important … (this places) kids in control of technology" (Pillar, 1992). Mr. Harris was, however, the exception in an environment wracked with technophobia. When his multimedia-center equipment needed repair, it was seen as a low priority, so a purchase order was never approved and he was no longer able to engage in these types of lessons during his instruction (Harris, 1994).

The question remained, How can we infuse technology to support instruction? Increasingly, the answer became to move from the "drill and kill" of CAI and toward the interactivity of open-ended responses like Webquests, and other project-driven approaches in using the computer as a tool for critical thinking. As this direction was expanded upon, teachers observed that students were hampered in expressing their ideas on the computer because they lacked knowledge of the keyboard. In a desire to help students make the transition from clicking an answer with a mouse to typing ideas in open-ended responses, keyboarding classes were reintroduced into the curriculum. They had been eliminated or reduced in number during the era of computer-assisted instruction as having become outdated with the demise of the typewriter (Pillar, 1992).

The reintroduction of keyboarding classes into secondary students' schedules was extremely controversial. Students taking advanced or remedial classes did not have room for this class in their schedule. Students taking the general education schedule had room for the class but found it to be boring and unchallenging, arguing that they could find the keys using the "hunt and peck" method to record their ideas

(Pillar, 1992). Purchasing expensive hardware for the sole purpose of keyboard instruction appeared wasteful and counterproductive in preparing students for academic success.

Business teachers, assigned to teach keyboarding as a job-saving measure, appeared reluctant to move students from keyboarding basics into direct computer application of skills through articulation with other classroom teachers. Lack of common planning time meant that few opportunities existed for teachers to communicate regarding ways in which the keyboarding skills could transition into computer applications in even the most basic ways. An example is the English teacher assigning a report on a particular author, and students practicing their keyboarding to work on the assignment under teacher direction in the business class as a practical application of the skill.

The realities of resistance to embracing technology in the classroom meant that administrators needed to lead reform efforts by requiring teachers to include use of the computer lab in their lesson plans. Teachers needed to document the infusion of technology through computer-lab time, which provided students the opportunity to research and compose open-ended responses. This might have taken the form of a Webquest or a research question under the guidance of the teaching assistant assigned to the computer lab and the classroom teacher. It might also have included accessing appropriate websites for reinforcement of skills, such as www.RegentsPrep.org on the secondary level or www.Starfall.com on the elementary level. Word processing in the computer lab and in elementary writing centers became an accepted form of instruction as a means of more effectively supporting the teaching and learning process; however, these were still basic applications of technology that failed to provide constructivist opportunities for learning (Niederhauser & Stoddart, 2001).

Some programs, such as READ 180, managed to successfully combine the concepts of CAI, word processing, and teacher-directed instruction into one package. As students moved from station to station within the reading center, teachers found that they appeared to respond to the multisensory instruction, making strong literacy gains (Lang, 2009). Unfortunately, once again classroom teachers saw the READ 180 teacher as the sole responsibility center for providing technology infusion in instruction (Cuban, 1993).

That misunderstanding would change again, when another tool emerged that would bring the responsibility center back to the individual classroom teacher: the interactive whiteboard. Used initially in the business world, the SMARTBoard was developed by SMART technologies, a business that saw the educational market open for a transition from the chalkboard. Gaining a large share of the market, the SMARTBoard emerged as another accepted tool for enhancing instruction. Other versions, such as the lower-cost Promethean board, gained traction in schools looking to stretch their technology dollars; however, the less expensive boards lacked the richness of features in the higher-end SMARTBoard. As a result,

although the SMARTBoard has been omnipresent in more affluent districts, it was being introduced into high-need, low-achieving schools at a slower pace (rAVe Staff, 2013; McNeese, 2007).

The technology divide was fueled by limited financial resources required to purchase and maintain this equipment. As competitive models entered the marketplace, the price dropped; however, in some districts the cost remained prohibitive. Some high-need districts adopted a phase-in process in which interactive whiteboards were purchased and installed annually by grade level as the budget permitted (Vaughn-Shavuo, 1994). The use of the interactive whiteboard also required accompanying professional development in order to truly access the richness of its capabilities in supporting instruction (Carpenter, 2010; Groff & Mouza, 2008).

As a result, the digital divide was evidenced in two ways: (1) The access divide created a lack of hardware except through "soft" funding and prohibited ongoing maintenance of the same; and, (2) The usage divide perpetuated lower-level thinking through basic "drill and kill" with limited evidence of constructivist approaches. The use of social media, blogs, Wikis, WebQuests, and iPads to support instruction in high-need, low-achieving schools appeared to be limited. The irony is that there was strong home use of these technologies by the children attending the very same schools. As in schools in more affluent communities, students attending high-need, low-achieving schools were in many cases more adept at using these tools than their teachers. Attending a school that failed to provide this same high-interest technology-based stimulation appeared to contribute to the spiral of low achievement as opposed to supporting reform efforts (Radlick, 1994). MySpace and subsequently, Facebook pages were used by secondary-school students to communicate daily. Phone calls, Instant Messaging (IM), video chats, and more were and continue to be common tools of communication for our students. More than anything, students attending high-need, low-achieving schools needed stimulating and engaging instruction that used these tools to fully draw them into the teaching and learning process.

Is teacher resistance the reason why professional development geared toward using these tools effectively didn't happen? Admiral Rickover is famously quoted as saying that "changing education is like moving a graveyard" (Rickover, 1983). He also elaborated on what it means to be educated, as follows: (1) to have knowledge of the world around us, to know history, literature, philosophy, science; (2) to possess skills such as the ability to read, to write clearly, to calculate; and, (3) to be able to think critically and logically (Rickover, 1983). Perhaps it is because educational professionals, after critical and logical reflection, determined that there was an essential need for effective professional development and that without it children's needs could not be met (Cummings, 1995). Much like the child given a nutritious bowl of oatmeal for breakfast but no spoon with which to eat it pushes back from the table rather than attempting to eat it without the necessary cutlery, and in doing so makes a nasty mess of things.

SUPPORTING PARENTS AND STUDENTS – IMPROVED COMMUNICATION WITH TECHNOLOGY

Support of parental involvement is a universal tenet of sound pedagogy. Given the Title I requirements for funding set-asides and annual parent meetings in high-need, low-achieving schools receiving millions of dollars in Title I, there was a push for inclusion in the reform effort. Parental inclusion in the educational reform effort was supported by technology by attempting to provide an avenue of communication with the community.

In the late ’90s, the Homework Hotline was installed in the district as a means of improving communication with parents. The software system was interactive and required ongoing maintenance by classroom teachers. Teachers were required to update weekly homework assignments via recordings that could be made through remote access using a home phone. Parents and students would then be able to call in to the teacher’s mailbox and hear the recorded homework assignment for the week. This was especially helpful for students who had been ill and needed to access the assignments to catch up and for parents whose children reported no assignments for the day. A parent was empowered by being given access to a means of verifying this information.

The Homework Hotline system could also be used for calling parents with a daily absence report. Parents could request any number be used for contact; if they preferred that their office number be called instead of the home number, the school could structure the software to follow those instructions. The administrator’s responsibility was that of verifying that phone numbers were correct so that the intended student’s home was contacted regarding the homeroom absence.

Special announcements were also made by calling parents to increase attendance at Parent-Teacher-Student Association meetings and Board of Education meetings, for example. The call-out system could be used to call homes in the evening up until 8:45 p.m., in an effort to leave the message with someone answering the phone (The Homework Hotline, n.a.). Attendance at meetings increased, with some parents voicing concern that they received too many calls, but glad that communication was increased. The system also supported reform efforts by increasing accountability in instruction. Parents raised questions about teachers who failed to record homework assignments and teacher evaluations included references to using technology to better inform parents and support instruction. Unfortunately, the system required that a person be assigned the task of “feeding the beast” in order to keep the information updated. As administration changed, the responsibility of managing the technology was not seen as a priority and the Homework Hotline became outdated and its use in the district ended. Eventually, it was replaced with a newer and less cumbersome system for calling out announcements, but the homework-recording component was lacking. As this happened, however, a new tool gained prominence as a support for parent-teacher communication: electronic mail, or e-mail, as it is commonly called.

Some classroom teachers began to use e-mail to contact parents of their students, as this was a tool with which they were becoming increasingly familiar. Although many were uncomfortable using their assigned school district's e-mail address, they were at ease using their personal e-mail address. This allowed for more flexibility of communication but introduced another level of concern regarding privacy and professionalism within the electronic exchange. Teachers were required to copy the principal on all e-mail exchanges to maintain a healthy dialogue and administrative oversight on what could potentially become legal documents in a superintendent's hearing or court matter. This increased degree of communication capacity led to more complex dynamics with regard to accountability in the school community.

As teachers and administrators became more comfortable utilizing technology to enhance communication with parents, the digital access and usage divides became more apparent. In a high-need, low-achieving district, many landline phone numbers were inaccurate as families found it easier to rely more heavily on cellular phones. The cellular phone or cell phone as it came to be commonly called, allowed for greater ease in ownership and cheaper billing (Keeter, Kennedy, Clark, Tompson, & Mokrzycki, 2007). It also allowed for facilitated changing of a number upon request and provided the option of disposability when needed. The maintenance of the cell phone as opposed to both a landline and cellular was in most cases purely a financial decision. Interestingly, as cell phones have become richer in their capabilities, this tendency to use them as a primary or sole phone has led to coining of the term "cell phone only" (CPO), and this behavior now appears to cross all socioeconomic levels (Aoki & Downes, 2003; Ansolabehere & Schaffner, 2010). The international market-research organization GfK released April 2015 data indicating that more than four in ten adults in the United States live in CPO households, growing 70% since 2010.

Twenty years ago, however, for many parents in high-need, low-achieving communities, maintaining a phone connection took precedence over the purchase of a computer system at home. One company that spoke with parents regarding assistance with the purchase of a desktop system was Blue Hippo. With several incentives such as a television and iPod for purchasing the desktop through their company, Blue Hippo hoped to encourage parents to make monthly payments over an extended period of time in order to put computers in their homes. Parents were reluctant to commit to a long-term payment plan, which although it collected manageable small amounts of money would have resulted in an expensive purchase once all of the fees were tabulated. In retrospect, parents were wise to avoid the "rent to own" financing which Blue Hippo advertised. Evidence of mismanagement appears on the Maryland-based Better Business Bureau website even though the company filed for bankruptcy in 2009. Complaints of deposits collected but no equipment delivered appear unresolved. Parents in high-need districts recognized the importance of technology access and yet in some cases were defrauded of their already limited resources.

The improved capabilities and reduction in pricing did ultimately lead to a proliferation of laptops, tablets, and smartphones, which helped close the digital access but not necessarily the instructional usage divide for students in high-minority, low-achieving school districts (Aoki & Downes, 2003). Curricular applications of technology using students' own devices in classrooms have not been well developed, to date. Having students bring their own devices/technology (BYOD/BYOT) to classrooms in support of instruction, as opposed to banning cell phones, laptops, and tablets, remains to be explored as a means of garnering parent involvement in sharing the responsibility for closing the digital access and usage divides (Lagarde & Johnson, 2014; Sangani, 2013).

SUPPORTING TEACHERS AND ADMINISTRATORS – MINING DATA TO DRIVE REFORM

Over the past twenty years, reform efforts in high-minority, low-achieving school districts have been driven by largely unfunded mandates coming through the Compact for Learning and No Child Left Behind. Five-year technology plans were required in order to receive federal and state funding. Title II specifically addressed the infusion of technology into the teaching and learning process, while every funding stream required some evidence of technology integration into the plan (Vaughn-Shavuo, 1994). Data-driven reform led to efforts to better collect and track the emerging trends in the data. The Board of Cooperative Educational Services (BOCES), as an arm of the New York State Education Department, provided support in the warehousing of data for school districts across the state. Other states across the nation, such as Connecticut, New Mexico, and Wisconsin, have organizations that serve as purchasing cooperatives like the New York State BOCES and they are generally referred to as cooperative educational services. Their websites offer data-driven analysis in support of school districts. In New York State, the BOCES serves as a collection and reporting agency for the benchmark assessments; therefore, it seemed most logical to house district data at that site for longitudinal review purposes. The data warehousing provided invaluable information for the development of "school-wide programs" and comprehensive school reform efforts in high-minority, low-achieving school districts. As with all information systems, training and care were needed to "feed the beast" to ensure valid and reliable data reports. Schoolwide plans, offered as a comprehensive reform-plan option for schools exceeding 75% poverty, allowed for flexibility in the use of Title I monies in an effort to increase achievement for all enrolled students. This federally based reform initiative was driven by poverty data for funding and student-achievement data for measures of success. In many cash-strapped districts, monies were now available for bringing computer hardware into schools. Title II monies focused on providing professional development regarding effective infusion of technology into classroom instruction. Comprehensive School Reform Development (CSRD) plans

tapped the data warehouse to mine for both demographic and achievement trends in districts. Both of these plans were only available as planning options in designated Title I of the Elementary and Secondary Education Act schools, those schools with high poverty and low academic achievement. The use of technology provided the framework within which the plans were developed to utilize a data-driven approach to reform efforts (USDOE, 2015).

As teachers and administrators became more adept at using technology to mine data and open discussion regarding root causes of low academic achievement in high-need districts, another layer of technology software unfolded to support the reform efforts: the Student Management System. Daily information input regarding attendance, demographics, and behavior reports (e.g., suspensions) was the fodder for "feeding the beast" (Petrides & Guiney, 2002).

Professional-development sessions were conducted to train classroom teachers, clerical staff, and administrators on how to effectively and efficiently enter data in order to have "clean" information to support academic reform efforts. Classroom teachers learned to take attendance daily using the teacher computer station specifically dedicated to the teacher's use in the classroom. This attendance data needed to be collected by the teacher by certain designated points in time daily in order to be accessed and processed through the attendance office for finalized reporting. Clerical staff needed professional development to input demographic information during the registration process and to update information as parents or other caregivers provided documentation regarding changes in an address, phone number, or guardianship. The demands of time and resources to continually feed and update information proved overwhelming as the additional responsibilities were added to persons already tasked with so much. In reality, updating of the information lagged behind so that the data became contaminated and of limited use. As Prakash (2013) has characterized it, "Blind application of data-mining methods (rightly criticized as 'data dredging' in statistical literature) can be a dangerous activity, easily leading to discovery of meaningless and invalid patterns."

Administrators required professional development to unlock the potential power of the software in interacting with parents, students, and staff for informed decision-making throughout the day. Administrators needed to be comfortable and adept with accessing students' schedules, attendance record, behavior reports, and demographics at any time. Having this accurate information in real time made for informed decision-making, which in turn led to improved delivery of services to students, teachers, and parents. Oftentimes, being able to access this information at my fingertips led to better decisions in supporting a child during a parent conference.

School Administration Student Information (SASI) software was a leader in providing this platform. Real-time reports could be generated to assess changes in classroom enrollment trends to make decisions regarding the need to split classrooms or to hire more teachers in the new budget. Real-time reports could

be generated to respond to New York State Education Department requests for data such as the Immigrant Census, which counted the number of children born outside of the United States and tracked the countries in which they were born, or the Violent and Dangerous Incidents Report (VADIR), which tracked suspensions and reported on school safety. The SASIxp (the next generation of SASI) literature summarizes the business perspective on school reform as follows, "Key to better educational experiences is to better manage schools. Key to better management is more and better data to inform decision-makers. Technology tools such as relational databases will give school personnel that data. Benefits range from cutting costs to improving services and boosting morale (SASIxp, 1996)." This business perspective on school reform efforts doesn't mention children and improving learning outcomes, but rather focuses on the management of the system that houses bodies until they have aged out. This philosophical flaw as related to business operations within school systems might have been the genesis of full adoption failure, even with the SASIxp rollout, which led to loss of market share, and ultimately the company's demise.

There were many times, however, when using SASI that the local area network (LAN) system was slow or down or not updated and the frustration of having the technology fail to support reform efforts is a vivid memory. This had a negative impact on professional development intended to support staff, especially first adopters, in using the system. This was not a reflection upon the SASI software but once again pointed to the need to better support the maintenance and upgrading of the hardware as critical infrastructure within the system, and the lack of resources available to do so in a high-need district.

Reports that previously had taken hours were now produced within minutes, providing that the data had been entered properly. PowerSchool became the next generation of student-management software, providing the same supports for data mining with the intent of being more user-friendly in design. The business website expresses a perspective that connects children and their education to the technology integration of their software. "PowerSchool plays a central role in K-12 education, serving as the hub of customers' education ecosystems with robust features…that allow education stakeholders to effectively manage school processes and student data and connect education technologies relied upon in school offices and classrooms alike" (PowerSchool, 2015). The business shifted gears to understand that in true educational reform, educators, not data managers, need technology hardware and software to provide information that will help them focus on what matters: the students' needs (PowerSchool, 2015).

The success of these or any student information-management systems always lies in "feeding the beast." The adage "garbage in, garbage out" accurately sums up the dilemma. Time, effort, and resources must be dedicated to the front end of the process in order to input accurate information so that the end product is reliable (Prakash, 2013).

WHERE ARE WE HEADED WITH TECHNOLOGY AND REFORM EFFORTS?

Over ten years after *A Nation at Risk* (1983) was published, *Perform or Perish* drew attention to an educational system in New York State that still allowed children living in poverty to fail academically. As the report from the Low-Performing Schools Advisory Council indicated, "Savage inequalities persist in the support we provide to students in our State (1994)." Twenty years later, these questions of educational equity in high-need, low-performing schools continue to haunt us, begging for resolution as each child's future unfolds. As David (1991) stated, "First, people need an occasion to change—a reason for taking on something more difficult… So the beginning steps of restructuring require leadership that invites change…that signals that it is no longer business as usual and that there is a sincere request for and commitment to support serious change efforts." Change efforts driven by businesses seeking profits have allowed for the appearance of honoring a sacred trust, but have truly worked to "maintain the legitimacy and privilege" of their class (Boyle & Silver, 2005; Kozol, 1992; Kozol, 1991).

If we have a hand in the making of our children's future, we must continue to support efforts to provide funding for the infusion of technologies into the teaching and learning process of each high-need, low-achieving school. This includes ongoing maintenance and upgrading of machines to address the digital-access divide (Tyack & Cuban, 1995; Pillar, 1992). Efforts must also support the accompanying professional development so that both classroom teachers and administrators gain an understanding of ways in which to use technology to fully support the teaching and learning process on a daily basis (Groff & Mouza, 2008; Niederhauser & Stoddart, 2001). This may entail rich partnerships with institutions of higher education with values rooted in inquiry-based learning, constructivist approaches, and community-based initiatives.

During reform initiatives, high-risk students were tested to death in an effort to monitor academic progress because of low scores, but then received "drill and kill" and scripted supports that fostered lower-level thinking skills, which in turn maintained low scores (Tyack & Cuban, 1995; Pillar, 1992). Joseph Rice (1897), in his search for a link between the time spent on spelling drills and students' performance on spelling tests, found none. Essentially, the spelling grind, the "drill and kill," leaving instruction at the lower level of thinking, did not lead to overall student achievement. Albert Einstein's oft-quoted assessment of this behavior remains applicable in this scenario: "the definition of insanity is repeating the same behaviors and expecting a different outcome" (Einstein, n.d.). The professional development, consisting of in-class modeling, practicing, and feedback support required to use computers and software in constructivist ways, is risky at best when funding streams such as Race to the Top apply pressure for immediate positive upticks on scores, yet it is this instructional approach that has fostered engaged learning and true academic gains (Pillar, 1992; Niederhauser & Stoddart, 2001). The vicious cycle disguised as the use of technology to support reform efforts has perpetuated a system in which lower-

wage jobs requiring response/reward system thinkers are filled by children exposed to "drill and kill" instruction through technology support. For various reasons rooted in societal norms, while many middle-class children have been encouraged and rewarded by parents and teachers for self-direction in their thinking and learning, the children of lower-class families are often taught to conform (Kohn). Classrooms in which the constructivist approaches to using technology through extended responses that foster critical thinking cultivate the decision-making required to enter and succeed in institutions of higher education and subsequently, higher-paying careers. This instruction should not be reserved for children outside the high-need, low-achieving schools experience.

Perhaps there was a time when people argued whether or not pencils should be used daily to support instruction. As the new technology, people were apprehensive about the rigidity of the shape as opposed to the more creative, arbitrary shape of charcoal. There may have been concerns about the spread of disease since you didn't have to wash your hands after each use of the pencil the way you did when using the charcoal. Some may have argued that it was too easy to write with the pencil and so children could play with it when they finished their real work with the charcoal. Some children were forced to practice repetitions of squeezing the pencil so that they could "drill" the concept of holding it correctly, while others were forced to "practice" forming shapes over and over again since they needed to "learn the basics" of holding the pencil. Yet when using the pencil with a constructivist view, children were encouraged to think critically, and those thought processes became easier as students were able to record thinking with greater ease and the information didn't easily smear, so it could be referenced, shared, and discussed with others.

The simple pencil illustration serves to reinforce that the argument regarding the daily use of technology is moot, given that our students were born in the age of color televisions, cell phones, iPods, iPads, iPhones, video consoles, and more. Technology provides additional tools for classroom instruction, tools that our students are comfortable with and excited to use in their quest for information, knowledge, and understanding. Technology also provides a means to better support the parent-school connection needed to best educate our children. Lastly, technology, when used effectively, can provide the information needed for school communities, especially in high-need, low-achieving schools, to inform decisions that best support children. True reform demands that the technology access and usage divides be conquered. The direction for true reform is very clear. Our children truly deserve it and our future, both as public school educators and as a country, demands it.

NOTE

[1] The author worked in the Hempstead Union Free School District in New York State during the time period recalled. Although students made gains during her tenure, the district still wrestles with maintaining progress and is identified as high-need, low-achieving by the New York State Education Department (http://www.p12.nysed.gov/irs/accountability/2011-12/November2011DistrictsAndStatusAddInfo.pdf).

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