Digital Youth in Brick and Mortar Schools: Examining the Complex Interplay of Students, Technology, Education, and Change

by Craig Peck, Kimberly Kappler Hewitt, Carol A. Mullen, Carl A. Lashley, John A. Eldridge & Ty-Ron M. O. Douglas — 2015

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Context: *The past decade has witnessed a sustained emphasis on information and communication technologies (ICT) in education, coupled with the rise of online social media and increasing pervasiveness of personal media devices.*

Research Question: *Our research question asked: How has this changing context affected the educational experiences of American high school students?*

Setting: *The exploratory, qualitative study took place at two high schools in a large metropolitan district in the southeastern United States. One high school was in a downtown area, and the other was in a suburban setting.*

Research Design: *The researchers used various qualitative research approaches, including interviews, on-site observations, and document analysis. Our interview participants included classroom teachers and support staff as well as students drawn from across each school's grade levels. We also shadowed 10 of the student interview participants through their entire school days.*

Findings: *In terms of classroom instruction, we found that ICT had affected school, teacher, and student practices in some ways, but traditional teacher-centered practices such as student completion of printed worksheets were still prevalent. However, widespread student access to personal media devices and online social media site influence had a noticeable effect on the two high schools. The researchers encountered specific "types" of students whom technology particularly influenced: "Digital Rebels," "Cyber Wanderers," and "eLearning Pioneers." In addition, we discovered that computer-based remedial programs served as problematic educational lifelines for students at risk of dropping out.*

Conclusions: *The two study high schools presented a complex portrait. In the end, technology functioned both as an imperfect school reform effort that produced only partial instructional change and as a successful though uninvited disruptive innovation that allowed students to challenge and unsettle existing educational norms. We close by considering implications of our findings.*

In the United States and around the world, the past decade has witnessed a sustained emphasis on information and communication technologies (ICT) as a potentially revolutionary means for transforming schools and schooling (Christensen, Horn, & Johnson, 2011; Moe & Chubb, 2009; Selwyn, 2013; Warschauer, 2011; West, 2012; Zucker, 2008). Concurrently, the rise of online social media and increasing pervasiveness of personal media devices (PMDs) has significantly influenced youth culture (Harris, 2011; McPherson, 2008). Prensky (2011) popularized *digital natives*, a term that other researchers (e.g., Palfrey &Gasser, 2008) have used to signify contemporary students' early immersion into an ICT-suffused world. At the same time, scholars have profiled the lack of actual use of computers in schools (Cuban, 2001), and others have expressed concern over the apparent role that corporate profit-making (and taking) has played in the push for technology in education (Spring, 2012).

Youth, technology, education, and change, then, are interacting in complex ways. To illustrate the interplay of these various forces in schools, we offer a vignette drawn from our research:

One Friday morning in late spring, the instructional day began at Downtown High School, located in a large

Southeastern United States school district. African-American 11th-grader Joanna Miller and 19 other students entered room 321 for their Small Business course, a technology-infused elective, and took seats in front of desktop computers.[1] The session began as a guest speaker, a 1961 Downtown High School alumnus who had retired from a career as a lawyer and business person, described his work experiences, discussed resume tips, and offered motivational words. The course instructor transitioned the students into the day's assignment: They completed computer-based multiple-choice responses regarding business term definitions and reviewed for a test that coming Monday on creating a personal "business image." The teacher monitored student progress through a program on his computer that provided a real-time screen shot of each student-assigned computer. This system allowed him to lock individual computers or the entire group to provide updates or check that everyone was on task. At one point, a student tried to access a popular social media website through a proxy but had the action blocked by the monitoring program. The teacher's computer-based monitoring of the students actually seemed rather laissez-faire. At one point, several students were engaged in completing the assignment, while a few others were completing work for other courses, surfing the web, or, at intermittent moments, quickly texting on their personal media devices.

Joanna, in fact, used her computer to complete the assignment's multiple-choice responses. She explained to the researcher how she preferred the online format because it allowed her to retake questions she answered incorrectly. After the bell rang, signaling time to move to the next period, Joanna continued on with her school day. She encountered instructional technology along the way, including when fellow students used a computer-interactive whiteboard for problem demonstrations in mathematics. In other courses like English, decades-old practices predominated as students sitting at desks arranged in traditional rows completed a photocopied crossword puzzle regarding a classic play. In Latin, the instructor engaged students in a discussion regarding Celtic mythology and read a myth from a book. In this sense, her instructional day offered Joanna a mix of technology-rich and technology-free experiences.

Despite the varied nature of instruction, one technology pervasive throughout the day was student personal media devices. Downtown High School rules specifically prohibited students from bringing technology like cellular phones and digital music players to school. In classrooms and in the halls, however, headphones dangled from ears and tiny keyboards met eager text-typing thumbs as students routinely, if often surreptitiously, indulged in their favored virtual electronic communication modes. In some cases, educational spaces became contested domains. In math, the teacher confiscated Joanna's cell phone (which a classmate was using) and two others. The teacher returned the devices at the end of class with a stern admonition against further use. In Joanna's Latin course, meanwhile, instruction in the aged language competed against modern times as one student in particular showed a remarkable affinity for modern multitasking. Shielding her personal media device beneath her desk, the student quickly tapped out text messages. She also used a pen to write notes to secretly pass onto classmates and, for good order, offered periodic comments to the larger discussion pertaining to Celtic mythology.

On one level, this vignette suggests the dualities regarding ICT at Downtown High School. Incremental changes in instruction had apparently occurred as technology helped alter teacher and student practices in some of Joanna's classes; however, decades-old practices such as student completion of worksheets remained a norm rather than an occasional aberration. On another level, the vignette implies that a significant conflict had emerged between how teenagers approach technology use in and out of school. Outside of education, digital youth like Joanna enjoyed easy, frequent access to personal media devices (PMDs); in this brick and mortar school, however, student access to such individual electronic media was entirely prohibited, even as the students found ways to use the devices routinely.

These tensions surrounding technology use represent some of the central issues that propelled our research study. We asked: How has the confluence of promising instructional technology innovations and digitally driven youth culture affected the experiences of today's high school students? To address this research question, we conducted a 2-year-long qualitative study into technology use in two southeastern United States high schools in a large metropolitan school district. One of the schools, Downtown High School, was racially and socioeconomically diverse. and Newlands High School was predominantly affluent and White but with a significant population of

African American students. Through interviews, on-site observations, and full-day shadowing of students, we noted how ICT had induced only partial change in instructional practices. We also encountered several types of students whom technology particularly influenced. We classified these vanguard groups as “Digital Rebels,” “Cyber Wanderers,” and “eLearning Pioneers.” In addition to uncovering this emergent typology, the researchers discovered how computer-based remedial courses served as problematic academic lifelines for students at risk of dropping out of school. For some such students, ICT appeared to be an electronic dead end rather than, as intended, a digital portal to increased success in school.

To help in interpreting our findings, we employ a conceptual framework drawn from the school reform scholarship of Tyack and Cuban (1995) and the educational innovation ideas of Christensen et al. (2011).

REVIEW OF LITERATURE

This study is related to three complementary areas of literature: monographs considering the potential of instructional technology to alter educational norms; research on digital media’s effects on youth culture; and empirical studies about ICT in schools. Regarding the first category, authors have contended that computers and other devices will assist educators in adopting new, effective instructional practices (Collins & Halverson, 2009; Zucker, 2008). In terms of how particular technologies affect education, West (2012) provided a substantive overview of the possible impact of emerging approaches such as wired classrooms and distance learning, whereas Warschauer (2011) described the transformational potential of cloud computing. Others have suggested that youth immersion in digital media culture can force educational change. Chen (2010), for instance, contended that the ubiquity of personal media devices ensures that today’s students are “carrying change in their pockets” (p. 213). Other authors have championed ICT as an essential instrument in altering the very way schooling is conducted. Moe and Chubb (2009), for instance, portrayed online instruction and personalized learning as means to “liberate” students from the debilitating, homogenizing constraints of the established school bureaucracy, in effect enabling educational revolution through individual choice. Similarly, Christensen et al. (2011) asserted that online learning is a “disruptive innovation” that empowers students and their parents to act as consumers pursuing fulfillment of individual learning needs, thereby breaking the long-standing educational monopoly of K–12 brick and mortar schools. We revisit the theories of Christensen et al. (2011) in establishing our conceptual framework that follows.

A more critical stance toward ICT in schools has also emerged in the past decade. In a frequently cited text, Cuban (2001) questioned the apparent gap between high technology purchasing expenditures in American schools and low student and teacher usage in actual classrooms. Other researchers expressed concerns that the push for ICT usage in education was mostly a scheme to enrich for-profit companies (Robertson, 2001; Spring, 2012). Selwyn (2013), meanwhile, critiqued the close association between for-profit neoliberalism and global-scale educational technology profiteering. At the same time, he underscored the important role that technology can play as a tool for supporting economic equalization. Interpreting the current state of educational technology in schools, Shirley (2011) contended that technology serves as a force compelling educators toward a greater focus on testing and accountability (the Third Way of education), rather than enabling them to pursue moral purposes and goals (the Fourth Way). He offered strategies that could help usher ICT in schools toward the Fourth Way.

Regarding digital media’s impact on youth culture, Buckingham (2008) and McPherson (2008) examined how children have utilized media in unexpected ways, fostering unlikely innovations and new forms of identity. In this sense, youth have seized on the otherwise unseen potential in technology in order to alter their development and modes of interpersonal engagement. As digital natives encounter contemporary schools, Palfrey and Gasser (2008) explained, society is considering “what to preserve about traditional education and what to replace with new, digitally mediated processes and tools” (p. 253). Selwyn (2011) established that a “digital disconnect” characterized the lives of tech-savvy students who attend brick and mortar schools. About online engagement, Harris (2011) reported how youth accessed information through ICT and delineated potential dangers they might encounter on the Internet. Mesch and Talmud (2010) portrayed the lives of students online and the social worlds

they created, while Costabile and Spears (2012) examined the interplay between students' digital virtual identities and their schooling lives. Everett (2008), meanwhile, provided insight into the relationship among race, ethnicity, and youth digital media culture. In sum, it is clear from the established literature that digital devices, pervasive Internet access, and emerging social media are having an important and still-evolving influence on adolescence worldwide.

In terms of empirical studies into ICT use in schools, researchers have described how access to technology encourages instructional adaptation by teachers (Coppola, 2004; Means, Penuel, & Padilla, 2001). In a study of 10 laptop-adopted schools, Warschauer (2006) demonstrated how computer ubiquity could spark greater student interest in learning. In contrast, other researchers have questioned why increased access to technology is having relatively little impact on classroom instruction (Cuban, Kirkpatrick, & Peck, 2001; Li, 2007). Sweet, Rasher, Abromitis, and Johnson's (2004) site-based study focused on low socioeconomic schools with high technology access that met high academic performance targets. Hohlfeld, Ritzhaupt, Barron, and Kemker (2008) used a theoretical model to describe a digital divide in Florida between low and high socioeconomic schools. Importantly, Hope (2005) and Garrison and Bromley (2004) examined how students often accessed school-based ICT in ways that subverted the established pedagogical intent of activities. Similarly, in a preliminary study based on interim data from one of the two schools, we described how students' increased access to new technology challenged school leaders in various ways (Peck, Mullen, Lashley, & Eldridge, 2011).

Our current study augments the established research literature in four ways. First, by analyzing how new media is impacting the lives of contemporary high school students in two American high schools, we offer qualitative, empirically grounded insight into the current status of technology in education. Second, by accessing and privileging youth voices, we provide readers an opportunity to understand how adolescents determine, assess, and reconcile the place of technology in their lives. Third, in our attention to how technology is helping foster a subset of new school-based types of students, we suggest how school-provided ICT as well as student personal media devices have apparently fostered change in ways unanticipated by reformers. Finally, by investigating schools with student populations that represent varied points on the socioeconomic spectrum, we can speculate how issues like poverty and technology intertwine.

METHODS

Providing detailed explanations and evidence of a qualitative study's methods can help establish its authenticity as well as enhance the ability of other researchers to replicate the study's research approaches. Based on the examples of rich methodology descriptions provided by Armstrong (2010) and Greene (2013), we provide descriptions and documentation here and in our appendices regarding our study design, setting, participant selection, data collection procedures, data analysis, and presentation of findings.

PROJECT TEAM AND STUDY DESIGN

This project constituted a nonexperimental, bounded qualitative case study (Yin, 2003) in which we investigated ICT use and effects in two comprehensive high schools located in a large metropolitan school district in the southeastern United States. Six individuals completed complementary functions in the study's research and writing. Three of the team members were active on-site researchers; two of the three active on-site researchers analyzed the data, including interview transcripts and notes, field notes, and completed observation protocols. Initial data analysis revealed the student and teacher instructional technology usage patterns that are reported first in the findings section below. Three other individuals joined the three active researchers in manuscript writing. During the manuscript development process, the three descriptive student typologies and issues attendant to technology's use as an academic lifeline emerged after iterative analysis and deep consideration of the data. The student typologies and academic lifeline data are reported second in the findings section. Our project was similar in nature to a technology study described in Yin (2003), but it was specifically constructed to follow Cuban and colleagues' (2001) qualitative approaches that included subject interviews and student shadowing.

SETTING

Our study district's size and diversity provided two advantages. First, the district offered an inviting combination of

locales, which allowed us to examine and compare a distinctly urban high school and a distinctly suburban one. Second, established district policy, in the form of carefully constructed school feeder patterns and ample busing access, ensured a minimum level of socioeconomic and racial diversity at each of the district's secondary schools, including the two we selected. Therefore, we were able to examine how students from different backgrounds encountered technology between and within particular schools.

Employing pseudonyms to help mask participant identity, we named our two site schools Newlands High School and Downtown High School. First, the recently opened Newlands High School offered a technology-rich environment. The school was built in an open, natural setting that had once served as farmland; large suburban homes filled recent housing developments that surrounded the school grounds. Though it was not a 1:1 laptop school, Newlands afforded its students and teachers easy access to computers through portable technology carts, ample technology-filled classrooms, and a large media center. Teachers routinely utilized devices such as computers, digital projectors, and presentation software to enhance their instruction as well as manage tasks such as attendance. The school also had an "acceptable use" policy that allowed students to use their personal media devices while walking in the hallways in between periods, eating lunch in the cafeteria, or hanging out in the media center before and after school. Students could also utilize their PMDs within classes at the discretion of individual teachers. Newlands served a predominantly White and affluent student body of approximately 800. Note that during our most intensive time of study at the school, it was still phasing in its full student population. Hence, only students in Grades 9–11 were present when we conducted the bulk of our on-site data collection. Student demographics were approximately 70% White, 25% African American, and less than 5% Hispanic or Asian/Pacific Islander. Fewer than 20% of students were eligible for free or reduced lunch, which indicates that a relatively low number of the school's children lived in poverty.

Our second site, Downtown High School, was originally built in the 1920s on an extensive campus. It included a main building with an ornate auditorium and a multistory, multifacility layout. The school was located near a large downtown area and served as the de facto demographic dividing line in the community. Modest single-family residences as well as public housing projects stood on one side of the school, and comfortable, spacious homes and expansive estates stood on the other side. The school served students from both sides of the community. Though also not a 1:1 laptop school, Downtown offered substantial ICT access that sometimes competed against the building's old infrastructure. Like at Newlands, students and teachers at Downtown generally had easy access to technology through mobile carts, computer classrooms, and a well-established media center. Teachers used computers, digital projectors, and presentation software in their lessons. Notably, some departments fared especially well in terms of technology access. Because of a grant established with a local university, for instance, mathematics teachers were able to incorporate top quality computer-interactive whiteboards into their instruction. They planned and executed ICT-infused lessons with input from university faculty.

Unlike Newlands, however, student use and possession of PMDs was specifically forbidden at Downtown. Accordingly, a large notice posted in the main office and throughout the building's first floor listed various prohibited items: "No cell phones, hats, do-rags, bandanas, scarves, CD players, head sets, iPods, or any other electronic devices allowed on campus. All items will be confiscated by [Downtown] administration." The notice's easy conflation of PMDs and distinctive teenager-friendly headwear provided a symbolic message: The technology and fashion choices of youth served as distractions from proper learning and therefore had no place in school. A 9–12 grade institution, Downtown served a racially and socioeconomically diverse population of approximately 1,300 students, with approximately 50% African American, 30% White, 15% Hispanic, and 5% Asian/Pacific Islander. More than half of the school's students were eligible for free or reduced lunch, which indicates that a significant number of the school's children lived in poverty.

PARTICIPANTS

To gain insight from key stakeholders directly, we interviewed 21 classroom teachers and support staff—10 at Downtown and 11 at Newlands. We ensured that the participating educators represented a variety of subjects and reflected the full staff's racial diversity. We solicited potential participants through an informational email sent to each school's entire faculty body and explained the study in more detail to interested candidates who attended a subsequent interest meeting held at each school. We added additional teacher and staff participants as the study progressed and individuals expressed an interest in joining. All teacher and staff interview participants joined the study voluntarily, and we provided them with human subject protections in accordance with institutional review board and district policies.

We also interviewed 20 student participants drawn from across each school's grade levels—12 students at Downtown and 8 at Newlands. We began the student selection process by asking teacher participants for

recommendations regarding students for whom technology held some particular importance. Through this snowball approach, we developed a pool of student participants who were generally representative of their school's diversity in terms of grade levels, demographics, and technology interests and skills. The research approach also included shadowing 10 students (5 from each school) through their entire school day. From the pool of interview participants, we chose students to shadow who effectively represented each school's demographics and grade levels, and who we thought might provide varied insight into the state of ICT in schools. All student participants joined the study voluntarily and, if under the age of 18, only with the permission of their parents. We provided them with human subject protections in accordance with institutional review board and district policies.

In addition to the individuals whom we interviewed formally, we benefitted from our student-shadowing approach that allowed us to witness interactions among numerous students and teachers as they engaged in everyday educational and social practices.

DATA COLLECTION

Because this study was an exploration into how new media technology was affecting high schools, we developed interview protocols for teachers and staff (Appendix A) and students (Appendix B) that asked them thought-provoking, open-ended questions as well as more specific factual questions about their in-school and out-of-school use of technology. Two pairs of teachers preferred to be interviewed together; otherwise, all the interviews were with individual teachers or staff. A total of 18 of the 19 teacher and staff interview sessions (which included two sessions in which 2 teachers interviewed together) were audiotaped; one teacher participant declined to be audiotaped but consented to the interviewer taking notes. All 20 of the student interviews were audiotaped and conducted with individual students.

Three on-site researchers conducted interviews. The study's primary on-site researcher and another on-site researcher interviewed teachers and staff. The two researchers conducted teacher/staff interviews together before doing so separately, which normed the interview protocol and process to maintain greater data-gathering consistency. The study's primary on-site researcher also directly conducted most of the Newlands student interviews and all the Downtown student interviews. A third on-site researcher conducted interviews with students at Newlands under the guidance of the study's primary on-site researcher, which again allowed for greater consistency in data collection procedures. Teacher/staff and student interviews lasted from 30 to 90 minutes. During ongoing visits to each of the schools, the on-site researchers routinely revisited participants to member check regarding accuracy of our data or to gather further information.

Data collection also encompassed observations (ranging in duration from several minutes to several hours) of prevailing technology practices in classrooms, hallways, media centers, and major community areas. In addition, the research protocol included the shadowing of 10 students (5 from each school) through their entire school day to witness typical teacher and student ICT and PMD practices. To ensure consistency of the data collected via this research approach, the primary member of the on-site research team completed all 10 of the student shadowings. In total, the three members of the project team tasked with site-based research completed over 100 hours of on-site observations. All observations were structured through a protocol (see Appendix D) that provided space for the researcher to sketch the setting being observed, identify the locations of student and teacher technology users, and record the number of times and types of ICT and PMDs accessed.

DATA ANALYSIS

We amassed considerable data related to the two schools, including interview audiotapes and notes, observation documents, and shadowing field notes. To aid with our analysis, we obtained a small amount of funding sufficient to have most (n = 32) of the 38 audiotaped interview sessions transcribed, which helped strengthen the foundation of our database. Our data analysis (Creswell, 2007; Glesne, 2006) involved two stages. In the first stage, we developed open thematic codes that we then narrowed to a distinct set of analytical codes representative of issues related to teacher and student technology use (Merriam, 2009). Two of the active on-site research team members, each of whom had conducted interviews, applied the codes to interview transcripts and available interview notes, as well as observation and shadowing field data. The pair coded data together before doing so individually in order to achieve a norming effect. We provide examples of three coded interview transcripts and a sample observation protocol in Appendices C and D, respectively. The study's aggregate coded data constituted the basis of our findings regarding the prevalence and effect of instructional technology in the two high schools, which we report first in the findings section.

During manuscript development, we revisited the aggregate coded data in an attempt to make deeper sense of how students used technology and how it affected their educational and personal lives. As utilized in previous research regarding educational technology (Enyon & Malmberg, 2011; Mama & Hennessy, 2013; Vanderlinde, Dexter, & van Braak, 2012), typologies offer a compelling way of organizing data into illustrative, informative findings. Therefore, we produced a typology of student technology use through an iterative process of brainstorming labels that might apply to emergent trends we noted in the data. After deliberation, we conceived three succinct categories that represented prominent types of students who surfaced in our study: *Digital Rebels, Cyber Wanderers,* and *eLearning Pioneers*. During the development of our typology, we also noted the effects of ICT as experienced by students who were at academic risk. This subject defied easy categorization or neat labeling. Accordingly, we augmented our consideration of three emergent student types with a focus on findings related to technology as a lifeline for students who struggle academically. We consider this topic as well as the typology of student technology use in the second part of our findings section.

REPRESENTING DATA IN THE FINDINGS SECTION

In presenting our findings, we made the conscious decision to capture prevailing trends in the form of representative examples and vignettes. In this sense, we borrow from the qualitative research technique of portraiture, as exemplified in works such as Lightfoot (1983). Data-based portraiture allows the researcher to distill his or her findings in order to profile education activity in a powerful, almost visual way. Given that we were conducting an exploratory study intended to provide insight into current trends in school-based technology, we decided that data-based examples and vignettes presented the best potential to create a rich portrait of technology use at the two schools.

CONCEPTUAL FRAMEWORK

Our conceptual framework manifests as a tension-filled combination of two competing theories: that technology represents an imperfect, costly school reform effort and that technology represents a still-emergent, transformative educational innovation. Toward the former, Tyack and Cuban (1995) and, later, Cuban (2001) portrayed educational technology as an example of a school reform long on promise but limited in terms of actual results. Cuban's (2001) title —*Computers in the Classroom: Oversold and Underused*—captures the thrust of this sentiment. Conversely, Christensen et al. (2011) framed technology generally, and online learning specifically, as a powerful force of innovation that will disrupt and, eventually, transform education for the better. Their title —*Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*—demonstrates their faith in the potential for positive change through technology. In our analysis section, we apply these theories as twin lenses to help us understand the meaning of our findings. We argue that today, technology operates in unexpected and sometimes unwelcome ways that are often beyond the control of educators. In our two case study schools, teachers and students alike seemed consumed and regularly overwhelmed by certain devices (such as PMDs) at the same time that instructional technology had limited effects in terms of changing teacher instructional practices or existing educational norms. We assert, then, that technology serves simultaneously as an intentional school reform that is generating, at best, incremental change and as an uninvited innovation so widespread and so disruptive that students are using it in ways that challenge and upset traditional educational norms.

FINDINGS

TEACHER AND STUDENT PRACTICES WITH INSTRUCTIONAL TECHNOLOGY

A decade ago, Cuban (2001) described a situation in which high access to technology throughout all levels of education had not led to widespread adoption or usage by teachers. Our study of two contemporary high schools supported the notion that, over the intervening decade, ICT had become a more essential part of teachers' instructional and professional practices. Though individually they reported favoring different types of ICT, our entire faculty and staff participant pool confirmed using some type or types of technology regularly in their professional lives. Emailing was now a basic job expectation, and teachers often used the Internet to exchange assignments with students. Teacher technology usage for professional purposes spanned a spectrum. A long-time, experienced English teacher at Newlands, for example, described himself as a reluctant technology adopter with an "old school," basic cell phone. Regarding his reluctance to use the Internet for buying products, he was once told by a friend, "You really need to get with the 21st century." Nonetheless, he allowed his students to listen to their headphones when they completed assignments. He also explained, "When it comes to communicating

with parents, I love email because I can do it at my time. I can say exactly what I want to say. I don't get pulled in any side conversations." Meanwhile, a first-year Newlands social studies teacher, not much older than his students, stated, "I do lesson plans using the Internet and things like that while I'm watching TV . . . I tell my kids that I'm part of the ADD generation. I can't focus just on the work or just on TV."

In addition to ICT's impact on teachers' completion of professional obligations, our shadowing and interview data indicated that electronic presentations and web searches had become typical student assignments across subject areas. Teachers also infused technology into their lessons with some regularity. At Newlands High School: In an English class, students worked in groups editing videos for a course project, and in world history, students presented multimedia projects on the topic of founding myths. At Downtown High School: In a business marketing class, students presented multimedia projects titled "My Life in Ten Years"; in AP statistics, students displayed self-created, eccentric, feature-infused review videos regarding topics like chi square; and in International Baccalaureate (IB) biology, the instructor presented a PowerPoint (retrieved from slideshare.com) that a teacher at an Indonesian international school had produced. In these and the other instances of technology integration we encountered during our visits, ICT had made a noticeable impact in the two schools we studied.

An important note, though, is that classroom ICT also appeared to either sustain traditional, teacher-centered practices or simply went unused. In a first-period IB English class we visited during a student shadowing, for instance, the electronic document reader sat unopened in a bag on top of the file cabinet. The desktop computer, connected to a projector, displayed a single presentation slide with the day's three-item agenda. However, the presentation slide remained visible and unchanged during the entire period. The teacher's laptop was used only to check attendance. Though unused on this particular visit, an overhead projector sat in the room as well. For the lesson, students engaged in an extended discussion regarding a work of literature after the teacher announced that they should take notes, which students did with paper and pencils or pens. In an AP U.S. history course session, the teacher evinced a technology focus when she encouraged students to submit their essays to an online plagiarism-screening program, played a video clip on the classroom's DVD-VCR-TV, and asked if they received an email reminder she had sent. At the same time, she exhibited traditional practices when she spent a portion of the lesson lecturing about Civil War economics and U.S. president Abraham Lincoln's assassination, and wrote notes in erasable pen on the whiteboard. She was also, according to the student participant, a vigilant confiscator of student PMDs.

We found these two classes to be typical in that ICT had altered school, teacher, and student practices in some ways, but traditional teacher-centered practices were still prevalent. Also of interest was that entrenched educational practices, such as students using pens or pencils to complete photocopied worksheets or weekly examinations independently, were a consistent norm rather than an occasional aberration. The visions of some technology reform advocates, in which increased computer access would enable student-centered, collaborative learning through authentic projects, had not yet arrived at scale.

TECHNOLOGY AND STUDENTS: EMERGING TYPOLOGY AND ICT AS ACADEMIC LIFELINE

New ICT developments that did have a profound effect on the two high schools, however, were PMD ubiquity and online social media site influence. At Newlands and Downtown, students, teachers, and school administrators alike navigated a new educational world in which virtually every educational stakeholder could be connected electronically at a moment's notice. Ironically, then, it was not the infusion of classroom ICT that made these otherwise traditional high schools into essentially digital domains, but rather the devices that students brought with them in their hands, book bags, and ears. In this sense, Newlands and Downtown appeared to fulfill Chen's (2010) dictum that students came "carrying change in their pockets" (p. 213).

We discovered that, as the old ways of schooling such as bell schedules, paper tests, and seats in rows intersected with tech-savvy, PMD-equipped teenagers, a "digital disconnect" (Selwyn, 2011) surfaced between digital youth and their brick and mortar schools. This situation produced a setting fertile for cultural incubation similar to the creative tensions present in an examination of technology in two American high schools a decade past (Peck, Cuban, & Kirkpatrick, 2002). In that case, nascent ICT integration in schools helped foster the development of two types of students: "Open Door" students who improved academically and gained social acceptance through technology, and "Tech Gods" who played a crucial role in helping technology coordinators maintain the schools' technology infrastructures. Roughly 10 years later, during our study at Newlands and Downtown, we recognized three new types of students emerging in addition to the Open Door students and Tech Gods profiled a decade earlier. Two of these new classifications, Digital Rebels and Cyber Wanderers, included students from across the socioeconomic status spectrum. The other group was more homogeneous: eLearning Pioneers were primarily White, high-achieving students at Newlands High School. In addition, we noted how

computer-based remedial programs at both schools served as problematic academic lifelines for students at risk of dropping out. We next briefly profile these students.

Digital Rebels

Research has demonstrated how technology has equipped students with the means for contesting school norms, structures, and authority (Garrison & Bromley, 2004; Hope, 2005). We encountered students who utilized their PMDs as means to rebel, overtly or surreptitiously, against school and teacher rules. Skilled students sent text messages routinely during lessons. Without the teacher's (or at times, the observer's) knowledge, these students used their clothing and objects for cover; some typed responses in their pockets without looking at their device. A few students pushed the bounds further by setting up proxies on school computers to bypass school district filters and access popular social media sites. In addition, students who possessed mobile phone data plans (or shared those of their parents) could use their PMDs to access any online social media they wished, given that the school district's Internet filters could not block such activity on proprietary wireless networks.

A White male 10th grader at Newlands High School proved particularly adept at evading classroom rules against PMD usage. He explained that he was able to type text messages without looking, so he only had to read incoming messages. He stated, "I'm normally a two-hander with my phone, but if I was just sitting here like this I could send a message just fine [in my pocket]." He later revealed that he did in fact send a text message during his interview, unbeknownst to the researcher. He also explained that he possessed skills that would have enabled him to help fix instructors' ICT issues, much like the Tech Gods profiled in a study a decade ago (Peck et al., 2002). But he also revealed that he was reluctant to share such knowledge: "I don't speak up about it. . . . Not big on fixing things like that." When asked to explain his reluctance to provide technology aid to his teachers, he remarked, "Don't want to help the teachers—it's time off class . . . 'cause they're going to have to call someone to fix it." This Digital Rebel, in essence, seemed to express a willingness to undermine a lesson through silent inaction.

At Downtown High, an 11th-grade African American female student described when and how she text-messaged during a lesson: "Well if I'm in class and I get a text, usually I wait until the class is working on some kind of work, but it's mostly after the teacher explains it." She estimated sending about 100 text messages on a typical day, with far fewer during the actual school hours. In fact, she described concerns with having PMDs in schools. In her own words,

There's cheating. They give the answers during text messages. Or if someone's planning to have a fight, they'll just do it through the phones. They'll text and meet up there and everyone will know where to go. And that kind of blocks the way of it being broken up [by adult supervisors], which is kind of dangerous.

In this sense, seemingly innocent acts of rebellion could actually transform into significant acts of danger.

Teachers possessed limited means to fight back against the apparent digital insurrection. As we shadowed students throughout their school days, teachers confiscated student PMDs that had been used in ways that disrupted instruction. Yet, most often the teachers simply returned the devices to the students at the end of the period, seemingly satisfied to have induced a brief respite in their ongoing digital communications. Other teachers ignored student PMD use or adopted an "out of sight, out of mind" approach of benign neglect. Still other educators did go to great lengths to disrupt student technology use. In one case at Downtown High School, a coach made all her players turn in their phones to her at the beginning of school as a tactic for preventing PMD-inspired confrontations during the day; a student participant revealed that a friend of hers circumvented this deterrent by carrying multiple mobile phones: one to turn in to the coach, and the others to keep and use. In another case at Downtown High School, two teachers used personal funds to purchase cell phone blockers in the hopes of eliminating student PMD usage during class time. Administrators subsequently sent all teachers a memorandum forbidding this solution. The principal explained that the blockers interfered with the administrators' cell phones, which constituted a safety issue. The principal added that any teacher using the cell phone blockers would be held personally liable in the event that aid was delayed to a sick or injured school constituent.

An administrator at Newlands discussed how the possible release valve provided by a student-appropriate PMD use policy did not always lead to student acceptance of usage rules. She explained,

One student told me, "You know, this is a new world and this is a new age." And I had to [confiscate his cell

phone] because he refused to give it up in gym. And he just said, “It’s a new world, a new age.”And I explained the policy and I said I realized that. And he said, “You check yours all the time, too.”. . . It is a new world and we have to start to identify and look at all that we are trying to impose on students. Is it old values? It’s not the same.

Such technology-fueled conundrums carried over to her relations with her own teenage son. She described some of the virtues of PMDs: “I know that any time I want him, I know I can get him.” She still struggled like many parents with what she called the “trust issue,” stating that she needs to know who he is texting, or, as she stated it, “making sure that when you text—who you’re texting, what are you texting, making sure I know all that.”

A White male 11th grader at Downtown High School perhaps best summed up the dilemmas regarding PMD use and access that educators face today. He stated,

You’re never going to stop it, there’s no way you can. I mean, [there are] people that know computers. They know technology, it’s like they could do it all on the back of their hand, sleeping. I mean, they know their ways around technology. I mean you just give a guy a new technology and let him play with it a couple of days and he’ll figure it out like nothing.

Such is the context for modern digital rebellion.

Cyber Wanderers

During our research, we also met students for whom, much like the Open Door students profiled in a previous study (Peck et al., 2002), technology proved essential. One such student from Newlands explained,

Main reason I love this school is because: Wi-Fi throughout the whole school, which is great. You can go on the web like during lunch or whatever. I’ll be in the library during lunch and I’ll open up my laptop and whatever, browse the web and everything. Sometimes, most of the time when I’m in math or English I’ll write my notes and write my essays on my laptop.

By this student’s own testimony and of his teachers, technology enabled his academic success and social adjustment. Some students in our study, however, became so immersed in or overwhelmed by new media technology that they meandered between the real and virtual worlds. To such students, whom we dubbed Cyber Wanderers, the lure of technology presented a possible danger: They could succumb to ICT as a powerful distraction rather than seize it as a powerful tool, or use ICT to engage in an environment that offered the potential for anonymous hostility. At Newlands, for example, we met an African American 10th-grade male student who was an avid online gamer, explaining that sometimes “people will wind up cursing when I do something wrong or mess up.” Conversely, he admitted using the screen name “heartless jerk” in an online gaming forum and “made one member quit” because of his harsh comments.

We also encountered a White male 10th-grade student at Downtown High School who checked his phone during our interview to discover, to his surprise, that he had sent 18,287 text messages the previous month alone. He described his text messaging as almost instinctual:

Well I start sending text messages usually ‘cause I haven’t talked to somebody in a while and [there are] some certain people you know that I maintain a constant texting conversation with. You know and I’ll just text them sometimes to ask them something in particular and sometimes just to start up a conversation, so it’s just kind of I realize that I’m you know, starting a conversation but I don’t really think about it, if that makes sense . . . I just kind of do it.

He also seemed cognizant that his text messaging had serious consequences: “My texting has probably gotten in the way of some learning . . . In Algebra 2 . . . if you don’t get it at the beginning it kind of puts you in a hole. . . . So I’ve kind of had to play catch up here.” Adding to his issues, he explained, “[I] definitely play a lot of video games while texting . . . in a way that kind of runs into a problem sometimes.” Cyber Wanderers such as these could find themselves thoroughly lost in electronic worlds while being inattentive to the formal curriculum.

eLearning Pioneers

*I*n the media center of the predominantly White and affluent Newlands High School, a small group of female students spent a fair portion of their days immersed in online learning. Loosely monitored by the school's media coordinators, youth whom we called eLearning Pioneers sat at computers and studied advanced Chinese or AP computer science while most other students throughout the school attended traditional classes. During one typical period during a school day, each of three students sat individually at one of the 30 desktop computers arranged around the media center; two of the students were engaged in online learning activities. The online courses could be noticeably self-paced. A staff member who participated in our research reported that one of our study's students took a virtual 8-month-long biology course; the student expended little effort for 6 months before completing all assignments successfully over the final 2 months of the allotted course time.

The eLearning Pioneers at Newlands included another of our study participants, a White 10th-grader who took two AP classes and a math class online in the school media center and attended two regular classes before going home. For her online courses, message boards and email provided the central means for teacher–student and student–student interaction. She noted,

in online classes . . . generally speaking, you pace yourself. Especially with my English class . . . she gives you the assignments and she gives you a syllabus for where you should be. But you turn them in at your own pace and you take tests when you can . . . you have a tab that you can click on and go to your "My Grades." It has the assignment, and what grade you got, and out of what and all the assignments you're going to need to complete for the rest of the year . . . it's easier to keep up with things. You know, like, I'm supposed to post to the discussion board today. You go and do that.

Our shadowing of our participant during a typical day neatly captured the hybrid nature of her educational experience. In AP environmental science, she sat with 18 classmates and completed a written unit examination; once finished with the test, the class watched a nature DVD played with the teacher's laptop computer and broadcast by digital projector. Our participant returned to the media center to complete an assignment for her AP computer science course, which was offered through the state's virtual public school program. She returned to a classroom with 20 students to engage in a lesson for Latin II, during which the teacher led students through a line-by-line translation of a text excerpt. Our research subject then departed from campus, with designs on completing an assignment for her AP English course offered through another state's virtual education program. Her AP English instructor, whom our student had met only virtually but described as "amazing," posted pictures of her own children, wanting to connect more personally with her students. Our subject reported, "I'll do an assignment and I'll turn it in, like an essay or something, and then she'll send me feedback and say, 'This was good but your introduction's a little weak.' Or 'You need to do this.'" We wondered whether our participant—an independent, self-motivated eLearning Pioneer—offered a glimpse into the American high school future (Christensen et al., 2011; Moe & Chubb, 2009), at least for some students.

Technology as an Academic Lifeline

For struggling students at both schools, technology served as an academic lifeline in the form of computer-based credit/course recovery programs. For *credit* recovery, students needed to prove content mastery and pass a state-created end-of-course examination; for *course* recovery, students needed to complete the same steps as for credit recovery, but they also had to document achieving sufficient "seat time" given that they had previously failed to meet minimum class attendance requirements. Some students were scheduled to visit a dedicated technology lab in each of the schools during their academic day for the purpose of using the credit/course recovery programs. Other students attended after school. Sitting in front of screens that mixed video and textual content related to a particular course, the students sought to complete the modules, pass the related unit tests, and, for those seeking course recovery, accumulate, as measured via a timer linked to a personalized account, sufficient seat time to meet state requirements over the course of the semester. At Downtown, the dedicated course credit-recovery classroom was established as a ring of 23 individual desktop computers. At Newlands, a lab within the main building was used for course recovery only during the school day, with programmed class sizes ranging from a few students to 20. These scheduled courses were considered a "last chance" to obtain necessary credits toward graduation. After school, a lab at the back of the media center served students who were either completing academic interventions prescribed by teachers or engaging in credit-recovery sessions.

The supervising instructor at Downtown noted the computer-based program's benefits, stating that it is "not boring" and "hands on" and that it provides "individual attention." She explained that in over 15 years of working to help increase the graduation rates of at-risk students, the process of support, now enhanced by technology, had improved noticeably over time. The drawbacks, she explained, were that success depended on student

motivation (“how much does the kid want it?”) and attendance (“you’ve got to get them here”)—two of the perpetual stumbling blocks in the effort to improve education for children from poverty (Jensen, 2009). In addition, some Downtown teachers participating in our study expressed skepticism that students gained much from the remedial program; instead, two instructors asserted that students subverted the system by tapping keyboard keys to boost their registered seat time; students also intentionally failed unit quizzes to be given correct answers for subsequent quiz administrations. The teachers contended that poor student motivation remained a fundamental problem despite the use of the high-interest computer programs.

At Newlands, an after-school visit to the credit recovery lab revealed 16 students present, and all except 2 appeared to be students of color. It was reported that on some days, attendance could rise as high as 25. During the observation, a student completed a tutorial and printed the celebration page as evidence he had finished the work. Others appeared highly engaged, with headphones on and eyes fixed on the computer screen. Some students, however, encountered difficulties: One asked several people (including the observer) how to complete a geometric proof; another explained that he had taken and failed a test five times. Adding time pressure to the situation, the 35-minute sessions were offered on Mondays and Wednesdays because the district only paid for after-school buses 2 days a week. Most of the students enrolled in credit recovery relied on buses as a primary or sole means of transportation from their homes to the suburb-situated school. The district did not allow students remote access to the course/credit-recovery programs, so they needed to complete as much as they could during school hours.

Whereas e-Learning Pioneers utilized technology to discover new opportunities to excel and soar academically, struggling students at Newlands and Downtown engaged in “last chance” tech use. This approach served as a problematic means toward ensuring students’ educational survival. Various factors appeared to limit the course/credit-recovery programs’ potential to help large numbers of students overcome opportunity gaps resulting from poverty (Darling-Hammond, 2010).

DISCUSSION

To analyze our findings, we invoke our conceptual framework. First, we revisit Tyack and Cuban (1995), who offered technology as an example of an imperfect school reform that, like many others, conformed to three central themes. First, the authors explained that multiple factors can complicate or alter reforms as they are implemented. For a variety of reasons, the presence of ICT at Downtown and Newlands High Schools produced only partial instructional change. In many instances, we saw rooms that functioned as museums of technological artifacts, some in use as intended, some modified for different uses, and some essentially warehoused and unused. In addition, those devices and programs used most routinely for instruction—computers, PowerPoint slide shows, and digital projectors—maintained rather than upended traditional, teacher-centered approaches to education. Much as previous studies have demonstrated, teachers, in essence, typically adopted those technologies that suited or were adaptable to their existing instructional preferences and needs (Cuban et al., 2001). Finally, infrastructure challenges affected how technology was used during the school day. For instance, the lack of 1:1 student to laptop access—still the predominant norm in U.S. high schools—certainly limited the degree to which teachers could infuse technology into their instruction (Warschauer, 2006). In these ways, divergent factors affected how ICT was implemented as an instructional tool.

Second, Tyack and Cuban (1995) asserted that reforms produce unintended consequences. School technology integration, as conceived by many reformers, is intended to proceed along a course in which technology is delivered to schools, and then teachers, after basic training, encourage students to utilize computers and other machines in ways that revolutionize their learning. Although we saw some cases of transformational instructional technology use at Downtown and Newlands, just as often, we watched students and teachers engage in familiar routines, such as note-taking and worksheet completion, that employed no electronic technology at all. In fact, the lack of widespread teacher instructional usage of ICT, despite significant access, may well have had the unintended consequence of compelling more student usage of PMDs, which were by far the predominant forms of technology actually used during the school days. Ironically, then, it was students, as characterized through the typology we have presented, who served as proactive ICT change agents. Most educators, conversely, were essentially reactive, adapting as unpredicted outcomes drove unexpected alterations.

Finally, Tyack and Cuban (1995) explained that reforms that are conceived and executed in a top-down manner by system outsiders and that do not include school constituents in planning and design have difficulty gaining traction and persisting. In one particular case we discovered at Downtown, technology infusion worked more like a bottom-up rather than top-down reform: the digitally enhanced whiteboards provided through a university-school grant-funded partnership in the mathematics department. The instructors, who were technology enthusiasts,

worked with university faculty to design and deliver ICT-based lessons. However, this was an atypical case. More typically, it was as though policy makers had approached teachers with a piece of equipment and said, “Here is something that you did not ask for but we know you really need.” The result of such transactions was predictable: The technology went unused or was adapted in ways that simply sustained existing practices. Without the direct involvement of teachers in ICT reform planning, before implementation occurs, it seems unlikely that the reform movement will ever achieve more than partial effects in terms of changing instruction. Moreover, students, many of whom represent a technology-using vanguard, were not involved in the reform development process, limiting their potentially useful contributions to helping design effective, lasting transformations.

Although instructional technology in the two schools appeared to exhibit the types of characteristics that often undermine school reform efforts (Tyack & Cuban, 1995), personal technology simultaneously made significant inroads into changing norms at the two schools. Christensen et al. (2011), who provided our second interpretive lens to understand our findings, framed schools as tradition-bound, change-resistant anachronisms. Such a setting is inviting, they asserted, for “disruption,” which they wrote is “a positive force” and “the process by which an innovation transforms a market whose services or products are complicated and expensive into one where simplicity, convenience, accessibility, and affordability characterize the industry” (p. 11). They positioned online learning as the innovation that will provide the means to enable such a revolution in schools because it is “student-centric” and therefore can prioritize and satisfy the learning needs of individual students (Christensen et al., 2011, p. 92). This inherent customizability, they contended, will ensure an increase in students’ intrinsic motivation and allow schools to maximize the academic potential of all youth.

Importantly, Christensen et al. (2011) explained that, much like how innovations transformed other industries, the disruptive effect of technology in education would occur in an area of “non-consumption” where little competition currently exists to resist it. Therefore, they suggested that online learning opportunities in AP classes, for homebound and home-schooled students, and as means to address student academic deficiencies, for instance, would proliferate exponentially to meet a quickly increasing demand for more technology-enabled personalized learning. In turn, schools would become places suited to such individual learning rather than traditional teacher-led mass instruction. In line with these ideas, Christensen et al. (2011) made bold predictions such as, “Given the current trajectory of substitution, about 80 percent of courses taken in 2024 will have been taught online in a student-centric way” (p. 102), and “One day, schools will find themselves using most of their resources to do the noninstructional [sic] jobs that *cannot* be done online and find themselves teaching fewer and fewer courses through traditional monolithic instruction” (p. 104).

In some ways, our findings from the two high schools support the idea that a nascent transformation in student learning may be simmering. Our small group of eLearning pioneers at Newlands High School, for example, accessed educational content unimaginable without the innovative power of online learning technologies. In addition, both schools sought remediation of students at academic risk through the use of technology-based programs. Curiously, though, the online coursework of the eLearning Pioneers included activities that seemed designed to replicate rather than dislocate traditional teacher classroom practices. In addition, an instructor in the Downtown High School computer-based credit/course recovery program reported that motivation remained a central impediment to enrolled youths’ success, despite the program’s various audio-visual features and student-centric technology that adapted learning to individual needs. In these ways, the intended online learning revolution appeared thus far limited in scope and conflicted in practice, though also possibly just in its infancy.

Other elements of our typology suggest that technology has indeed affected education greatly, though in unintended and uninvited ways. Digital Rebels, for example, used their PMDs contrary to adult educator wishes and in ways that could interrupt learning or generate potential danger. Moreover, Cyber Wanderers found themselves meandering between the real world and the virtual, sometimes undermining rather than enhancing their academic potential. Such a situation generates significant questions. Is contemporary technology, as represented in the form of potent, concealable handheld personal media devices, simply an uncontrolled and possibly uncontrollable phenomenon? Will PMDs, rather than online learning, inevitably compel teachers to adapt and implement new practices (including incorporating student PMDs into lessons), lest they risk losing certain segments of their students permanently? Should we consider student-owned PMDs, rather than district-owned ICT, the real disruptive innovation in education?

In the end, our two conceptual framework lenses illuminated our findings as essentially a conundrum: Technology in the two high schools was another apparent case of imperfect instructional reform, yet technology in the two high schools was also a successful though uninvited disruptive innovation. We do not seek to reconcile these apparent interpretive disparities, but rather accept them as accurately representative of the complicated portrait of stability and change in K–12 schools. After all, schools are places where tradition has routinely confronted innovation, as

today teacher-led instruction confronts student-held PMDs and as a student's attention to a printed worksheet confronts the same student's attention to his iPhone message. Technology in schools, then, both competes and coexists with existing educational norms at the same time that it disturbs and reinforces traditional instructional practices.

CONCLUSION

Our study asked: How has the contemporary age of digital immersion, in which adults and adolescents alike routinely access powerful technological devices and establish extensive electronically enabled relationships and interactions, affected the high school experience? To address this question, we used various qualitative research approaches to examine relevant conditions at two southeastern U.S. high schools, Downtown and Newlands. On one level, the infusion of technology had produced only limited instructional reform. On another level, personal media devices and school-based ICT had helped foster the growth of new types of technology-influenced students. In essence, these two traditional brick and mortar high schools encountered only fitful progress toward a technology-fueled revolution in instruction at the same time that they faced a fierce youth digital media culture that seemed intent on pushing against and even upending long-established educational mores.

We conclude by highlighting several implications of our findings. First, educators would do well to understand the relationship between technology and high school-attending adolescents as multifaceted and complex. Although popular terms such as *digital natives* suggest a monolithic body of youth with common electronic, media-based interests and abilities, in actuality teenagers approach, utilize, and appreciate technology in unique ways. Some students show an affinity for text messaging, whereas others shun the practice. Some youth are enamored of social media websites; others avoid such sites. The three student classifications we developed in this study—Digital Rebels, Cyber Wanderers, and eLearning Pioneers—suggest that students encounter, interpret, and engage with technology in different ways. A message we want to communicate is that rather than preparing schools for the arrival of one style of digitally immersed youth, educators and reformers need to prepare schools for the arrival of many kinds across a spectrum that reaches beyond our typology.

Another implication of our study is that educators should begin to investigate how and why traditional practices such as worksheets, basic quizzes, and tests continue to hold such sway in high schools. On numerous occasions, the researchers were struck by how much the classroom experiences of the participants were consistent with their own high school experiences from previous decades. In many classes, long-familiar routines of a teacher lecturing, a teacher calling out questions and students responding, a small student group completing teacher-assigned work, or students taking individual examinations were disrupted only by occasional bouts of off-task behavior, including student PMD use. Notably, however, even the virtual classrooms and computer-based remedial programs where ICT had made the most dramatic inroads into actual usage appeared to replicate, not challenge, dominant teacher-centered instructional practices. It seems fair to wonder, then, whether technology can be a tool to help transform classroom practices toward student-centered learning or simply be adapted to serve the long-reigning paradigm of teacher-focused pedagogy and curricular control.

In addition, our findings challenge the notion that technology offers a simple "silver bullet" remedy that can effectively ameliorate student academic problems. Various factors, for instance, limited the power of ICT as an academic lifeline for struggling students. Technology also appeared to betray rather than boost one of our Cyber Wanderers in particular. As companies continue to tout claims that electronic devices and online programs offer the key to dramatic academic improvement, it is important that educators follow the essential consumer dictum *caveat emptor* before they commit fully to massive technology purchases. To begin to seize the potential of ICT, educational leaders must provide teachers with proper training in effective instructional practices as well as prepare thoughtful school-based plans for helping students overcome obstacles they may face because of poverty and other factors attendant to their family backgrounds. In sum, educators would do well to recognize that technology can be part of a complex, multifaceted solution for student academic improvement and success; however, it is not the entire solution itself.

In terms of our study's implications for researchers, we offer two. First, though relatively uncommon in educational technology research (Schrum et al., 2005), the kind of intensive site-based inquiry we conducted here can provide valuable "real world" insight into the dynamic intersection of technology, education, and change. Returning regularly to our sites to interview and observe participants as well as to shadow students through their entire school days provided us with sustained opportunities to witness educational stakeholders' typical ICT practices and authentic PMD interactions. We encourage future researchers to consider the idea that extended site-based research, though time consuming, can produce fine-grained, informative details that will help enhance and augment the broader understandings of school technology usage currently gained through survey-centric studies

and other more global research approaches. Second, we hope our typology of student technology use as well as findings regarding ICT as an academic lifeline will prove a useful starting point for future researchers interested in examining the nexus of students, technology, and schools. We imagine that the variety of students affected by technology in new, unanticipated ways will only grow.

In any case, it seems safe to predict that the technological context in which high schools operate will continue to evolve as time progresses. Illustratively, roughly a decade ago, Peck et al. (2002) contended that, despite ample access to school-based ICT, only 5% of students were greatly affected by technology at two San Francisco Bay Area high schools. Most students from their study led educational lives marked by a clear dichotomy: technology-free school days followed by frequent computer and Internet use at home. Today, however, remarkable advances in personal media device power and access have emerged and matured with full force. Hence, no matter whether particular teachers at Downtown and Newlands incorporated or shunned ICT in their classroom instruction, the vast majority of students at the two high schools did indeed encounter technology, given that their use of PMDs was so prevalent and pervasive. If the recent rapid progression toward personal media device ubiquity is any indication, in the years to come, additional, unexpected new technologies may arrive to challenge the educational status quo in ways that, in our current moment, are difficult to imagine.

As a means of closing, one of our teacher participants at Newlands described the challenges she and other educators faced because of student possession of PMDs:

I took a cell phone today when it was out and it didn't need to be out. I'm almost to the point now where I'd rather have them on their desk in front of them so I know what they're doing. If it's sitting on their desk, I know they're not texting. I'm almost to that point of it. But I think it's just something we have to learn to live with. You know, it's kind of a give and take. We're still trying to figure it out.

Her comments reveal an essential, perplexing dilemma that contemporary educators face regarding technology: On the one hand, they are expected to infuse ICT into their instruction; on the other hand, they are tasked with ensuring that students use their PMDs appropriately or, more likely, not at all. Such evident tensions suggest how educators, students, researchers, reformers, and the broader public are indeed "still trying to figure it out" these days, as digital youth encounter brick and mortar schools.

Notes

1. Pseudonyms have been used throughout the manuscript for the district, school, and students we studied.

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APPENDIX A

Teacher Interview Questions

I. Personal Technology Use Information

1. What is your personal comfort level with new media technology (*very comfortable, comfortable, neither comfortable nor uncomfortable, uncomfortable, very uncomfortable*)? Please explain further.

2. When did you begin using media technology like cell phones and the Internet? What were some of your first experiences using media technology?

3. Have you had any positive experiences using media technology in your personal life? If so, what were they?

4. Have you had any negative experiences using media technology in your personal life? If so, what were they?

5. What are some of the media technology that you use today? Do you use this media technology at home or elsewhere?

6. What are some of the web sites that you use? What are your favorite ones and why?

7. I am going to mention some media technology in use today. Please let me know if in the **last week** you have you used or accessed the following, whether at school or somewhere else:

a. Cellular phone

b. Digital camera

c. Mobile Internet device

d. "I-Pod" or MP3 player

e. Video sites like "You Tube"

f. Networking sites like "Facebook" or "MySpace"

g. "Google" or other search engines

h. Email

i. Text message

II. New Media Technology in Your School

1. a. How often, if at all, do you personally use computer technology in your classroom instruction (*very often, often, sometimes, rarely, never*)? Are there other types of technology you personally use during classroom instruction? Please elaborate.

b. How often, if at all, do your students use computer technology during your classroom instruction (*very often, often, sometimes, rarely, never*)? Are there other types of technology your students use during classroom instruction? Please elaborate.

2. In general, how often do teachers in your school integrate computer technology into classroom instruction (*very often, often, sometimes, rarely, never*)? Please elaborate.

3. Do you bring any of your personal new media technology to school? If so, what media? When do you use it if you use it on the school campus?

4. In general, how many students in your school use new media technology during the school day: *all, most, some, few, or none*? Please explain.

5. Are there any ways that student use of new media technology during the school day is having a positive effect in your school? If so, how? (*If applicable: What are your thoughts on the school's appropriate use policy?)*

6. Are there any ways that student use of new media technology during the school day is having a negative effect in your school? If so, how?

7. If there is a problem with technology, whom do you go to?

8. What suggestions do you have for ways that your school community might effectively address increased student use of new media technology during the school day? Thoughts on 1:1 computing?

III. Concluding Questions

1. Do you have anything else you would like to add?

2. Do you have any questions for me about this interview or the research study?

APPENDIX B

Student Interview Questions

I. Personal Technology Use Information

1. At what age did you begin using media technology? What were some of your first experiences using media technology?

2. Have you had any positive experiences using media technology in your personal life? If so, what were they?

3. Have you had any negative experiences using media technology? If so, what were they?

4. What are some of the media technology that you use today? Do you use this media technology at home or elsewhere? Is this media technology considered yours or your parent or guardians'?

5. What are some of the web sites that you use? What are your favorite ones and why?

6. I am going to mention some media technology in use today. Please let me know if in the **last week** you have you used or accessed the following, whether at school or elsewhere:

a. Cellular phone

b. Digital camera

c. Mobile Internet device

d. "I-Pod" or MP3 Player

e. Video sites like "You Tube"

f. Networking sites like "Facebook" or "MySpace"

g. "Google" or other search engines

h. Email

i. Text message

II. New Media Technology in Your School

1. You were identified by staff at your school as an enthusiastic user of new media technology. Does that description apply to you? Why or why not?

2. In general, how often do teachers in your school integrate computer technology into classroom instruction (very often, often, sometimes, rarely, never)? Please elaborate.

3. Are there any classes that you have that you feel the teacher does a really good job integrating technology into the lessons? If yes, please describe.

4. Do you bring any of your personal new media technology to school? If so, what media?

5. Do you ever use or access personal media technology at school? Why, when, and how?

6. In general, how many students in your school use personal new media technology during school: *all, most, some, few, or none*? Please explain.

7. Are there any ways that student use of new media technology during the school day is having a positive effect in your school? If so, how?

8. Are there any ways that student use of new media technology during the school day is having a negative effect in your school? If so, how?

9. What suggestions do you have for ways that your school community might effectively address increased student use of new media technology during the school day?

III. Concluding Questions

1. Do you have anything else you would like to add?

2. Do you have any questions for me about this interview or the research study?

APPENDIX C
Sample Transcription Coding

We applied the following codes: PB = Personal Beliefs about Educational Technology; SUP = Student Use of Personal Media Technology; SUS = Student Use of School Technology; TLC = Teacher/Leadership Technology Challenge; TP = Technology Problem; TPU= Teacher Preparation/Professional Use; TIU = Teacher Instructional Use; ++ = Positive effect; -- = Negative effect

EXAMPLE 1

Interviewer: At what age did you begin using media technology, and what were some of your first experiences using media technology?

Student 1: Practically since I was born almost. Um, I got my first computer when I was like 5, I used to play little kid games like, I don't think they make these CD-ROMS anymore, they used to be called Living Books, but I used to be totally addicted to those things. **SUP**

Interviewer: And it was off a CD-ROM?

S1: Yeah, it was on a CD-ROM which was probably running Windows 95, I think. It was slow. The first computer I built though was in second grade, I built my first PC for the second grade science fair. Totally got a good grade. **SUP, SUS**

Interviewer: And these Living Books, does that mean that you could go in and . . .

S1: It was basically like the Dr. Seuss books but on CD-ROM and like interactive and stuff. **SUP**

Interviewer: Ok, and could you determine the ending or the next page or destinations?

S1: Sort of, it had like little mini games.

Interviewer: And this computer you built in the second grade, how did you, did somebody, I mean did your family buy that? How'd that work?

S1: It was for the second grade science fair and my dad bought all the parts for me, right, then basically he helped me a little bit on the way, but I pretty much screwed everything together, configured everything. My brother helped by screwing in a CD-ROM drive or something. **SUP, SUS**

Interviewer: Ok, alright and then have you had any particularly positive experiences using media technology in your personal life and if so, what were they?

S1: Um, like positive like what?

Interviewer: Something that you say, you remember back and it might be a whole bunch of things, but you think, "I'm really glad I was able to use media technology, it was a good thing for me."

S1: Um, the fact that I know a bunch about computers, the fact that I used computers a lot and that I know a little bit of coding experience. That little bit of coding experience has definitely helped me a little bit. Maybe even a lot because everyone in like my computer classes always comes to me when they have a problem with their computer or even like a little electronic device. Like if their laptop screws up they come to me. **PB**

Interviewer: And are you taking the Cisco Networking Academy here?

S1: Yes. It's Mr. _____ Computer engineering class. Best class ever. **PB, TIU**

Interviewer: Ok, good. So then that's where you actually learn to build a network and sustain it and maintain everything. Do you like how, and we'll get more into this when we talk about the instructions, but do you like how that class is set up, how you learn?

S1: Oh, definitely. It's probably the most well set up class that I've ever attended probably. Most of the stuff is either hands-on, on the computer or on the Internet. There's barely any, actually, bookwork, like on paper, because I do not like paperwork. Basically, most work that I like to do is on the computer. That's why I'm in computer engineering. I really like hands-on stuff, so computer engineering is perfect. **SUS, TIU**

EXAMPLE 2

Interviewer: What are some of the media technology that you use today? In your general usage?

Student 3: I use the computer at school to like, finish homework, and a computer at home to talk to friends. **SUS**

Interviewer: Do you have a cell phone?

S3: Oh, yeah, I use that a lot. **SUP**

Interviewer: And how do you use that? Do you just call people or do you text message?

S3: Both.

Interviewer: And do you text message a lot?

S3: Yeah, 'cause my parents got me unlimited.

Interviewer: They got you unlimited? And so, how many text messages would you send a day, would you say?

S3: Maybe, like, over a hundred. **SUP, TLC**

Interviewer: Over a 100, is that right? And who do you text message? Friends?

S3: Yeah.

Interviewer: And do you have friends that text message that much also? Is there a circle of folks?

S3: Yeah.

Interviewer: And what are the things that you text message about? What are you talking about, typically? What would be a typical text message?

S3: How was your day?

Interviewer: It's just kind of keeping an update on what they're doing?

S3: Yeah.

Interviewer: And do you text message friends in school?

S3: Yup. Most of the time, I'm bored though. **SUP, TLC**

Interviewer: And how about your parents as related to the use of technology, is it yours or is it your parents? I know you said your parents got unlimited, but you have your own technology at home that you use? Or how does

that work?

S3: Like, me, my sister, my dad and my mom all have our own computers. And we all have our own phones. **SUP, TLC**

Interviewer: And you share a network at home, wireless or something like that, and then you all access your own things?

S3: Yeah.

Interviewer: Ok, and do you ever share information with your parents, do you text message them? Or do you send them email?

S3: I mean, I never email my parents and like sometimes when I can't really talk and I need something, I talk to them through texting, but like that's very rare. Most of the time I just call them. **SUP**

Interviewer: Ok, so texting isn't really something you do with your parents.

S3: Not really. My parents hardly know how to. **SUP**

EXAMPLE 3

Interviewer: The first question: What is your personal comfort level with new media technology? Is it very comfortable, comfortable, neither comfortable nor uncomfortable, uncomfortable, or very uncomfortable?

Teacher 7: I'd say neither comfortable nor uncomfortable.

Interviewer: OK, can you explain?

T7: Well, it just depends on the technology and how much practice I've had with it. I'll say I feel pretty comfortable with my computer, with Microsoft Word and things like that. But when I go beyond that, then my level of training varies considerably, and if I've had time to practice with it and learn the ropes, then I feel OK with it. Otherwise, not so much. **TPU, PB, TLC**

Interviewer: Do you, uh . . . do you feel like . . . has there been an emphasis on that kind of training at the school or in your career?

T7: There has. We have (here at this school) some pretty nice technology. We have the Elmos that are much better than your standard overhead projector. And we have the, I don't even know what it's called, but we have stuff on our computer that can actually go up on the screen. So that's pretty cool. That's really nice. But we also have, it's a little Smart Board, a little bitty one. And we had one practice and we went and another teacher told us how to do everything. But then, we don't have the time to . . . I don't have the time to just sit down when no one's around to just play with it to learn everything. And so, I've not used it in class. I tried to use it in class one time, but it was so sensitive that it just kept messing me up. I'd hit one thing and it would shut off and everything. It's just a matter of learning how to do it. But the sensitivity was killing me, so I just went and did it from my computer. The idea is that you can be anywhere in the room, use that board and monitor. . . **TLC, PB**

Interviewer: Is that the Promethean Board? Is that what it's called?

T7: InterWrite.

Interviewer: InterWrite. Oh, wow.

T7: And it's pretty cool if I just had time to practice it and had someone I could go to immediately with questions and things like that. **TLC**

Interviewer: Is there an in house expert that's pretty good with those things?

T7: I'm sure the media specialist would be able to help with it. But I'm talking about right in the middle of class.

Interviewer: I hear you. That's a challenge, right? Um, when would you say you first began using media technology like cell phones and the internet? When would you say you first started doing that?

T7: I don't know the year. I know that my first cell phone was one of those big bag phones. And I still, if you look at it, mine's still pretty old school. This one here is about 7 years old. But all I do is talk to my wife on it. So I don't really . . . I mean on my way home or that kind of thing. So I don't need it. . . **PB**

Interviewer: To have pictures or Internet access or any of that?

T7: I don't need it. It's funny though, because I coach and the kids will say, "Can I use your phone?" and I give it to them and then they'll make fun of it. And I say, "Wait. You're borrowing my phone and you're belittling it at the same time?"

Interviewer: What about the Internet? When would you say you got on the, first started using the Internet?

T7: Probably about 10 years ago. But I'm so old school that we had a dial-in modem until last year. And so a lot of the stuff, I couldn't watch videos or anything else. So it was pretty worthless for that. I mean, I could still do email and everything and I could look up things, but I couldn't get . . . you know. **PB, TPU**

Interviewer: Now that you have faster access, do you find yourself using it more, or is it about the same?

T7: I do, but I'm still, I'm really not into videos or things like that. I know a lot of the younger teachers are, but I'm just not into that. I'm not into Facebook, I'm not into the YouTube. I just, like yesterday, I was trying to look up a poem by Gordon Parks called The Funeral. And instead I got a video of a clip called Band of Horses singing "The Funeral." And I watched it, but that wasn't what I was looking for. You know, so I'm just really not. . . I mean, every now and then there'll be a band I'm interested in and I'll see if there's a group I want to see from the like the '60s or whatever. But I just, I'm just not into that kind of stuff, personally. **PB, TPU, TP**

APPENDIX D

Sample Observation Protocol

Examining the Impact of New Media Technology on High Schools

Observation Protocol

Date/Time _____ School/Location _____

Teacher/Staff _____

	Symbols S Student T Teacher M Mobile Device I IPod/MP3 L Laptop Computer D Desktop Computer Draw a rough sketch of setting. If device is in use at any time by student, circle the appropriate letter and note time.

General Description:

How were students using new media technology? How many students used each device?