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The Coded Schoolhouse:

One-to-One Tablet Computer Programs and Urban Education

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Information Studies

by

Roderic N. Crooks

2016

ABSTRACT OF THE DISSERTATION

The Coded Schoolhouse:

One-to-One Tablet Computer Programs and Urban Education

by

Roderic N. Crooks

Doctor of Philosophy in Information Studies

University of California, Los Angeles, 2016

Professor Jean-François Blanchette, Chair

Using a South Los Angeles charter school of approximately 650 students operated by a non-profit charter management organization (CMO) as the primary field site, this two-year, ethnographic research project examines the implementation of a one-to-one tablet computer program in a public high school. This dissertation examines the variety of ways that information and media technology function in everyday life within the institution — including classroom instruction, school discipline, and evaluation — through qualitative methods, primarily class observations, photographs, and interviews with teachers, students, and administrators as the program evolved over two consecutive school years. This project contributes needed empirical context to questions of technological innovation in public education, providing the first-ever multi-year study of a one-to-one tablet computer program in a California public school. I argue that a number of factors contribute to an overall resistance among teachers and students toward the use of tablet computers for instructional purposes, including the mandates of administrators,

publishers, and hardware manufacturers; the resource requirements of network infrastructure; a number of professional demands placed on teachers; and a lack of autonomy among student users. By contrast, school administrators experience few barriers to using tablet computers for surveillance, discipline, and recordkeeping. I explore issues of labor and surveillance related to this program to dispute persistent narratives about the so-called digital divide and to complicate the virtue of access espoused by the library and information professions.

The dissertation of Roderic N. Crooks is approved.

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University of California, Los Angeles

2016

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Roderic N. Crooks grew up in Los Angeles, California; Memphis, Tennessee; Portland, Oregon; and Vancouver, Washington, where he graduated from Hudson's Bay High School. He completed a Bachelor of Fine Arts in Illustration at the School of Visual Arts in New York, New York in 1999. He entered The Writers' Workshop at the University of Iowa in Iowa City, Iowa in 2003 and earned a Master of Fine Arts degree in 2005 with a thesis project called "The Human Technique," a work of fiction. During his time in Iowa City, he worked as an art handler at the University of Iowa Museum of Art and as a technician for the International Writing Program. He taught English composition classes at Borough of Manhattan Community College and Kingsborough Community College between 2007 and 2009. In 2009, he returned to Los Angeles to enroll in the Department of Information Studies at the University of California, Los Angles. He received a Master of Library and Information Science in 2011 with a thesis project called "Exploring Paradoxical User Reactions to *iPhone Tracker*: Journalism, Business, Cyberinfrastructure, Privacy, and Regulation." During doctoral study at UCLA, he completed a graduate certificate in digital humanities, volunteered for OUTreach, an LGBT+ service organization, and worked for seven years at the Civil Rights Project at UCLA, an education research institute.

CHAPTER ONE

FIRST DAY OF SCHOOL

On November 18, 2013, after several weeks of intense and sometimes frantic planning, staging, and troubleshooting, administrative staff at Los Angeles Academy Schools College Prep # 7, a public charter school in South Los Angeles of roughly 650 students, oversaw the distribution of over 500 Apple Computer iPads, one for each student in grades nine through eleven. School principal Dan Montoya, his three assistant principals, and Sonia Quezada, a remedial math teacher recruited to serve as tech support, were tasked by "Home Office," the charter management organization (CMO) that owned their school, to pull off the implementation without controversy[1].

Figure 1.1. iPad checkout, directed by Student Technology leaders. 18 November 2013.

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[1] For a sense of the incredible outpouring of bad publicity related to tablet computer programs in Los Angeles public schools, see http://articles.latimes.com/2014/jan/04/opinion/la-le-0104-lausd-ipad-mailbag-20140104. For a summary of legal actions, see http://projects.scpr.org/timelines/lausd-ipads/.

The day of the distribution of the iPads, a number of visitors accepted invitations to observe the rollout, which took up an entire school day. Higher-ups and information technology (IT) support from Home Office, officials from other schools interested in implementing one-to-one programs, teachers from sister institutions owned by the CMO, journalists, esteemed graduates, and a few researchers (myself included) joined the staff and students of Number Seven for the day to watch a tightly scripted routine that ended with each student in possession of a tablet computer. Specially appointed "Student Ambassadors" roamed the halls, greeting guests and offering directions helpfully. The elaborate production, coordinated by Ms. Quezada and a cadre of her specially trained Student Technology Leaders (STLs), involved nearly every student, teacher, and administrator in the school at some point. Students spent all day in their advisories (homerooms), waiting for a turn to check out on of the iPads that had been delivered to the school a few weeks earlier and stored in a locked classroom. Class by class, each student came to Room 109, commandeered for the day from Ms. Wilson, whose classes would be taught outside for the duration, to line up and receive a device in its distinctive Apple box. The room was divided up into stations so that each student could cycle through to check out a tablet and get a standard issue carrying case. Ms. Quezada described the set-up, designed and executed by her STLs, as being "just like the DMV." The STLs presided over what was a powerfully analog process of registration and inventory control, matching student identification numbers to device serial numbers. This paper-intensive procession enabled the STLs to issue every eligible student an iPad inside the span of that single school day. They marked their best time for processing a class on the wall and made a game out of trying to beat the number.

Abruptly, just minutes after the last advisory had been issued their iPads, another announcement came over the PA system. Mr. Tustin, Director of Instruction and Student Success, said, "All right, teachers: it is now time to make sure all your students' iPads are locked

up at this time." At this command, advisory teachers instructed their students to place their iPads inside one of the charging carts, a sort of wheeled safe, that had been placed in every advisory classroom. Student Ambassadors called roll in each room so that every student present could check back in his or her iPad. No sooner had the STLs completed the work of getting every student a tablet, than they were called upon to lock them up for the day: to minimize the risk of loss, theft, or damage, Principal Montoya and Home Office had decided that student's tablets could not leave the school. STLs spread out in teams to teach advisory classes how to secure tablets at the end of the school day and dedicated a full hour to assuring that every single iPad issued that day was accounted for and locked inside its designated cart. A month would pass before students were again allowed to touch the devices, during which time the STLs used what they had learned that day to prefect their inventory routine. They drilled constantly over the month to create and master new sets of procedures to handle inventory: regular check out, fire drill check-in, early release, and so forth.

The first day of school for iPads was an aberration, an exceptional day in a school that values routine, but almost everything that I would later see with regard to this one-to-one program could be seen that day: elaborate rituals around the use of tablets, relatively little interest in tablets by classroom teachers, invocations of surveillance, and a sense of competition with other kinds of public schools. The introductory material that follows explains how I built my dissertation project around this one-to-one program, how I conducted my research, and what I found. I start with my research questions, summarize my findings, and briefly describe how I frame this ethnographic project. I spend some time here describing my field site and explaining how this project differs from other kinds of research of one-to-one programs, a description that should inform the reading of the three longer chapters that follow. I end by explaining the layout of the rest of the dissertation.

This dissertation is about Number Seven and its experience with a one-to-one tablet program. While the study of educational outcomes related to specific uses of computers or computer-like devices is an interesting topic worthy of study, this dissertation takes an intentionally broader focus on people, the technologies they use, and the relationships between them in order to question the very notion of equity of access. Access is a central virtue of both the library profession and the library and information sciences research literature. As the American Library Association defines this concept on their website:

> Equity of access means that all people have the information they need - regardless of age, education, ethnicity, language, income, physical limitations or geographic barriers. It means they are able to obtain information in a variety of formats - electronic, as well as print. It also means they are free to exercise their right to know without fear of censorship or reprisal.

As it is understood here, equity of access does not differentiate between formats, or, more pointedly, such a definition applies the principle of access to books to access to commercial digital media. As I will show throughout this project, such a leap, although widely accepted, poses problems in terms of the very equity it is meant to support. My interest is in the kinds of work and changes that go into making tablets available for instructional use in the first place, in the kinds of work activity that support and underpin a one-to-one program. I am also interested in the meanings and assumptions that make computers "evocative objects," affectively and intellectually charged artifacts through which one understands oneself (Turkle, 2011). I will use descriptions of what happened when hundreds of new computing devices were turned loose inside the already chaotic environment of an urban high school such as Number Seven in order to explore the understandings about computers and about public education that make such an intervention purposeful, important, and possibly inevitable. To contextualize this approach, I briefly summarize below what research into one-to-one programs and mobile devices applied to learning has already shown.

ONE-TO-ONE COMPUTING PROGRAMS

In contrast to theoretical works in communications, information studies, science and technology studies, and other cognate fields, education research has focused more or less exclusively on the reach or efficacy of computer technology used as an educational tool. Education researchers have produced a number of studies and books over the last decade that describe in great detail what happens when schools put computing devices in the hands of teachers, students, and administrators. While approaches vary, no universal benefit to adding computers to schoolrooms has been found. Instead, research generally suggests that information and media technology can be most useful for learning when it suits the teaching goals and strategies of instructors and when its use comports with the values of the community in which is employed (Schofield, 2006).

Education researchers have responded vigorously to notions of a digital divide specifically and the presumed educational benefits of digital media more generally by evaluating various technological interventions in schools to determine what benefits they promise for students. The digital divide concept, quite influentially articulated in the United States Department of Commerce's National Telecommunications and Information Administration report, "A Survey of the 'Have Nots' in Rural and Urban America" (1995), observes the clear correlation of low socioeconomic status with access to computers and suggests that this differential lack will itself result in further economic marginalization. Typically, research that incorporates this digital divide framing proceeds quantitatively, by determining a measurable improvement in some relevant area of student performance, or qualitatively, by documenting a benefit or enrichment to some aspect of schooling or learning attributable to the presence of some type of computer or digital technology. Other researchers describe the use of some class of digital artifact or media as a project of some new style of learning (e.g., 21st Century learning, m-learning, e-learning) or a new kind of literacy (e.g., digital literacy, new media literacy, ICT

literacy). Despite changes in the nature of computing that might obviate such a framing, particularly the development of commercial cloud services, mobile devices, and the app architecture, the digital divide concept has persisted (Burrell, 2012). While research in tablets in public schooling is only now emerging, a fairly robust literature already exists to describe one-to-one programs based on a number of studies about laptops, iPods, and other forms of mobile technology. Below, I group the relevant education literature in three loose clusters: studies of one-to-one technology programs and the various ways their benefits have been described; learning projects based on mobile technologies and the various attempts made to justify their inclusion in a variety of educational schemes; and new ways of articulating the goals of education that justify the use of digital media. Taken together, these works suggest programs that outfit students with some form of technology offer various benefits or enrichments, but infrequently improve quantifiable learning outcomes. For the most part, this literature presumes and documents some benefit to the use of one-to-one technology programs, but rarely engages with any substantive discussion about possible drawbacks to these technologies.

Perhaps the most famous and ambitious one-to-one intervention of all is the One Laptop Per Child Program, a non-profit initiative founded by Nicholas Negroponte, designers associated with MIT's Media Lab, and many large technology corporations. OLPC developed several inexpensive models of computers (the XO and its successors) and sold them to various national governments and development organizations in the Global South, where they were meant to accomplish educational benefits based on Papertian (constructionist) ideas about learning (Ames, 2016). While the initiative did succeed in distributing roughly 2.5 million computers all over the world, 85 percent of them in Latin America, much of the activity users engaged in involved media consumption rather than computer programming or writing, leaving the program with an

ambiguous legacy in that their chief function was to serve media content created by transnational corporations to children.

Warschauer and Matuchniak (2010) exhaustively review educational approaches to various forms of technology (framed broadly as "digital media") in terms of access, use, and outcomes. Because these authors view digital media as fundamentally transformative of society and the economy, they argue that this wide variety of technologies has an "important role in education, and especially in promoting educational equity" (p. 180). Referencing thirteen years of studies by the National Telecommunications and Information Administration, the authors seek to rescue the digital divide concept:

> Today the divide resides in differential ability to use new media to critically evaluate information, analyze and interpret data, collaborate with others in knowledge production, and communicate effectively to diverse audiences — in essence, to carry out the kinds of expert thinking and complex communications that are at the heart of the new economy (p. 213).

Consistent with earlier framings of the digital divide, the authors correlate inferior levels of educational outcomes with low socio-economic status.

In an important study that provides one of the few counterpoints to widespread enthusiasm for educational technology (a work I will return to frequently in this project), Cuban et al. (2001) look at the provision of laptops to public high schools, specifically addressing the notion of a digital divide. The authors described an apparent paradox in that greater access to computers by students and teachers ("high access") does not lead to greater or more significant use of computers in instruction ("low use"). The authors also find that even in cases where computers were frequently used in instruction, they were used "to maintain rather than alter existing classroom practices" (p. 813). The authors use interviews with teachers and students at two "high-tech" Silicon Valley schools; observations, surveys, and analysis of internal reports; and external reviews, grant applications, and newspaper articles to seek "a complete, even positive picture of computer use for instruction" (p. 817). The authors identify the ratio of

computers to students as a driving, influential, putatively self-evident metric of "a school's

technological success" (p. 818). The authors sort teachers and students by their frequency of use

of computers at home or at school as serious users, occasional users, or non-users, corresponding

respectively to a habit of weekly, monthly, or irregular use (p. 820). The researchers also note

distinct patterns of student behavior in response to computers and the importance placed on

them; they labeled students who attached a sense of social identity and academic competence to

their skilled use of computers as "open door students" and those who were recognized by adults

and fellow students for their technical acumen as "tech gods":

> Student computer experts eased the demands placed on an understaffed and overburdened
> technology support team...[T]eachers were responsible for establishing the school's network,
> maintaining 300 or more computers, writing grants for new equipment, and determining the
> school's technology policies. Tech coordinators cultivated select cadres of technologically
> proficient students to help them meet these challenges (p. 823-4).

Describing then current high school practices as part of "teacher-centered" learning, the

authors argue that public high schools will only incrementally change with the adoption of new

technologies as "deeply entrenched structures of the self-contained classroom, departments, and

teachers' disciplinary training" will maintain a continuity with the already established practices

of the comprehensive high school (p. 830). Finally, the authors account for the paradoxically low

use of computers in instruction as a consequence of contextual factors such as the structure of the

school day as the historical product of the development of the comprehensive high school in the

1920s (p. 827) and "defects" in the technology such as incompatibility, crashes, slow data

transfer speeds, or other kinds of "glitches" (p. 829). Later, I will show that such technical

realities mark all sustained use of computer systems except for the most idealized or controlled

situations and might more productively be thought of as features rather than aberrations.

Warschauer (2008) collects qualitative data from class observations, interviews, surveys,

and official documents from ten elementary, middle, and high schools in California and Maine to

evaluate frequent claims about the educational utility of one-to-one laptop programs in terms of various kinds of literacy. He finds that, cost notwithstanding, one-to-one laptop programs contributed positively to promoting improved teaching and learning of various forms of literacy in the schools studied (p. 650). Importantly, Warschauer shows that no measurable improvement on test scores occurred and demonstrates that the presence of laptops failed to "erase academic achievement gaps between students with low and high socioeconomic status" (p. 52). Instead, Warschauer focuses on kinds of teaching practices that emerged though the continuous use of laptop technology in the classroom. He finds that laptops enabled certain kinds of desirable teaching activities: "[R]eading instruction featured more scaffolding and epistemic engagement, whereas student writing became more iterative; more public, visible, and collaborative; more purposeful and authentic; and more diverse in genre" (p. 52). He suggests that the use of laptops increased information and communication technology (ICT) literacy, a term of his own creation that joins information literacy and multimedia literacy (p. 60).

Despite the lack of measurable improvement in educational outcomes, Warschauer et al. (2010) suggest that one-to-one laptop programs improve student writing:

> When students have daily access to Internet-connected laptops, they conduct more background research for their writing; they write, revise, and publish more; they get more feedback on their writing; they write in a wider variety of genres and formats; and they produce higher quality writing (p. 221).

Of particular interest to the present study, this work focuses on cheap netbook computers outfitted with open source operating systems (Ubuntu) and free-to-use software (Google Apps) and presumes the presence of "access to laptops, wireless networks, social media, and a forward-looking pedagogy" (p. 223). The specific benefit claimed for student writing also presumes text entry via QWERTY keyboard.

In another piece, Warschauer (2010) elaborates on the beneficial changes to the teaching of writing in schools that instituted one-to-one laptop programs. Writing papers and finding

information online comprised the most common activities undertaken by students. These activities changed the processes by which students learned to write in several areas including pre-writing, drafting, rewriting, and dissemination. He suggests that automated essay grading tools, controversial among teachers in the study, "do not replace good teaching but should instead be used to complement and support it" (p. 109). In this research, the changes made possible to the teaching of writing are themselves seen as intrinsically good, as something that will promote "the kinds of writing and literacy skills required of 21st century life" (p. 110).

Berger and Thomas (2011) address issues of institutional change as they pertain to the inclusion of new forms of technology in schools and show that the incorporation of mobile computing devices should not be reduced to purely technological or pedagogical terms, preferring instead an approach that synthesizes both. They analyze various forms of resistance by individuals and groups and provide heuristic tools to smooth the management of web-based and digital interventions. They also discuss how technologies that serve to individualize instruction might result in forms of Foucauldian surveillance:

> While their learning outcomes and competences are dictated by market rules and market requirements, individuals are required to self-regulate and self-organize their learning process to achieve certain learning objectives and gain certain competencies, often outside institutional boundaries (e.g., in informal or nonformal settings) (p. 108).

This reference to internalized coercion and the spread of the school's hierarchy beyond the school's walls serves as a rare corrective to less critical works that take it as a given that technology is inherently educational and that incorporating new forms of technology poses no risks. Harris and Hofer (2009) advise that identification of student learning objectives should precede the selection of classroom technology, which should be a later step in instructional design to assure that technology serves the aims and methods of a given class.

Citing mixed evidence on the correlation of access to a home computer with the quantifiable achievement gap between minority and non-minority community college students,

Fairlie (2012a) gave randomly selected community college financial aid recipients refurbished laptops and measured how this access to technology affected grade point average. The author finds that access to a computer at home modestly increased grades for all students, but increased grades considerably more for minority students than for non-minority students. He concludes that access to the laptops helped minority students more because minority students and their families experienced "financial, informational and technical constraints" that depressed levels of computer ownership relative to non-minorities (p. 678). He suggests that "tax breaks or special loans for educational computer purchases, an expansion of computer refurbishing programs, and laptop computers for home use may be needed" (p. 679). This field experiment pertained to college students rather than high school students, did not differentiate between kinds of computers previously or concurrently owned by students in the study (e.g., laptop, desktop, tablet, smartphone), and attributed all positive results to the provision of a laptop that students could take home. In a related publication, Fairlie (2012b) demonstrates that providing students a laptop they could take home improved computer skills and that such benefits accumulated more strongly to young, minority, low-income, and female students.

Research specific to mobile technologies such as smartphones and tablets has recently started to emerge; this research seeks to apply lessons learned from laptop-centric studies to other forms of information and media technology. Fernández-López et al. (2013) design an iOS "mobile learning platform" for special education students and demonstrate improvements in five areas tested. Although the study uses no control group, the authors suggest that special education students could benefit from individualized lessons delivered over mobile devices. Hutchinson et al. (2012) report favorably on the use of iPads in grade school literacy instruction, with the caveat that technology should be selected in response to predetermined learning goals and evaluation strategies. They distinguish between technological interventions that serve a

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curricular goal and those that serve purely technological goals. These authors also touted the usefulness of iPads with the explicit assumption that these devices accompany students home to "promote anytime, anywhere access" (p. 15). Martin and Ertzberger (2013) write that ICT in the form of smartphones and tablets "added a new dimension and capabilities to situated learning" to create something called "here and now learning," (p. 77). The authors compare an undergraduate art history lesson delivered via personal computer and an analogous lesson delivered via iPad and iPhone. The study finds higher student engagement, operationalized here as a student's self-reported interest in a lesson, in the mobile lesson but higher accomplishment (test scores) in the PC-based version. This research points to an empirically observable disconnect between high levels of engagement, however operationalized, and learning outcomes.

Where the preceding education researchers attempted to demonstrate the utility of various forms of computing to previously established educational or social goals, other authors valorize the incorporation of mobile and digital technology in classrooms by arguing that such an incorporation is inherently good or that it achieves some new kind of literacy. Trentin and Repetto (2013) suggest that familiarity with contemporary technology outside the classroom runs up against traditional schooling methods, creating "an ever-widening gap between the students' personal/daily use of Web 2.0 and mobile technology and the manner in which schools propose using them for educational activities" (p. xiii). They argue for a new vision of techno-powered education that bridges informal environments and school, a vision that seeks to capture young people's presumed facility with technology and convert it to interest in other kinds of lessons. The work modulates between descriptions of the state of technology and prescriptions for how schooling should change to accommodate a transformation already underway. Idrus and Ismail (2010) audaciously (and incorrectly) claim that the ubiquity of mobile devices "demolishes the notion of distance; it demolishes boundaries and now it will even demolish the very concept of

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what it means to be here or there" (p. 2766). They argue for mobile education ("m-learning"), a

paradigm that takes as given a transformation in social and institutional relations because of

"increased popular access to information and knowledge anywhere, anytime" (p. 2767).

Combing concepts of new media literacy and computer education, Kafai and Peppler (2011) urge

that DIY-inspired creative media production for youth "should be considered an essential part of

our discussions of learning with new digital media, inside and outside of school" (p. 115). This

framing describes the creation of various forms of media and the use of particular technologies

as part of a "robust" education, as both an enrichment of education and a vital competency for

contemporary life that is intrinsically valuable rather than instrumental to some other kind of

learning objective (p. 90)

Such redefinitions of learning and literacy are supported by numerous declarations by

administrative and professional bodies, including the American Library Association's oft-cited

definition of digital literacy as "the ability to use information and communication technologies to

find, understand, evaluate, create and communicate digital information"(Office for Information

Technology Policy Digital Literacy Task Force, 2013, p. 1). This definition of digital literacy has

circulated widely, been taken up by various public and private education funders, and worked its

way into educational agendas, including the Common Core State Standards. Other professional

bodies have issued statements endorsing the use of various kinds of technology in education. The

Board of Directors of the International Reading Association (2009) issued a position statement

asserting that

> to become fully literate in today's world, students must become proficient in the new literacies of
> 21st-century technologies. IRA believes that literacy educators have a responsibility to integrate
> information and communication technologies (ICTs) into the curriculum, to prepare students for
> the futures they deserve (n.p.).

These several studies show a field concerned with the utility of technology and almost

uniformly unconcerned with any broader implications of these kinds of interventions. Although

the literature is not univocal in expressing the potential benefits of such programs, its silence in addressing the insistent impulse to load up on digital devices at all costs despite the lack of convincing empirical evidence that such efforts improve outcomes is pervasive. This dissertation uses ethnography to bridge the realm of the purely empirical, what students do with computers, and more abstract concerns about what the computing situation does to us. To do this, I take a different approach to evaluating how learning happens or does not happen, one that explores successful and failed interventions alike.

RESEARCH QUESTIONS AND SUMMARY OF FINDINGS

This dissertation documents the variety of ways that tablet computers and related technologies function in the context of a single institution. This project contributes needed empirical context to questions of technological innovation in public education, providing the first-ever multi-year study of a one-to-one tablet computer program in a California public school. As an ethnographic project, this dissertation takes an emic approach, one that eschews any specific commitment to a theory or operationalization of learning (Burrell, 2009). To the contrary, I explicitly avoid such an approach in defining the site to be studied, a decision that led me away from the school grounds at times, into the surrounding community. I use theoretical works about infrastructure, digital labor, and surveillance to contextualize data collected at the school. This project focuses on the technological intervention undertaken by administrators and how they describe, understand, and articulate its purposes and aims. Class observations and interviews with teachers and students show how tablets functioned in the school, how they became part of daily activities and in doing so, shaped routines of work, study, and evaluation. This project complements emerging education research into mobile learning programs and continuing research into one-to-one computer programs by addressing these efforts beyond the question of their potential instrumental value in public schooling. This research seeks to expand

the ethnographic record, to richly document and describe the conditions of the field site and how informants understand the role of technology in it. The research is organized around three questions, dealing respectively with devices, data, and discourses:

RQ1. How are the various uses of tablets supported by social and technical networks within the institutional framework of the school? How do decisions about the configurations of devices and their supporting infrastructure express the interests of students, teachers, administrators, manufacturers, publishers, and the larger community?

RQ2. What kinds of data are generated by the use of tablets in the school's daily activities — e.g., instruction, discipline, evaluation, surveillance — and how do such data circulate? Who may access such data and how may various stakeholders use these data? How does use of tablets ignore, enhance, or impede existing data regimes?

RQ3. How do the communities involved directly or indirectly in the daily life of the school describe the use of tablets vis-à-vis the central legitimating ideal of public schooling? How do discursive regimes around public schooling and technology address the specific resources required for the iPads and their software to function?

The four chapters that follow will address these questions in greater detail. Overall, the pattern of use that emerged matches previous description of one-to-one laptop programs: high levels of access to digital technology have only in rare cases resulted in use in instruction (Cuban et al., 2001). Every teacher interviewed after a class observation expressed a desire to use tablets more than he or she was able to and named a fairly consistent set of barriers to implementation. The overwhelming response of teachers to the program is a feeling of insufficiency relative to an idealized version of "doing tablets." Instead of integrating tablets into classroom instruction, teachers have described a number of obstacles to using the devices alongside previously installed classroom technology. Students also reported a variety of challenges that prevented them from

using the tablets in ways they had previously imagined; class observations consistently showed a number of others. These obstacles include the energy and network demands of the tablets, the architecture of the system that delivers and monitors software, the many kinds of credentials that must be managed for student users, and the single-user orientation of interfaces. Tablets produced many demands for resources, especially labor. These resource requirements were attended to by teachers and by unpaid student workers. School administrators, by contrast, named no consistent set of obstacles to their use of the tablets, primarily for purposes related to surveillance, disciplinary action, and counseling. Tablet computers and their apps provided data in a format that was relatively easy for school and district officials to combine with other forms of physical and electronic surveillance.

METHODS

This study uses ethnographic methods to richly describe a single case of the application of mobile computing technology to a specific institutional setting; the project describes the great variety of activities, explanations, and performances that constitute use of such technologies. Ethnographic research, with its emphasis on the co-constitutive nature of culture and meaning, has been used to describe how a particular group, community, or profession has made, used, and defined information and how such informational activity produced meaning within the studied population. Researchers in information studies (IS), anthropology, and cognate fields have presented ethnographic research with greatly different ideas about the nature of their conclusions, the generalizability of such research, and the implications for other kinds of projects. Ethnographic research in information studies clusters around how particular cultures and sub-cultures make and use information. Ethnographic research in IS has described scientific practice (Shankar, 2006, 2007; Millerand & Bowker, 2009); communities the spring up around information technology (Coleman, 2013; Kelty, 2008; Koh, et al., 2005); information institutions

and their ongoing efforts to identify the needs of their users (Pierard & Lee, 2011; Mehra & Srinivasan, 2007; Trace, 2006); and the design of information systems and technologies (Beynon-Davies, 1997).

Education researchers, who often employ quantitative methods to measure the effectiveness of particular interventions, have also used ethnographic approaches to understand school life, particularly those aspects of education that can be identified as a culture. Ball (2002) makes the link between education and ethnography explicit by characterizing the school as a central social institution and distinct cultural site that, before the 1960s, rarely received any notice from scholars:

> Most of us can recall our first day of school vividly. We entered classrooms as wide-eyed observers, eager to learn, immigrants to a foreign homeland that was unique in its culture and setting, with its own norms, values, procedures, routines, and populations. Aside from the novelty of that very "first day of school," we rarely reflect upon the complexity of the day-to-day experiences within those classroom walls. School was simply a way of life, a routine; it was what we "did" each day, with an ultimate goal of receiving a diploma at graduation. This is an expected milestone in our society, a symbol of collective spirit and shared experience (p. 73).

Education research that uses ethnographic methods tends to focus on "teachers, students, curriculum, and internal or external structures that subtly or abruptly impact the overall quality of classroom life" (p. 77). Ethnography offers "a tool for understanding the norms and expectations of the members of the classroom culture," an approach that presumes that actions and their meaning can be captured by an observer (Putney and Frank, 2008, p. 226).

This project looks at the school as an institution that functions in a broader educational milieu that includes such profound forces as state and federal policy, an influential national educational reform movement, and various flows of transnational capital. The approach differs from multi-cited ethnographies that follow goods though "chains of production" to highlight flows of money, power, people, and goods to describe instead the great variety of material practices and supporting discursive practices that exist within one relatively small school

(Marcus, 1995). This project does not aim to determine optimal inputs for particular educational outcomes. Instead, this project seeks to understand the continuing penetration of computational activity into daily life enabled by the advent of smartphones, tablets, and other forms of information technology through direct observation. This study also accepts that non-use (or use of a given technology in ways not predicted by its designers) is of particular significance to economically marginalized communities, where such non-use "may have sociocultural repercussions that reach beyond the individual" (Baumer, et al., 2015, n.p.).

For two consecutive school years, I visited the school regularly, logging approximately 275 hours. I observed classes, conducted interviews, and examined devices and data. Outside of class observations, I recorded semi-structured interviews with a dozen teachers to ask them to comment on the teaching I had observed. I attended faculty meetings and curriculum planning sessions. I also attended social events, such as the school renaming ceremony, parents' nights, staff parties, prom, and graduation. I took detailed field notes during every visit or immediately after leaving. I corresponded with teachers and administrators via email. I also attended special events in the local community, such as a computers class organized for parents by the school. I joined students for a community service activity at a church. I visited with teachers after school, in coffee shops, bars, and their homes. Finally, I conducted a focus group-style meeting with a group of 25 Student Technology Leaders, which was followed by a written activity. To attend this meeting, students were excused from class for an hour and compensated.

All names used in this dissertation are aliases meant to protect the identity of informants and their school.

DESCRIPTION OF FIELD SITE

The primary site of this project, Los Angeles Academy Schools College Prep # 7, is located in a South Los Angeles neighborhood called South Park. The number of students in the school varies,

largely due to transfers in and out by individual students, but hovers around 650, the maximum

number of student bodies legally allowed in the building as determined by Home Office's

interpretation of its charter, fire safety laws, and educational guidelines. Most students at the

school are Latino and come from Spanish-speaking families. In the 2013- 2014 academic year,

the last year for which summarized statistics are available, Number Seven reported a student

population that was 89 percent Latino, 10 percent African American/black , and less than 1

percent white, Asian, or Native American; similar statistics for the following school year were

not yet available, but by all accounts should be unchanged. 98 percent of students at the school

qualify for free lunch and nearly 89 percent speak a language other than English in the home.

The families of students must complete an application to apply, a four-page document that

includes demographic data about the family and the student as well as education history.

Students and their families must sign this application, which includes language about

expectations for parental involvement, reserves the right for the school to require additional

courses for students (such as afterschool or weekend tutoring), and lists extensive rules for

behavior and dress. A fuller demographic description of the community appears in the next

chapter.

ORGANIZATION OF THE DISSERTATION

This dissertation presents two years of field work thematically[2]. The next chapter, "What It

Takes to Do Tablets," looks specifically at the work of Number Seven's teachers during the

creation of the one-to-one tablet computer program from the perspective of recent studies of

infrastructure. I situate aspects of several bodies of work that address infrastructure within the

framework of a critical-material turn in social and behavioral sciences and differentiate between

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[2] The Appendix contains a chronology of key events depicted in subsequent chapters.

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two distinct but simpatico approaches that partially constitute this turn (infrastructure studies and materiality). I define infrastructure in a necessarily broad sense, as a "moving target" that includes a number of systems, artifacts, and relations needed to deliver public education via tablet computer; I also define and identify key components of work infrastructure, a more specific term that foregrounds the ways that decisions about systems and devices play out in terms of an organization's activity. Using field notes, interviews, and photographs, I construct an "infrastructural inversion," a way of "shifting the emphasis from changes in infrastructural components to changes in infrastructural relations" (Bowker et al., 2010, p. 99). I show how the requirements of tablet computers came to alter and shape the practices that constitute the work of teaching. The work of classroom instruction at Number Seven came to involve the manipulation and creation of documents in the tablet-ready, PDF format, a strategy that entailed a number of demands, associations, and unforeseen consequences. Finally, I visit digital divide narratives and use the infrastructural analysis offered in the preceding sections to show how the one-to-one tablet program engendered logistical and ethical conflicts by conceptualizing public education as a purely informational activity, as the effortless transfer of digital information. I argue instead that any digital divide framing that discounts the action of infrastructure will unjustly burden the very communities that digital technology is meant to benefit.

In the third chapter, "The Value of Youth," I focus on the student experience of tablet computing. This chapter has two aims. First, it seeks to sketch out dimensions of affective labor and intellectual capital to describe the very real value derived from information and media technologies, and, by extension, to computers more generally, especially in terms of the much studied habits of the kinds of young users who figure in this chapter as both end users and laborers. Second, it aims to contribute empirical nuance to debates around new media economics. I show how the one-to-one tablet computer program demanded new forms of work, particularly

in the areas of interoperability, maintenance, connectivity, and inventory control, work that was accomplished primarily by Student Technology Leaders, the unpaid student workers who appeared at the start of this introductory chapter. I describe this labor in terms of the technical processes it accomplished and also in terms of its affective dimensions. The unwaged, uncompensated work of students generated significant social capital for the school and intellectual capital for student workers themselves. While this work was understood as technical in nature, affective dimensions figured prominently in its constitution, both in terms of the pleasures it offered and the demands it made. To conclude, I unite these two threads with a question about value. I seek here to insert the economic analysis of the previous section into research on the information and media technology usage patterns of young consumers. I suggest that further exploration of the value exchanged by use of information and media technologies will be necessary for either a robust political economy of the digital or a realistic sense of the habits of digital youth.

Chapter Four, "Small Defiances," looks at the emergence of a variety of surveillance practices that developed via the actions (and counteractions) of teachers, students, and administrators in pursuit of various forms of accountability. Accountability, an ethos explicitly announced in various documents and venues and implicitly referenced by a variety of routines within the school, worked powerfully to structure and justify a set of surveillance routines and rituals focused on and enacted through tablet computers. This chapter uses the concept of a surveillance assemblage, a heterogeneous collection of systems, people, artifacts, and ideas, to describe how tablet computers and related objects came to perform the practices of accountability. I draw on literature from several fields to define surveillance, focusing in particular on the question of agency in Foucauldian models of panoptic surveillance and subject formation. I review surveillance activities as they happened in three distinct, common processes

in the school: instruction, advising, and testing. Depictions of the school's complex electronic surveillance measures as articulated by principals, teachers, and STLs portrayed the surveillance apparatus as immediate, ubiquitous, and predictive. Paradoxically, as students and teachers adjusted to the use of tablets over the course of two years, the constant invocation of the administration's surveillance capability failed, in some cases, to force a particular behavior or achieve a particular outcome. In effect, reminders of surveillance meant to tout the reach of the school administration's supervisory gaze revealed such vision to be partial, probabilistic, and retroactive. I argue that conspicuous displays of surveillance power, rooted as they are in appeals to a panoptic principle, revealed limits of the power of school authorities to accomplish the goals for which accountability regimes were instituted in the first place; I explore this seeming contradiction and conclude by asking if this pattern holds at different scales of surveillance.

The concluding chapter ends this dissertation by visiting a computer literacy class held at Number Seven for parents. I use this episode to talk about the cultural meaning of computers, to question the discourse of success and failure in public education technology programs, and to support my argument that the use of tablet computers in public education is overdetermined and ignores quite a bit about what education researchers have already learned about teaching.

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CHAPTER TWO: WHAT IT TAKES TO DO TABLETS

> Technology is above requiring an interpretation; it interprets itself. You merely need to select the right objects and place them precisely in the picture; then they tell their story of their own accord.
>
> — Photographer Hilla Becher, 1989, quoted in her obituary.

> In talking of materiality here, we want to go beyond the brute fact of material forms. That is, what is of interest to us is not simply the fact that apparently abstract and ineffable digital "stuff" actually takes material form; rather, we want to understand the particular material properties of these forms and their consequences for how people encounter, use, and transform them. (Dourish and Mazmanian , 2011, p. 4)

INTRODUCTION: TIME OUT FOR TABLETS

For the first six years of Number Seven's operation, the school day alternated odd and even-numbered class periods, so that a typical day consisted of a short advisory period and three subjects-based classes. This arrangement met one of Academy school's stated Core Values (as stated on the charter management organization's website):

> Increased Instructional Time: Our schools feature extended class days, with many courses taught in uninterrupted two-hour blocks. Our school year lasts 190 days, 10 days longer than that of the Los Angeles Unified School District.

Although this language about the importance of instructional time (and a gratuitous bit of shade thrown at a rival school district) remained posted conspicuously in each classroom at the school, Principal Montoya, acting on the mandates of Home Office, increased the amount of time students spent in advisory, a non-instructional class, in December of 2013, in order to accommodate the check-in and check-out of tablets. The LAUSD tablet program, already the subject of numerous complaints and a spate of bad publicity, allowed students to take tablets home with them, a situation some commenters described as dangerous in South Los Angeles, where the cash resale value of the tablet might make students into targets for thieves. Although stories of gangs lined up outside schools to steal student tablets were discussed in social media, no such activity was reported by the many local education reporters covering the iPad program at LAUSD for *Los Angeles Times* or Southern California Public Radio. Thefts of tablets at LAUSD numbered less than 100 in total the first year (CBS Los Angeles, 2013); at Number Seven, no

tablet was stolen or damaged beyond use during the time of my study. Still, Home Office, in a

climate of considerable public outcry over one-to-one tablet programs, decided early on that their

students would use tablets only in school. This necessitated the development of check-in and

check-out procedures, which in turn necessitated allocating more of the school day to advisory.

Time	Odd Day	Even Day	Time	Wednesday
8:00 – 8:40	Advisory	Advisory	8:00 – 9:40	Period 1 or 2
8:45 – 10:45	Period 1	Period 2	9:45 – 11:25	Period 3 or 4
10:45 – 11:05	Nutrition	Nutrition	11:25 – 12:00	Lunch
11:10 – 1:10	Period 3	Period 4	12:05 - 1:45	Period 5 or 6
1:10 – 1:40	Lunch	Lunch	1:45 – 3:45	Teacher PD
1:45 – 3:45	Period 5	Period 6		

Figure 2.1. Weekly schedule before the one-to-one program. 40 minutes per day are allocated to advisory on a full school day.

Time	Odd Day	Even Day	Time	Wednesday
8:00 – 8:40	Advisory	Advisory	8:00 – 8:10	Advisory
8:43 – 10:41	Period 1	Period 2	8:13 – 9:47	Period 1 or 2
10:41 – 10:58	Nutrition	Nutrition	9:50 – 11:24	Period 3 or 4
11:01 – 12:59	Period 3	Period 4	11:24 - 11:54	Lunch
12:59 – 1:29	Lunch	Lunch	11:57 – 1:31	Period 5 or 6
1:32 – 3:30	Period 5	Period 6	1:34 – 1:45	Advisory
3:33 – 3:45	Advisory	Advisory	1:45 – 3:45	Teacher PD

Figure 2.2. Weekly schedule after the one-to-one program. Shortening lunch, passing time, and course instruction creates a second advisory period. In total, 52 minutes per six-hour school day are devoted to the non-instructional advisory period, the primary use of which is to distribute and collect tablets.

While the extra twelve minutes per day spent in non-instructional classes might seem

trivial at first glance, this administrative adjustment stands out for a few reasons. First, since the

school year for United Academic students is set at 190 days per calendar year by Home Office

(faculty and staff's nickname for the Charter Management Organization, Academy Schools), the

allotment of time for an afternoon advisory quickly adds up, resulting in a reduction of 38 hours

of class time over the whole school year, not including time already set aside for morning

advisory. Second, for the purposes of the present analysis, it is less the amount of time set aside

for non-instructional purposes that is of interest and more the mechanism by which a seemingly

inanimate object directs and orders complex behaviors by a number of actors. The finite resource

of time in the school day was redistributed (and, as the next chapter will show, the development

and daily deployment of an elaborate, labor-intensive routine was set in motion) because tablet computers required it, despite the previously elaborated organizational goal of increased class time. Such an alteration is pervasive, but hard to pin down from the points of view of teachers and students, who, once the new schedule had been mastered, barely registered that such a comprehensive intervention in the structure of their scholastic activities had even taken place. In the rush of daily life, this profoundly symbolic and materially significant change was absorbed into the cyclical ebb and flow of assignments, tests, assemblies, conferences, and meetings, the whole phenomenal now of high school life. This organizational change brought about in the context of the one-to-one program illustrates neatly the action and importance of infrastructure, how the putatively technical demands of the tablets themselves reconfigured some of the terms of classroom instruction and, as a result, reconfigured the fundamental terms upon which public education as practiced by Number Seven operated.

This chapter attempts to explain such action at a distance via a synthesis of two analytical approaches that have been profitably used by scholars to explore the institutional and social consequences of digital technology: materiality and infrastructure studies. Both of these approaches form part of a critical-material turn in social and behavioral sciences, a growing recognition of the "the importance of artifacts, natural forces, and material regimes to social practices and systems of power" (Mukerji, 2015). As I will show in the next section, these consonant approaches differ primarily in what they take as object. In the case of scholarship that visits questions of materiality, primary interest lies "below" the interface, within the black box of the digital technologies that have come to create, order, store, and structure the digitized traces of daily life, work, school, and communication (Blanchette, 2011). Materiality encourages scholars to correct a bias toward exclusive focus on interfaces, to challenge what Kirschenbaum (2008) calls "screen essentialism." Simply put, these works examine how the form and structure of

things give rise to a particular kind of unfolding in the world (Introna, 2006). Explorations attuned to the material nature of digital artifacts and the networks and actors that animate them stand in stark contrast to dominant discourses in popular, scholarly, and policy domains that disguise values, interests, and regimes of accumulation beneath a portrayal of information in digital form as vaporous, ubiquitous, or otherwise without physical or material presence. Infrastructure studies, by way of distinction, has been interested primarily in context, in the broader systems and networks that support the function of individual computers and computer-like devices in work places and labs, such as collections of desktop computers, routines of collaborative work, and the uneven distribution of authority and expertise in organizations. By way of synthesis, a critical sensibility, one that seeks to upend and overturn the supposed neutrality and passivity of digital technology, pervades both approaches. This chapter concerns itself with the various elements of the school's work infrastructure, particularly those elements that collectively formed the one-to-one tablet program, because, as I will demonstrate, these elements fundamentally shaped and configured relations between people and between groups of people. By examining the contests and contradictions that had to be resolved so that tablets and related technologies could function, this chapter demonstrates how the interests represented via the demands of infrastructure came to dominate and order parts of educational activity.

After establishing this theoretical framework, I will return to my empirical material and present interviews, field notes, and photographs to accomplish an "infrastructural inversion," that is to say, "shifting the emphasis from changes in infrastructural components to changes in infrastructural relations" (Bowker et al., 2010, p. 99). The story of Number Seven's experience with tablet computers is largely a story of contestation, conflict, and eventual détente around the consequences of decisions about infrastructure. This methodological approach, attuned as it is to Star and Bowker's (2006) "moving target" of infrastructure, borrows liberally from recent STS-

influenced analysis on the materiality of various kinds of information and media technologies. Before teachers could "do tablets" (a common verbal construction used by teachers to describe their work with the devices), they had to process curricular materials into some tablet-ready form. This work revolved around the manipulation and creation of documents in PDF format, a format that brought with it a number of demands, associations, and unforeseen consequences.

In the final section, I return to digital divide narratives and use the infrastructural analysis offered in the preceding sections to show how the one-to-one tablet program engendered logistical and ethical conflicts by conceptualizing public education as a purely informational activity, as the effortless transfer of pure information. I argue instead that any Digital Divide framing that discounts the action of infrastructure will unjustly burden the very communities that digital technology is meant to benefit.

LOCATING INFRASTRUCTURE STUDIES IN THE MATERIAL TURN

In this section, I proceed to build an analytical framework by mining scholarship concerned with infrastructure studies and more recent studies interested in materiality. While these approaches are certainly not synonymous, I argue that they are genealogically similar analytical techniques, both of which aim to pierce the ahistorical and apolitical discourse of digital technology, particularly as such technology is applied to knowledge production. As will become clear, the increasing breadth of computational activity — the sites where computers and computer-like devices are deployed; the ever-increasing variety of aspects of human life recast as computational problems; and the exponential growth in volume of those heterogeneous stores of information collectively called data — requires an attention to infrastructure and materiality, to the significant properties of computational artifacts and systems in complex action and movement.

Infrastructure Studies as Attention to Context

The primary move of the scholars interested in infrastructure in the fields of information studies, communication, science and technology studies, and other cognate disciplines is a shift in the key term infrastructure from noun to verb, from a concept of stuff to a concept of action. To illustrate such a shift, I begin with a lay view of infrastructure — what I will refer to later in this chapter as a commonsensical definition — as the artifacts and systems that support human endeavor. As Bowker et al. (2010) write, in a framing aimed at bringing the methods of infrastructure studies into focus

> The term "infrastructure" evokes vast sets of collective equipment necessary to human activities, such as buildings, roads bridges, rail tracks, channels, ports, and communications networks. Beyond bricks, mortar pipes or wires, infrastructure also encompasses more abstract entities, such as protocols (human and computer) standards, and memory (p. 97).

Using this traditional or commonsensical approach as a starting point, the authors argue against such a strictly object-bound definition, insisting instead that infrastructure is a kind of action at a distance, a pervasive and ongoing set of shaping activities at work in large-scale technical systems (p. 98). Methodologically, the authors suggest an "infrastructural inversion," a move "backstage" to watch how the production of a computer-mediated experience is made to happen:

> The question is whether we choose, for any given problem, a primarily social or technical solution, or some combination. It is the distribution of solutions that is of concern as the object of study and as a series of elements that support infrastructure in different ways at different moments (p. 102)

This dynamic and highly contingent view of infrastructure casts technological systems as relational, as that which orders the actions by and between humans. This metaphorical emphasis on mise-en-scène as an ongoing set of actions performed by objects will be a key point where we can later usefully contrast infrastructure studies with other critical-material approaches.

Nuancing the commonsense view of infrastructure as a substrate that blends into the background and a historical view that exclusively attributes to humans the ability to cause

change, Star and Ruhleder (1994) hold that "choices and politics" embedded in technological

systems drive action, a view that has inspired many subsequent ethnographic studies of

technological systems (p. 253). The authors dispute "mythologies of systems development," the

common, rationalistic view explicit in the assumption of top-down, hierarchical approaches to

technology common among designers of systems, who, implicitly at least, hold that "[a]ll work

can be observed and routinized, all information codified" (p. 253). According to this schematic

thinking, human behavior is reduced to a source of systems requirements and a set of

computational problems to be solved; any other aspect of organizational or individual volition

exercised outside the model acquires the status of problem or failure. Borrowing heavily from

Bateson's "ecology of the mind" and views of schizophrenogenesis, the authors depict

infrastructure as a category of technical objects that embody different contexts; these contexts

work on a symbolic and technical level individually but can produce insurmountable conflicts for

users when combined. Problems for users arise not only when a technical object fails to perform

as planned, but when a "double bind" arises, when the various contextual levels of use conflict in

ways that reveal their incommensurability or otherwise signal conflict between competing,

mutually exclusive but equally true premises that artifacts depend on to be intelligible at various

levels of abstraction (p. 254). These discontinuities disrupt communication and the function of an

organization such that they must be resolved in a series of tradeoffs, compromises, or dictates.

These conflicts are more than disputes about how machines work; they may be "disputes

between schools of thought" (p. 258)

Infrastructure studies then is deeply concerned with context and how the design of

technological objects and systems presumes and engenders particular kinds of behavior. This

interest manifests in an attention to conflict and breakdown, to moments of tension and

frustration for users. From the perspective of infrastructure studies, such moments are useful in

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that they make visible complex relations that under normal conditions are invisible. The mixed signals that users receive indicate tensions between interlocking systems of meaning, value, and ethics and provide an avenue for the analyst to make explicit the assumptions mobilized by artifacts.

Matter below the interface

To complete the analytical framework needed for the next section and to flesh out the critical material turn of interest to the current analysis, I turn now to a framing that emerges from a broad set of multidisciplinary works in cultural postmodern literary criticism, anthropology, media studies, communication, and information studies. These works tend to focus on some aspect of the digital, e.g., artifacts, platforms, formats, and so forth (Kirschenbaum, 2008; Sterne, 2010; Trace, 2011; Blanchette, 2011). These approaches are unified in that they are analytical, seeking to take apart some technological edifice to see how the way that something is built or organized conditions use, especially when the workings of the object are disguised or the object circulates as a self-contained black box. Materiality in this sense differs from the Marxist philosophy with which it shares its name in that it insists on no particular philosophical framework and does not concern any unified explanation of historical forces (Wolff, 2003). Much of the work on the materiality of digital artifacts and systems proceeds from questions first posed in postmodern literary criticism. Hayles (1999) recounts challenges to the liberal subject of modernism as a series of historical and cultural developments that stretch back to the founding of cybernetics. These developments proceed from "how *information lost its body*, that is, how it came to be conceptualized as an entity separate from the material forms in which it is thought to be embedded" [italics in original](p. 2). According to Hayles, from this disembodiment of information, this imbuing of the power to separate from any fixed medium yet remain intact, a number of other developments followed, culminating in a fundamental challenge to the

separation of humans and machines: "When information loses its body, equating humans and computers is especially easy, for the materiality in which the thinking mind is instantiated appears incidental to its essential nature" (p. 2).

In some respects, popular understandings of the functioning of digital computers would seem to uphold Hales assessments about information's loss of its body, about its reduction to a probabilistic choice between states, its equivalence to mathematical pattern, its abstraction to concepts of entropy and order (for example, Gleick, 2012). Information stored in digital form can often be seen as doubly immaterial, an ideal form beyond the physical plane itself composed of smaller and smaller invisible structures. To put the conflict that inspires Hales and many other scholars bluntly, we have to encounter digital information somewhere, but our most common understandings of how information operates allow it to be everywhere and nowhere at the same time.

Dourish and Mazmanian (2011) summarize scholarly interest in the material nature of digital information, stating

> the social world manifests itself in the configuration and use of physical objects and that the properties of those physical objects and the materials from which they are made — properties like durability, density, bulk, and scarcity — condition the forms of social action that arise around them" (p. 1).

The authors describe such an analytical approach as multidisciplinary and underexplored in the context of research on digital technologies and new media. The bulk of the piece offers out five potential senses in which the materiality of information could yield useful insights as a taxonomy of concepts: the material culture of digital goods, which concerns symbolic and cultural values of digital machines (p. 5); transformative materiality of digital networks, which focuses on informational infrastructures in the built environment (p. 6); material conditions of information technology production, which includes systemic questions of power, resources, and political economy (p. 7); consequential materiality of information metaphors, which examines the

rhetorical informationalization of social life, science, and knowledge production (ibid.); and finally, the materiality of information representation, which studies the ways that information can be interpreted, negotiated, manipulated and understood to represent and subsequently carry meanings (p. 8). The authors focus on two case studies of the final category (materiality of information representation) to explore the intersections of materiality and organizational research. In the first case, they illustrate the constraints and potentials of digital photography in an arts organization that erroneously presumed digital photography to be identical to analog film in the production and interpretation of images (p. 15). In the second, unpredicted changes to the result from substituting computer simulations for munitions in nuclear weapons research (p.19). What emerges from this dense and succinct survey and demonstration is the importance of materiality as an analytical tool, as a way of asking questions that unpack tightly bound and mutually reinforcing ideologies of information.

In a similar vein, Leonardi (2010) draws on communication, sociology, visual studies, management, and sociology in the context of directing theories of organizational change to consider "the artifacts that people use when communicating and interacting with others" (n.p.). In considering discourse, software, and rhetoric, he defines three senses of materiality: as physical substance, as practical (as opposed to theoretical) instantiation, and as significance, importance, or relevance. Leonardi summarizes ongoing disagreement among scholars as to the degree to which matter matters. On one end of this spectrum, it is argued that technology and machines shape human activity (such as work, play, or romance) through their properties and affordances, while another seemingly contradictory and equally valid position holds that physical objects are shaped and informed by social processes, particularly in design and use, and are only meaningful when applied to human endeavor. While the author does not resolve this conflict, he

argues, "Especially in the case of digital artifacts, what may matter most about 'materiality' is that artifacts and their consequences are created and shaped through interaction" (ibid.).

van Doorn (2011) seeks to dispute the common notion of the "digitally virtual as somehow separate from the material conditions of everyday reality" by emphasizing performances of gender and sexuality in digital environments that bridge both virtual and physical spaces (p. 532). The author carefully disambiguates ideas of the virtual, "a transhistorical ontological category that inhabits many different media and other technological objects" (p. 533) from the digital, e.g., computer-mediated communications such as MySpace, YouPorn, and Internet Relay Chat (IRC), in order to show the difficulty of maintaining any discrete boundary between an incorporeal, virtual plane and "the materially concrete" (p. 534). The author uses "materiality in the form of digital text or images" and shows how gender and sexuality "are reconfigured by the novel ways in which they can be visualized and enacted, which allows users to perceive them as virtual practices of becoming rather than concrete properties rooted in a stable physical body" (p. 536). Materiality in this work then focuses on digital representations rather than on the optical or magnetic media on which they are inscribed: hypertext, images, and other kinds of digital informational objects form the material basis for projections of virtual bodies, remediating digital documents into hybridized bodies and spaces. Although this approach to materiality differs from the previously mentioned approaches, it shares with them an interest in escaping a conceptual impasse, in this case, the physical and the virtual.

The main intellectual move of materiality as an analytical approach then is an attention to the features of technological systems and artifacts, to the significant features that constrain or promote particular kinds of use. Material approaches do not conform to any particular methodological convention, nor do they necessarily delineate any specific set of features that

might be relevant. Material approaches also accommodate a number of definitions of materiality (e.g., Kirschenbaum's (2008) articulation of forensic materiality, the always individual physical traces of digital objects, versus formal materiality, the way protocols act on data to display and compute). Despite these ambiguities, materiality provides an avenue to move beyond the powerful cultural and epistemological authority of media and information technologies into the messiness and unexpectedness of their function in the world.

Education Research in the Material Turn

A focus on the materiality of information and the action of infrastructure can provide needed insight into what has become a controversial debate over the mission of American public education, the suitability of digital platforms to this activity, and the economics of learning. Education research, owing to its focus on measurement, representationalist conceptions of knowledge, and reproducibility (Fenwick and Landri, 2012) has only recently focused on infrastructure, and primarily done so by looking at the use of objects instead of "how material objects themselves configure the classroom and the knowledge therein" (Roehl, 2012). Many education scholars have started recently to engage with materiality, with the properties of the various digital technologies incorporated into education research at various levels (Voithofer, 2005); however, since material approaches do not produce quantitative results, they are less prevalent in the complex and multi-causal production of education policy (Maroulis et al. 2010). European "sociomaterial" scholarship in education uses materiality to describe the inseparability of human and non-human agents and to question many of the assumptions of education research, in particular the ascription of agency exclusively to humans (Fenwick and Edwards, 2013). Chtena (2015) synthesizes several different definitions of materiality to address the relevance of materiality to education research. She identifies four dimensions of materiality of immediate

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relevance to education research: performative interface, or the horizon of possible interaction

created by the design of interfaces; material constraints, such as limits in bandwidth or storage;

materiality of information traces, such as records or data created by educational software; and

materiality of cognition, the way that objects and things play a part in thinking and learning

(ibid.).

Education scholarship that engages with material or infrastructural approaches has started

to emerge in the international context, especially around development work and global

initiatives. von Davier et al. (2013) visit developments of large-scale assessments (LSAs), tests

and data collection instruments meant to establish measurement across populations, as indicative

of international interest in the development of human capital. They write, "[N]ot only have we

seen an expansion of who is assessed in terms of the range of participating countries and

populations within those countries, but international large-scale assessments are also broadening

the horizons in terms of what is being assessed" (p. 5). This observation provides empirical

verification for what has become a contentious issue in American public education, the

proliferation of standardized testing in all its various guises[3]. It is precisely such approaches that

Anagnostopoulos et al. (2013) address in an edited volume that orients education research toward

the contextual approach of infrastructure studies. The authors describe the prominence of LSAs

and the production and circulation of data for accountability regimes of various kinds. Critically,

the authors point toward an ecological approach to understanding education infrastructure, to the

idea of the action of a heterogeneous assemblage that could include at a given time such entities

as data, analog tests, teaching practices, community feelings, bureaucratic edicts and so on, all

working in concert. They argue for an attention to infrastructure as a means of reasserting

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[3] A fuller discussion of how tablet computers figure into discussions over the growth of standardized testing can be found in Chapter Four.

democratic control over a public education system that, by means of appeal to data that claim to be objective, apolitical, and scientific, is being redefined and transformed.

Synthesizing these two previous approaches, Sellar (2015) situates the action of various types of infrastructure as the establishment of a kind of rhetorical hierarchy, a super-authority that subsumes local or even national autonomy. He suggests the growth of education data infrastructure in particular is increasing in scale, scope, explanatory power, and algorithmic complexity:

> The rapid analysis and usage of these large quantities of data will require increasing automation of data processing, as we have seen in other areas such as financial trading and Internet searching. As a result, a degree of control is gained by algorithms in relation to data-driven decision-making in ways that are not always visible, and potentially not readily comprehensible, to the human actors who use and are affected by data processing systems (p. 773).

Material approaches to education are not only theoretical: they have also informed empirical analysis of education, emphasizing the local, situated character of learning environments and infrastructures (Soffer, 2016). For example, Monahan (2008) takes a unique approach to documenting the material information technology infrastructure of public education in Los Angeles; in this framing, infrastructure refers "to the technological assemblage required for Internet access (e.g., computers, software, cables, switches, hubs, electrical outlets, security systems, air-conditioning systems, furniture, and so on) and implicitly to the social components necessary for those systems to 'work' (e.g., funding, policies, curricula, incentives, training, technical staff, contractors, etc." (p. 89-90). Using participant observation at public schools under construction, semi-structured interviews, attendance at board and committee meetings, and physically shadowing "buildings and school sites as newer technological systems are integrated with them" the author illustrates the messy, unfinished, uneven and problematic terrain of technological infrastructure in schools. The author begins his work with a quote from a school administrator who, based on as assertion of the immateriality of information, offers as self-

evident the fact that information, and therefore education, wants to be free. It is against this sentiment that the author struggles, shrewdly and movingly presenting nine photos of the cognitive, logistical, educational, and economic disruptions posed by a technology commonly understood to be immaterial, cheap, and ubiquitous: "The disruptions at school sites, the labour conditions for technical workers, and the dystopian visions of students each represent folds in this emerging paradigm of post-Fordist production, folds that cannot be seen without delving into the messy materialities of technological systems on the ground" (p. 99). Monahan depicts a world of glaring inequalities and power differentials manifested in material forms: in security gates, metal detectors, control rooms, bundles of wires, loose cables, and malfunctioning equipment. This work uses materiality analytically to reveal the rhetorical nature of the idea that information flows through technology effortlessly and that more technology equates to greater educational access and greater equity.

Monahan's work chastens advocates of a frictionless, immaterial infrastructure that provides access to education for all with a strategic use of photographic documentation. He usefully incorporates a dimension of political economy as well, questioning the position of IT workers and educators within the broader economy and showing how their economic fortunes sink when the costs of fixing information in digital form are ignored. This approach requires that we look at (in the most basic sense) the position of educators, students, and IT workers when we consider technology as the solution to problems of equity of access.

The preceding section contrasts the approaches of infrastructure studies and materiality and shows how both are beginning to be incorporated into scholarship that investigates information and media technologies deployed in public education. These studies should not be taken a single methodological blueprint, but as a family of analytical approaches to problems posed by popular conceptions about information, especially information in digital form. These

approaches ground discourses around information, access, education, digital divides, and emergent technologies in empirical methods, in the messy realties of technology, and provide a means to avoid being swept up in ideological and propagandist framings that elide important distinctions. Ethnographic, photo documentary, and historical methods can be sharpened with attention to the physical, instantiated, significant properties of digital objects and infrastructure.

GOING BACKSTAGE WITH TABLETS

The one-to-one tablet program began in September of 2013; STLs and Home Office staff distributed tablets to students on November 18, 2013. Over the remainder of the school year, school administrators, teachers, and STLs developed systems to count, store, charge, repair, and configure student tablets, a variety of activities not directly related to instruction or instructional design that had to be planned, executed, and routinized after tablets had been distributed to students and staff. In the weeks that immediately followed the distribution, school staff and STLs scrambled to respond to a number of unforeseen problems, many of them related to the needs and systems requirements of tablets. It is difficult to capture the confusion and fevered activity that accompanied the tablet program for over six months, a period of time Ms. Quezada simply referred to later as "The Chaos." The difficulty of implementing the tablet program took a toll on Ms. Quezada, who took several months off starting in September 2014 for stress-related health problems.

The instantiation of this one-to-one program immediately posed a number of paradoxes to the outside observer that, although accepted completely by participants within the single school studied, illustrate the complexities of infrastructure in action: the immobilization of mobile technology through technological, bureaucratic, and physical means; the simultaneous apprehension of student users as computer illiterates and capable hackers; and the conception of information technology as a readily accessible, formless ether that is none the less beset by an

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unyielding stream of disruptions, distractions, and technical difficulties. Yet by the end of the second year, the devices had achieved the status of the mundane, the conflict and difficulties they had inspired in the work of teachers largely absorbed into the rhythms of school life. In some sense, tablets accomplished the feat of receding into the background of the school, such that Ms. Crause, a resource teacher, could say of students in April of 2015,

> Ms. Crause: The novelty of the iPad wears off within a couple of weeks and so they grow very, almost unappreciative of technology. It's just another item to them. They don't see it as a tool; they don't see it as a privilege. They almost desensitize to technology.

It is easy to understand how Ms. Crause's students might stop seeing the tablet computers that they encountered daily. Despite the powerful meanings that they carry and the feelings they evoke, technological objects have a way of receding from consciousness, of slipping back into an unobtrusive, background state. We stop seeing digital things so easily: that's part of what makes them powerful. The "infrastructural inversion" offered in the next paragraphs then should be taken as a figure ground reversal rather than a formal principle components analysis, a depiction of the action of technological systems and objects on the school and its communities as it happened, a way of bringing attention to what is always receding from view.

After an exploration of this story's dramatis personae that follows, I will describe the state of the computing infrastructure of the school during the two-year timeframe of my study in the mode described by Bowker et al. (2010), as an inventory of objects, actors, and their interactions, as a dynamic set of artifacts and their consequent enactments. With attention to the slipperiness of the object of infrastructure in mind, I will attempt to define those elements needed for the school to perform its function, to the aspects of "work infrastructure,' work here combining the daily routines of teachers, students, and administrators with those artifacts that become continuously, unconsciously ready-to-hand (LeMahieu, 2015, p. 474). Finally, after describing the relevant devices that were already in the school before tablets arrived, I will

explore some feature of the tablets themselves. This setting of the scene will allow me to go "backstage" as it were, to shift the analytic gaze from a simple listing of objects toward some of the ways that artifacts and technological systems could be seen to shape daily life through the work of teachers and their creation, use, and circulation of tablet-ready curriculum.

Stakeholders

Infrastructure projects suffer when attention to the concerns of stakeholders is neglected in planning (Enserink, 2000). I begin my description with the key stakeholders in the school. Borrowing again from Star and Ruhleder (1994), my approach rejects a simple framing of a technology project of this sophistication as a failure or success, but instead seeks to explain how workers in complex institutions are situated partly by the technological artifacts they use, but also by their professional roles. Here I am mapping Star and Ruhleder's approach to the study of academic scientists in a collaborative research project onto a public school, onto Number Seven specifically. The stakeholders included here are students, teachers, administrators, the community, the CMO, and the market, including people who worked selling things to Number Seven and the larger commercial field in which they operate. Admittedly, such a listing of key stakeholders and their various motivations and interests represents an alternative policymaking framework than that employed by the Academy Schools, which essentially decided what technology would be used without consultation.

Students

According to the information sheet provided by the school's website,

Number Seven is a 9th through 12th grade independent, public charter school, founded in 2007 by United Academic, Charter Management Organization. All students at Number Seven take college-preparatory courses and are held to high expectations. One hundred percent of the students are enrolled in college-preparatory courses that meet the University of California and California State University's minimum "a-g" undergraduate admission requirements. We are fully accredited by the Western Association of Schools and Colleges.

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The number of students in the school varies largely due to transfers in and out by individual students, but hovers around 650, the maximum number of student bodies legally allowed in the building as determined by Home Office's interpretation of its charter, fire safety laws, and educational guidelines. To review, most students at the school are Latino and come from Spanish-speaking families. In the 2013- 2014 academic year, Number Seven reported a student population that was 89% Latino, 10% African American, and less than 1% white, Asian, or Native American, although this small number likely indicates the mixed ancestry of students also represented by other demographic categories; similar statistics for the following school year were not yet available, but by all accounts should be unchanged. 98% of students at the school qualify for free lunch and nearly 89% speak a language other than English in the home. The families of students must complete an application to apply, a four-page document that includes demographic data about the family and the student as well as education history. Students and their families must sign this application, which includes language about expectations for parental involvement, reserves the right for the school to require additional courses for students (such as afterschool or weekend tutoring), and lists a number of rules for behavior and dress. Students and their parents or guardians must also sign a separate contract governing the use of tablet computers and assuming financial responsibility for broken, lost, or stolen tablets.

Figure 2.3. A bin used to store confiscated student phones during the day. Although phone usage by students is forbidden during school hours, the widespread ownership of smartphones made such a rule unenforceable. Instead, teachers went after egregious violations and made a show of occasionally confiscating phones, or, in cases when a student's behavior came under scrutiny, inspecting phones for evidence of other kinds of misbehavior.

Students were presumed to be without adequate access to technology by schools administrators. The level of home technological access of students is difficult to measure, although the school itself made no attempt to determine what kinds of technology or broadband access students had at home, preferring instead to assume that students had no access to computers or broadband outside of school at all, an assumption shared by all the teachers I

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interviewed. Students were generally not required to complete homework assignments that involved Internet or computer access. If a teacher wished to assign homework, all required materials would have to be delivered in printed form. Although I initially included questions about home technology access in interviews with students, several teachers warned me that students might not be honest in responding to these questions, since lack of computing resources or broadband Internet at home would indicate that a student's family was poor. Despite this widely held view, many students had smartphones. Although cellphones are technically forbidden during school, every student I interviewed had a smartphone; smartphones are ubiquitous and are on display whenever students are not directly supervised by teachers (and many times when they are). Critically, students are not allowed to use any outside computers or computer-like devices while at school. Students who owned laptops or tablets were forbidden to use them during school hours, under penalty of referral to Principal Montoya, ultimately enforcing a vision of lack of access by rulemaking.

Teachers

The school consists of up to 47 "instructional staff" (at the time of writing), approximately 30 of whom are full-time teachers with a designated specialty that corresponds to a specific credential, a special license given to teachers of a given subject (e.g., math, history, and so forth) and administered by the Commission on Teacher Credentialing, a part of the executive branch of California's state government. Credentialing is itself a long and complex bureaucratic process that can be implemented in a number of ways. California teaching credentials are relatively hard to acquire (as compared to other states) and require masters-level education as well as some ongoing, continuing education later in the career of a teacher. Betts et al. (2000) show that in California, schools that serve poorer neighborhoods have fewer

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credentialed teachers per student than do schools that serve more affluent communities. Of the roughly 30 teachers at Number Seven, three are not professional teachers, but are hired as permanent, on-site substitute teachers (they lack the graduate education and credentials of their peers) and float from class to class to cover for absent teachers as a cost-savings measure. During each school year, at least two teachers were Teach for America corps members, graduate students without credentials in training to become professional teachers. A psychologist and a speech pathologist, both employed by the school district, pay regular visits to the school: their work week consist of a circuit of schools operated by the CMO, so they divide their work week between several campuses.

Three teachers are designated as Resource teachers. Resource teachers are credentialed to work with small groups of low-performing student who have each been assigned an Individual Education Plan, a document created for students with certified learning disabilities that includes information about services, assessments, and timelines. Resource teachers work in several modes throughout the day and are attached to particular students, either in small groups or embedded with their student cases in larger classes.

Two full-time college counselors monitor the college applications of all students, a process that proceeds in stages over each successive school year. College counseling is a central activity of the school, one that distinguishes Academic United's particular brand of charter; both counselors hold a Pupil Personnel Services credential.

Teachers then vary in terms of education and experience, but every full-time, permanent teacher has or is in the process of finishing a graduate degree. In contrast to their formal education in teaching and subject expertise, teachers were not offered professional development in using tablets for teaching, operating software, or adapting analog lessons into tablet-ready formats. Of all the teachers I observed and interviewed, only two reported receiving more than

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an hour of training in the use of tablets at any point before or after the school-wide distribution; in fact, during the entire two years of my study, only Ms. Quezada, the school's Technology Coordinator, reported having more than three hours of training in the use of any form of digital technology. As Mr. Craig, a history teacher, described the ad hoc nature of the implementation, "[I]t's kind of hard to build from scratch and integrate a constant student technology, but here we are...I think the whole process is kind of a learn-on-the-go thing." Mr. Craig's assessment of the program, of it's tempo and its profound influence on the moods and sensibilities of teachers, was a common theme in my interviews.

Administration

The administrative staff consists of the school's principal and three assistant principals, as well as various other school employees who support the teaching staff. Principals exert a strong and direct influence over school culture. Owing to their managerial style, the compact size of the campus, and their ability to supervise their non-union teachers in nontraditional ways, principals at Number Seven are incredibly active and visible. Principals are required to maintain a teaching load of one class, although in practice, the more senior staff, the principal and vice-principal, do not. Additional administrative staff include three security guards, two hall monitors, a porter, a copy clerk, four receptionists, an accountant, and an administrative assistant. In the second year of the program, a dedicated IT person was hired, but his work was never fully integrated with the tablet program, perhaps because the routines of work with tablets had already been established prior to his tenure.

Administration at Number Seven, keeping with Academy Schools' brand, can be heavy-handed. In accordance with the overall political argument of the charter school movement, Principal Montoya and his staff operate as mangers of the work of teachers and have adopted a number of white-collar workplace techniques for the purposes of administering teaching in

school: these include regular emails, reports, meetings, and performance reviews. Additionally, school administration uses techniques more traditional to public education: faculty meetings, grade reports, parent-teacher conferences, and so forth. Administrators also roam the halls of the school and monitor the school's sole entrance, acting as security guards.

As one teacher described school administration

Mr. Tyler: It took me a while to get used to it. I'm not used to working somewhere where there's so much yelling. I know it's about discipline and all the stuff they say about how this school is supposedly so much better, but the way I was trained, you don't yell at a kid. You talk to them. You find out what is wrong with them, if they need something. You certainly don't yell at a teacher. Dan [Principal Montoya] is great; he's a friend. But it's just something I don't like about how they do things around here.

The community

The community consists of families and institutions involved in the school and in the South Park neighborhood. South Park is a part of South Los Angeles, the largest division of the city of Los Angeles; local media often use the term South Central Los Angeles as a blanket term to specify the black and Latino parts of the city south of Interstate 10. The South Park community includes parents, neighbors, a Catholic church, and a branch of the Los Angeles Public Library (Number Seven, the church, and the school occupy three corners of an intersection, the fourth being a parking lot sometimes used for gym class or for special school events). South Park, Los Angeles is a lower-income, primarily Latino neighborhood. According to recent census data analysis by the Los Angeles Times, the neighborhood is 78.6 percent and 19.2 percent black (Los Angeles Times Data Desk, 2009). Relative to the Los Angeles metro area as a whole, South Park is demographically homogenous, consisting almost entirely of black and Latino residents. The median household income of $29,518 is low for both the city and the county. The population density and the ratio of single-parent families are among the highest in the city and county; average age and educational attainment are among the lowest (ibid.).

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Many teachers chose to work in the school out of concern for underserved communities and a personal, explicit commitment to social justice. As Ms. Quezada described the attitude of herself and other staff to the community, she expressed this interest as a norm, as an aspect of the school's culture:

> Ms. Quezada: We're in South Central so these kids have a lot of baggage, a lot of background issues. From their family homes to their poverty levels, things like that. So, the unique thing about our school is that we care. We're willing to go above and beyond for the kids, outside of just the education point of it. There is always a limit that we know, we're always concerned with legal limits and stuff like that. But, it's not unusual for Montoya to give the supplies or for a teacher to provide the supplies. It's a norm here.

Lower rates of home broadband access are correlated with lower socioeconomic status, lack of legal immigration status, and residence in South Los Angeles; additionally, Californian black and Latino households have lower than average rates of home broadband access (Baldassare, 2013). These statistics would support teachers' assertions that many students did not have home Internet access.

Figure 2.4. A view of the school courtyard during Parents' Night. Local community organizations, including government organizations and private non-profits, use the school to reach community members, many of whom are undocumented and/or do not speak English. The school has ben used as a hub for consumer boycotts, insurance exchanges, community health workers, drug and alcohol abuse counseling, English language courses, and computer literacy classes aimed at the parents and families of students rather than students themselves.

The Charter Management Organization

Academy schools are centrally managed in a manner that intentionally evokes

associations with corporate governance rather than a traditional public school board: according to

the CMO's website, "Our Board defines and implements key non-negotiable parameters that

define the Academy brand of schools. These parameters cover both the educational model and operational dimensions." According to their most recent annual report, Academy Schools is non-profit, legal entity with assets over $900 million.

The Senior Leadership Team consists of nine positions: President and Chief Executive Officer, a Chief Financial and Operations Officer, a Vice President of Real Estate and so forth. A Board of Directors composed of roughly 25 Academic executives and representatives of industry brings, "leadership and experience in education excellence, charter school management, leadership development, finance, operations, politics, community engagement, law, and fundraising." In general, the CMO and its various constituent bureaucracies set policy and exercise oversight over all of their local schools, acting primarily through Principal Montoya; few teachers reported any direct contact with the CMO.

Home Office exerted strong control over many aspects of the one-to-one program, including deciding what kind of hardware to buy for the initial phase and configuring the schools wireless network and Internet connection. Home Office staff came to the school on the day of the first distribution, but afterwards, IT work became the responsibility of the school, delegated to Principal Montoya, then to Ms. Quezada and her STLs. In the day-to-day operations of the school, the CMO and its delegates are not physically present, although the Principal continually interprets and implements Home Office policies.

Academy also asserts strong quality control over class education. Each classroom displays posters and other visual materials that display Academy's values. Each of the permanent classrooms also features Academy-branded teaching materials. For example, classroom whiteboards are always divided up in a series of grids that correspond to different activities to be accomplished during a class period. At the start of each class, students are to begin working immediately on an activity in the upper left corner of the board labeled "Do Now." In this way,

students are conditioned to begin classwork as soon as they enter a classroom rather than talk or visit with neighbors. Teachers differed in how closely they hewed to the routines required of them by Home Office, but they risked discipline if they deviated.

Markets

Ed-tech denotes a rapidly expanding sector of the digital economy that consists of the makers of an incredible diversity of technological products and services used directly or indirectly for educational purposes by both institutions and individuals. Ed-tech includes hardware and software makers, notably Apple and Google, the first and third most valuable tech brands in the world at the time of writing. Ed-tech differs from traditional education publishing in that it blends novel software and hardware products with brand identity reminiscent of Silicon Valley and startup culture (King et al., 2016; Culp et al., 2005). Ed-tech also differs from traditional scholarly publishers in that companies distribute software products in particular in the mode of consumer software purchases: via download and extensive use of contracts (ibid.). This mismatch between the relatively settled area of intellectual property law and the potentially more restrictive realm of commercial technology development can be illustrated by the numerous lawsuits that erupted over LAUSD's purchase of tablet computers and software, which was generally viewed as having needlessly and expensively ceded some its bargaining strength to technology companies (Gilbertson, 2015). The sector includes manufactures of hardware (such as Apple) who sell versions of their computers or devices to public schools, colleges, or universities; makers of software or general purpose productivity tools that can be used in schools (such as Google or Microsoft); producers of topical apps that implement specific teaching techniques (Quizlet, Khan Academy, or Lumosity); and enterprise-level course management of recordkeeping systems (DataDirector or BlackBoard, for example). As the variety of purposes to which computers systems are put to use in education continues to grow, so too does the value of

this sector. At present, the federal government does not track the overall size of the industry, although the Department of Education will begin publishing statistics related to the sale of technology to publicly funded schools later in 2016. An industry group calculated the size of the market to be over $8 billion in the 2012-13 school year, with an annual growth rate of over 10% (Chen, 2015). Ed-tech companies develop tools and features that can be modified for specific school districts or university systems, as well as turnkey solutions that can be adopted in a single class without modification. Ed-tech companies deal with sensitive user information (grades and the personal information of minors, typically) and have little incentive to develop interoperability in their products and services. To the contrary, they have significant incentive to develop ecosystems that lock in users and keep data captured in their products within a manageable pipeline.

While there are several explanations for the steady growth of the ed-tech sector, at its base, such rapid expansion relies on a growth in demand. Schools and universities are more willing to purchase computers and software and to purchase them more rapidly, without the lengthy bidding and research processes that have traditionally accompanied academic purchasing and provisioning. Ed-tech companies have also formed partnerships with technology companies that aim to quickly bring new products into schools so that they can be improved and marketed more broadly. For example, Academy Schools employs a Director of Innovation and Technology tasked specifically with creating and managing technological interventions in teaching, including the one-to-one program. Such a close relationship with technology companies allows Academy Schools to compete with other school districts for students, to position itself as technologically sophisticated (as indeed it does via its website and promotional materials).

School staff, faculty, and students interact directly with ed-tech in a variety of ways that are quite novel: the use of technological devices quite literally brings the market closer to

education, inserting it directly into schools via a number of interfaces—log–ins, service-level

agreements, and so forth. While the CMO makes decisions about district-wide technology

purchases, the school principal makes others, classroom staff can decide on other kinds of

purchases, and even students themselves can opt to purchase apps or in-app purchases for study

purposes. This produces unique risks for individual users. As Blanchette (2015) writes

> The take-it-or-leave-it approach to many providers' service-level agreements (SLAs) as well as the embedded and automated functionality of many Cloud services (Apple's iCloud being a prime example), conspire to produce an environment in which consumers experience many new and unfamiliar risks, often with minimal or confusing control over the parameters of their participation (p. 14).

Various sales agents visited the school throughout the program, these visits forming yet

another mode of customer access. Principal Montoya's control of the school budget gave him

latitude to purchase many kinds of technology from sales agents, who routinely visited to sell or

service various systems. The few teachers who reported receiving training in the use of tablets or

software credited this training to these agents, who earned a commission on whatever equipment

or software packages they sold to the school. On June 5, 2014, I attended a meeting with

Principal Montoya, Ms. Quezada, and several students. At this meeting, a sales representative

brought a few different models of tablet computers to sample; students tested each and asked

questions. At the end of the hour-long meeting, Principal Montoya ordered a set of tablets for

seniors to use, since they had not been included in the first year of the program. Based on this

meeting, Principal Montoya committed a significant portion of the $65,000 he had budgeted for

devices for seniors. In another instance, I watched an English teacher negotiate the purchase of

an app she wished to use in her class over the phone, on her lunch break.

Work infrastructure

Having identified some key actors in the school's use of technology, I turn in this section to

some of the technological components of the school's work infrastructure, first by a fairly

straightforward inventory of space and facilities, including those computers and devices already present at the time of the one-to-one program's implementation, then via a more detailed look at the make and model of the tablet used most frequently and its various features.

Computers

For technologically advanced projects, a set of laptops for student use predated the tablet program and could be requested by teachers for particular in-class activities. Over the course of my study, Number Seven maintained two carts of twenty-five laptops each, enough laptops for two classes (Apple A1181 Macbook 4, 13" LCD Core 2 Duo (T8100) 2.1GHz 2GB Memory 120GB HDD). These computers are several years old and incompatible with newer versions of Mac OSX. They are also incompatible with some kinds of state-mandated testing sites or software. Teachers generally did not request laptops for daily instruction, but did use them for special activities they had planned. I mention these laptops here to establish that many kinds of technology were already in use before the one-to-one tablet program and continued to be used throughout. It also shows that, previous to the one-to-one program, teachers were required to prepare course materials without the presumption of individual screens. Typically, teacher projected or printed slides to lecture from and collected work in paper form.

Space

Most teachers worked in a single classroom throughout the day, although some classes met in hallways or outside. Three resource teachers shared a single room. Visiting professionals, such as speech therapists, psychologists, social workers, and probation officers share the Resource room. Many teachers mentioned lack of space as an obstacle to overcome in the execution of their professional duties. Ms. Crause, quoted earlier in this chapter, explained,

> It's kind of intuitive to believe that non-public schools are far more supportive of the work place environment than charter or public schools are in terms of just getting materials, access to space, but they are far more supportive in that area. Here it's very difficult to find space, to find materials. I buy lots of my materials. I got kicked out of my classroom for another classroom. I was put in a

classroom in September and then they kicked me and my kids out and put us in the hallway. So I had to make a classroom in the hallway, which wasn't very conducive to learning.

Students and teachers may access one of five Internet-enabled iMac computers in the media center by permission of a teacher or counselor. The media center is reserved for the use of students in completing college applications and all college application-related computing needs are given priority over every other kind of use, including schoolwork. As Ms. Archer, a counselor reported, the lack of available screens proved problematic in terms of college applications: she ran short of computers and had to come up with novel workarounds to get all her seniors to complete mandated college applications, a situation that will be discussed at length in the next chapter.

Although not every teacher is assigned a classroom, every classroom teacher in the school is given a laptop computer, Internet access, and an email address. Each of the main classrooms has an Apple TV and a digital projector, an Epson Smartboard (BrightLink 595Wi Interactive WXGA 3LCD Projector), and speakers. The Smartboards can connect wirelessly to a teacher's laptop or may be switched to accept other inputs, such as a document camera or the Apple TV. Teachers use the Smartboard to project slides of lectures, watch video content of various kinds, or, in rare cases, to project the contents of a student computing device. The Smartboards can be controlled by a stylus that draws digitized marks on projected images. Teachers can also write on the projection surface itself with dry erase markers and often combine various modes of inscription, projections, and drawing in elaborate, multilayered images that they work from for several days. For example, a history teacher, Ms. Merton, projected a map over a dry erase board. In an extended exercise, she had students color the projected map with dry erase markers and color paper versions of the same maps with colored pencils. Later, she used the stylus to circle and draw on the projected map image. In this way, each classroom developed complex visual information for students, which constituted the bulk of curriculum that

I observed and formed the basis of what became the emergent norm of instruction that I will visit later in this chapter.

There are few built-in closets at Number Seven. While it may seem trivial, the space needed to store the tablets themselves proved hard to manage. To store and charge the tablets (and sets of classroom laptops as well), specialized carts were purchased, one for every permanent class and one for the office, a total of approximately 25 carts. During periodic maintenance or inventory of carts, STLs would bring all the carts together, a procedure that made a single classroom unusable for the duration of that activity. At the end of the year, the carts were removed from classrooms and lined up along the second floor corridor.

Figure 2.5. A row of iPad carts lined up along the upstairs hallway. In normal use, these armored charging bays would take up a corner of an already crowded classroom. They must be placed near an outlet; only STLs and Ms. Quezada are given keys o these carts so that teachers will not lose or misplace any of their contents. Photo by Ms. Quezada.

Administrative technology

The school itself has a variety of technological systems in use at the time of the tablet implementation. These include closed-circuit television cameras and monitors, a public address system, and PC workstations for office workers, and a dedicated laptop that serves as a log book for school visitors. Students and teachers also have access to two digital video cameras, which are used to produce a student-run YouTube channel. Each principal (that is, the principal, the

vice-principal, and the three junior principals) have an office, a laptop, and a hand-held, portable

two-way radio receiver.

Figure 2.6. Unboxing the iPad Air (A1474, WiFi/Cellular – 1st Generation) by Apple. Image by inUse Experience via Creative Commons Attribution 2.0 Generic (CC BY 2.0), https://creativecommons.org/licenses/by/2.0/legalcode.

Tablets

The one-to-one tablet implementation itself consisted of a tablet computer, software in

the form of a set of apps, and a protective carrying case for each student, with the exception of

seniors, who, for the first year, did not participate[4]. The model of tablet purchased for the

school's first installation included roughly 500 Apple Air tablets. The iPad Air (model number

A1474) originally ran Apple's iOS version 7[5].

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[4] As the LAUSD program floundered, Number Seven actually expanded its tablet program, purchasing a second model by Asus that was used exclusively by seniors in the second year of my study.
[5] Full technical specification of this model are available at http://ipadwiki.com/ipad-technical-specifications/tech-specs-for-the-ipad-air-a1474-wifi-cellular-1st-generation/.

Tablet computers differ from traditional PCs in several ways, including input/output, operating system, accessories, and software:

Input/Output. Tablet computers operate via a gestural interface, a system that reads movements of the body. A touch-sensitive screen doubles as mode of input and display. The design of this interface inspired significant consumer and media interest and incorporated concepts developed in industry and academic research into graphical user interfaces from as far back as the 1960s (Myers, 1998). The tablet interface operates without a mouse or other kind of pointing device, relying instead on a series of gestures to interpret user commands (e.g., swipe up/down to scroll, pinch to zoom, and so on). This gestural mode of input relies on a set of user behaviors that are considerably less established than older input methods and can produce significant dissonance with more established and standardized modes of input (Norman, 2010). Numerous media outlets cited the lack of a keyboard as inherently problematic, particularly as the devices were meant to teach high school English, including composition and certain state-mandated exams requiring keyboards (Blume, 2014).

The device connects to power or individual computers via a proprietary cable (the Lightning connector). The tablet also lacks common ports for physical connections such as USB, Ethernet, SD Card slot, or other kinds of data transfer. Output on the device is limited to the screen and the single Lightning data port (although printing options can be configured, no printing option had been configured for tablets at Number Seven). The relative difficulty of printing from iPads has been of interest to the business community (Faas, 2012). Several teachers in my study addressed this lack of support as a positive feature, referring to a desire to use less paper for environmental reasons or responding to a culturally powerful vision of "paperless" office work (Humphry, 2014). Curiously, all of my interviewees made references to paper, although my interview protocol did not ask any questions specifically about that medium.

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The configuration of inputs and outputs on an iPad prioritizes network connectivity. Installing software, sharing files, or running software often requires an Internet connection: no other means of getting needed data objects onto or off of the tablet exists. As a result, iPads are voracious users of bandwidth. Recent guidelines of student broadband network connectivity suggest a minimal level of upwards of 100kbps per student, but this robust requirement predates the one-to-one program. Presumably, broadband needs increased greatly with the introduction of over 500 new computing devices on a single day. Technicians from Home Office configured the schools network routers, then locked the equipment in a rack that local school staff could not access for fear of service interruptions. Throughout the length of my study, access to the school's Wifi network was unreliable in many classrooms. The school's courtyard, where many classes took place, was out of range of Wifi. While many complaints were made to Principal Montoya and Ms. Quezada, Home Office did not relinquish control of that resource to the local level.

Operating System. iPads run Apple's iOS operating system, first developed for smartphones. The tablets came with iOS version 7 and were updated to version 8 in September of 2014, one year after the initial distribution of student tablets. The operating system functions as an interface for the operation of the device, from which users access various applications (apps). Unlike the familiar metaphor of the desktop, with its draggable folders and skeuomorphic representations of common office implements such as sheets of paper and trash bins, the iOS operating system offer users few opportunities to copy, move, or delete files, Instead, file management is delegated to apps, individual software environments that access aspects of the device using various abstract layers of the tablet (e.g., the network layer, the device layer, the operating system layer, and the app layer) (Grimmelman, 2011). As with desktop computers, each layer constitutes a different abstraction of the type and volume of material resources the device can draw on in the execution of commands (Blanchettte, 2011).

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Accessories. Tablet computers also include a number of hardware and accessories. Notably, the iPads included two cameras, a front-facing and rear-facing camera. The tablet also features dual microphones for recording audio. The cameras, although standard with the devices, were almost immediately disabled by Ms. Quezada using the schools' device management system[6], because they were deemed disruptive. As Ms. Quezada put it, "The selfies were out of control." If teachers wished to use the cameras for instructional activities, they had to make special arrangements with Ms. Quezada, who would grant student access to the cameras for a specified, limited time. iPads also contain a number of sensors, a microphone, and an accelerometer, all of which can be accessed by specific apps.

Software. The tablets included a suite of standard apps, but immediately students and teachers added more. Although schools have been eager to include tablets, educational software development has lagged behind hardware development (King et al., 2016; Murray and Olcese, 2011). The number and variety of apps changes constantly throughout the study, as both teachers and students requested more software. The amount of software (i.e., the number of individual apps) and the overall size of these apps and their data (i.e., the amount of Flash memory used on a device) increased over time. By the end of my study, over 37 different apps were in use on tablets[7].

This particular configuration of resources in the design of the tablet also adds another institutional component to the use of apps and software: tablet computers rely on an entirely closed, proprietary system to distribute software (Basole and Karla, 2012). Apps for tablets must be vetted and distributed exclusively by the iTunes store. Apple is the sole authorized point of sale for iPad software, which may only be installed at the factory or via download from an

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[6] Software, including the school device management and surveillance solutions, are discussed in Chapter Four.
[7] For a fuller list of apps in use as of May 2015 see the Appendix.

approved iTunes account linked to a valid form of payment. iPad software is subject to app store

approval, a process that has not fully been disclosed by Apple, but includes questions around

content, design, and functionality (Ugus, 2012). In exchange for access to its customers, Apple

keeps 30% of the total price of every app it sells and 30% of all in-app purchases. This control

over access to customers is common to tablet computers: the Google Play store serves a similar

function for Android devices, as does the Microsoft App Store for Windows Mobile devices.

Critically, students were forbidden to log in to the App Store using individual accounts they had

set up outside of school: school tablets used the Profiles feature to configure specialized

credentials for students that eliminated the ability to download or purchase software or media.

Ms. Quezada decided what software would be installed on student tablets (based on teacher and

student input) and "pushed" this content to tablets via the Profiles feature and an enterprise-level

device management system produced by JAMF Software. Some apps come pre-installed and

cannot be removed, even if they are not in use, for example, the Camera and Photos app.
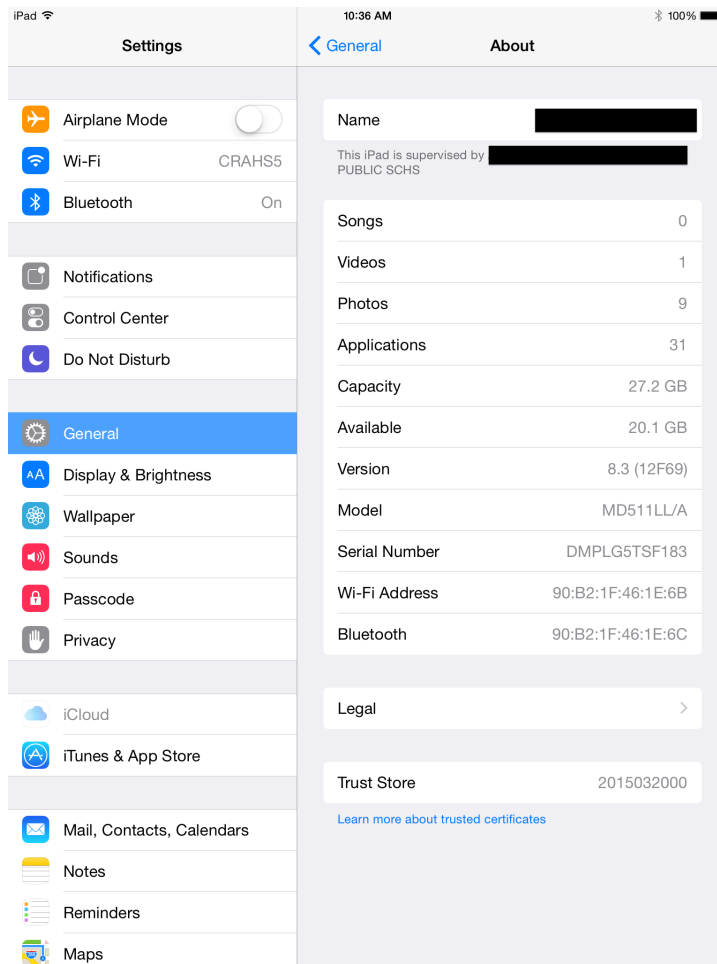
Figure 2.7. A view "inside" a student tablet. The number of apps in use increased continually, so that by the end of the second year of the one-to-one program, students had 31 apps installed on their devices.

Putting it all together

For the purposes of making visible the action of infrastructure (going backstage, as it were), there are three key points to emphasize from this description of school stakeholders and the kinds of technology in circulation during my study:

First, at the moment that tablets entered the school via the one-to-one program, a number of competing, complimentary, and ancillary digital devices and systems were already in place. Each category of devices present is itself a complex object, often made up of many other objects or assemblages of objects, documents, and other entities. As the preceding general description of the tablet and its affordances illustrates, technological objects are incredibly complex and only

appear as discrete entities from a particular perspective (from the vantage of an end-user, for example). This description draws from scholarship that views smartphone and tablet architecture in the work place as a metaphorical ecosystem, as composed of dynamic agents that operate according to their own scripts, rules, and behavioral routines, creating through interaction a complex environment (Eaton et al., 2014). This conception, one of "service systems involving highly distributed, heterogeneous, and resource-integrating actors whose relationships are governed by shared institutional logics, standards, and digital technology" stands in stark contrast to digital divide rhetoric, which views communities of color as technologically disadvantaged (ibid., p. 217; LAUSD, 2013). This rejection of the digital divide framing is not merely theoretical: the imputation of deficit and the reification of a digital divide are explicitly referenced in policy documents that explain the adoption of one-to-one tablet programs district-wide. As this description has shown, the idea that technology was lacking in the school is simply untrue. Any policy predicated on an absence or lack of technology is inapt.

Second, the use of any media and information technology in the school, tablets included, depends on successful completion of a variety of technical processes (e.g., printing, networking, updating, sharing,), but also on adherence to the dictates of professional and work relations. Student use of computers, for example, is highly constrained by rules and contracts of behavior. Teacher use, to further illustrate this dynamic, is similarly contingent on policies and rules established by Home Office policies as implemented and interpreted by Principal Montoya. All use, by teachers, students, administrators, and other staff, is constrained by terms of service and other kinds of instruments which define what kinds of uses are allowable and unallowable. For example, rather than attempt to repair iPads that had malfunctioned or been damaged, Ms. Quezada collected these units and brought them to the Apple Store on a weekend to consult the

Genius Bar. This strategy guaranteed that the tablets' warranties would not be voided by school staff or student IT workers.

Finally, teachers were largely left to figure out how to incorporate tablets, or, in the case of English and math teachers, given only partial guidance. In this way, the implementation of instructional techniques, assumed by administrators to be self-evident or automatic, developed via informal channels, by teachers talking among themselves to determine what worked and did not work for incorporating tablets. While some activities, such as standardized tests of various kinds, were mandatorily delivered via tablets, teachers had, at the outset, wide latitude to use or not use tablets however they liked. This absence of planning and training allowed certain modes of use to coalesce without any specific pedagogical vision. In the absence of an educational goal, infrastructure was itself free to determine what tablet instruction would look like.

In the next section I scan forward in time, to show how the infrastructural inversion I have just developed came to shape teaching. An emergent mode of instruction focused on the circulation, display, creation, and editing of tablet-ready documents, one that, although not predicted by administrators or teachers, came to stand in for instructional quality.

Figure 2.8. This section of the hallway next to one of the two entrances to the school was filled with disused and abandoned materials during my entire study, including several interactive white boards that had been replaced by projectors. This "graveyard " of disused media attracted electronic equipment that was not in use but too expensive to be discarded.

"MASS-USER-UNFRIENDLINESS"

As it concerns classroom instruction, the one-to-one tablet program altered existing work

routines and created new ones. In this section, I want to focus on describing how the one-to-one

tablet program introduced new kinds of work for teachers: the processing and creation of content

for apps and websites via word processing, document export, and multimedia data capture via

tablets. This work was directed largely by teachers, but also by students. This work involved taking the traces of the disparate communicative and informational transactions involved in teaching and converting them into formats that could be used by apps, platforms, and websites that could in turn be accessed by student tablets, primarily by creating and circulating PDF documents. The sheer number and variety of computers and computer-like devices in use in the school and the design of the tablet, based as it is on the presumption of a single user, resulted in many kinds of "technical' difficulties that teachers themselves had to work through. These technical difficulties were often not the consequence of malfunctions, but the logical and inevitable consequence of the scale of the program, the affordances of tablets and software, and the inflexibility of file formats and data standards, what one informant called the "mass-user-unfriendliness" of tablet computers.

While parts of this set of repetitive tasks would certainly fall within the traditional work of American public school teachers, which has involved various forms of recordkeeping, records management, desktop publishing, document reproduction, and other forms of document-related productivity for decades, much of this new kind of work results from the ad hoc process of trying to incorporate tablets into instruction, into the actual structure of various kinds of class activity, a process compounded by the great increase in the number of computing devices and the complexity of their operation. The demands of tablets and their software, especially in terms of the data and formats they required to operate, could introduce new kinds of work over and above the effort required to deliver similar instructional activities in analog modes. This problem was introduced by the specific formats required by the tablet, but also the scale of the implementation.

In what follows, I will first explain teachers' reactions to the one-to-one program. I will include descriptions of classes I observed where teachers attempted to use tablets and

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encountered difficulties. These problems encountered by many teachers eventually came to inform a new mode of teaching, one I detail at length and describe as an emergent norm. Over the first year of the program, this mode of using tablets solidified as a routine, communicated between teachers informally and eventually endorsed by Principal Montoya. In this way, teachers developed a way to "do" tablets with the available resources and infrastructure. After these explorations of teaching practices, I explore a common tactic, the incorporation of PDF documents, from the perspective of media history.

Initial teacher reactions

As Ms. Quezada described it later, teachers were struggling with "mass-user-unfriendliness":

> Ms. Quezada: Do you want to hear about it? About the frustration? There's just no way to imagine what it would be like to use iPads like this. If I have 25 kids in a class, about half of them are going to forget their passwords. And then the ones that have had their devices taken away…I always have to prepare two activities for everything, so that there is an alternative.

Ms. Quezada's analysis of the tablets focused on iPads in general, although her frustrations were, in fact, directed at various aspects of the one-to-one program, including the difficulty of device management, lack of curricular software, and aspects of design, including the affordances of the tablet interface itself. Notably, Ms. Quezada's professional frustrations with regard to her own work mingled with those of her students, with their difficulties in "doing" tablets for schools work and standardized testing. As she explained with regard to using tablets for math instruction:

> You can't type math. Even on our benchmarks. We either have to agree that we're going to change the way they type it out. For example, to write an exponent. If you type it out, you use two and then, you make the little up-facing caret. But then, if you're doing it online, they don't always have it there. So, what they'll do is they'll, put an arrow and then, the big two. So then, it looks like three, little arrow, two. But in order for the kids to type that, they have to be trained or shown that they can type it like that.
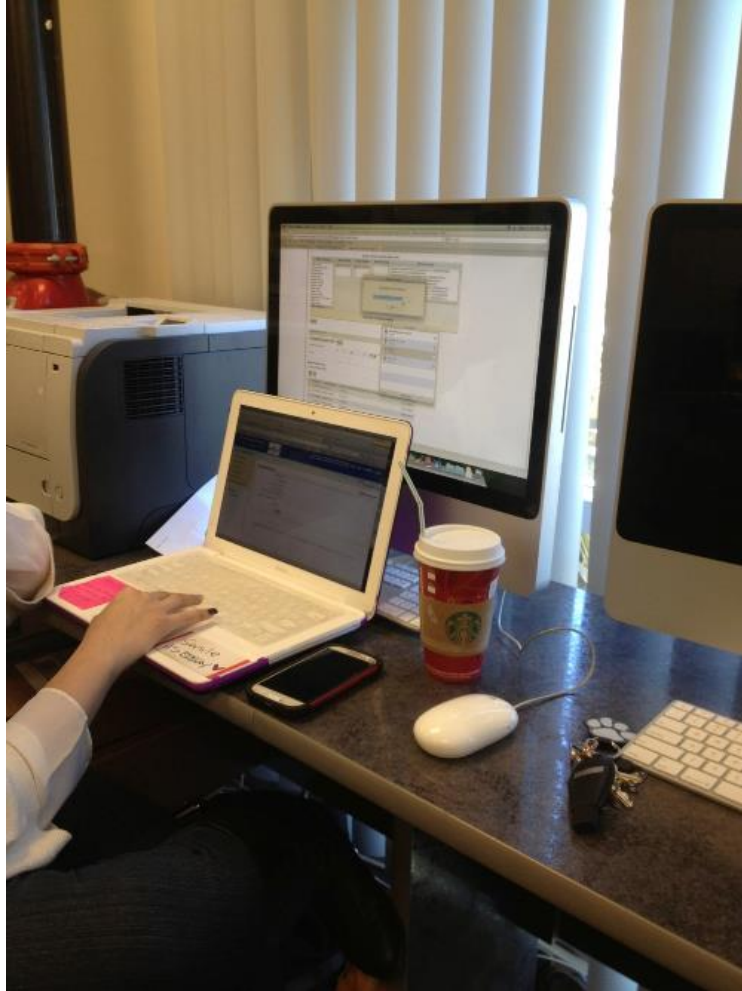
Figure 2.9. This picture shows Ms. Quezada at work on a laptop and a desktop simultaneously. She was also using her tablet at the same time. She has stored a needed password in her phone. This kind of juggling of multiple devices in order to collect the documents and points of access needed to run a single class was a by-product of the tablet program and a transformation of the work of teachers, who had previously relied on a staff person to make and deliver paper copies.

As the above example illustrates, the affordances of tablets altered what could be taught, and in this instance, what counted as correct and what was counted as incorrect. These mingled difficulties of student and teacher work produced a number of challenges both practical and pedagogical that teacher themselves had to mitigate. For example, in spring of the second year of my study, English teacher Ms. Shell requested access to the cameras on the students' tablets so that her class could make videos acting out scenes from Shakespeare's *Romeo and Juliette*, a play they would spend several weeks reading. Ms. Quezada and the STLs used the Profiles feature to activate student cameras for a week. During this week, Ms. Shell organized a number

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of readings in the courtyard, breaking students into groups to select scenes, assign roles, and act

them out. She had intended to have students record the skits, but immediately encountered

problems in finding a suitable way to share the videos recorded on individual cameras.

Eventually, she created a Gmail account, which could then be used as a YouTube log-in

credential. She spent some time distributing the credentials to various students, but, ultimately,

she was unable to consolidate the videos in a form that would allow them to be shared. Scuttling

the original plan, she decided to have students read from paperback books without any recording.

Of this activity, she said later:

> Ms. Shell: I changed my mind. It wasn't worth it. By the end, after all the struggle and spending
> hours trying to get it to work, I just got them a set of paperbacks. The kids love it too. I send them
> out to read to each other. We all just need a break from the technology. At first I was telling them
> that videos would make the play relevant to them, but the way it worked out, I had to go back and
> admit that reading it was probably better.

Make-work instruction

This "mass user-unfriendliness" could be seen in a class I observed on January 17, 2014, when I

watched a class taught by Mr. Tyler, whose students are on IEPs, Individual Education Plans.

Many of these students have been diagnosed with some kind of learning disability. However they

came about, these plans are binding on the school and trump other kinds of requirements for

students; they require, in effect, that each student concerned be given individualized instruction

and interventions to reach grade-level competency, although many students never catch up. In

addition to help during their daily classes in other subjects, they spend a block with Mr.Tyler

called "Support." In this class, they get help with remedial skills, study skills, and general advice

about how to be a student. Mr. Tyler's Math Support has seven students, five girls and two boys

For the most part, the students worked in the dark. Mr. Tyler said, "We don't do overhead

lights in here." He began his class by having a student stand before the class to read the day's

activities aloud from a piece of paper. The agenda began with a game of Memory, a version of

the children's card game that featured simple math questions. Mr. Tyler struggled to keep students focused on tasks, as they barraged him with questions constantly. The questions generally concerned behavior rather than math: Can I listen to music? Can I sit next to my friend? Can you adjust the lights? Mr. Tyler warned students that if he saw any of them using their phones instead of doing the activity, he would confiscate devices. Still, many of the students kept their phones out on their desks or typed on them during class.

He awarded winners of the Memory game play cash as a reward. Mr. Tyler guided students to use Khan Academy on their iPads, a website-based math instruction program. Before students could access the site, Mr. Tyler spent some time talking them through how to access the Internet. The students clamored to be allowed to listen to music on their phones while they worked: of the seven students in the class, four had smartphones out, including two iPhones. A student asked if she could use her phone to access the site instead of her iPad, as the iPad's access was slow. Just as the last student gained access to the site, the timer on Mr. Tyler's phone sounded. He told the students he would start it over, since it had taken the entire scheduled time for the activity for students to sign into the needed service. Mr. Tyler walked among the desks in the darkened classroom, watching, mostly to make sure students were accessing the correct site.

Instructions proved cumbersome, as students struggled to access the Internet via their iPads and continued to barrage Mr. Tyler with behavioral and procedural questions. "Log in to Google," he cooed, often repeating this instruction. "Press 'Allow.' Enter your password." One student reported that he had logged in successfully, but when Mr. Tyler looked at the student's screen, he discovered that the student had not logged in at all and was staring at an empty web browser window. It took roughly ten minutes for Mr. Tyler to get the seven students up and running. Many of them listened to music on their phones as they worked. Mr. Tyler told one student to stop tinkering with the music on her phone and first use her iPad to access the lesson.

Mr. Tyler moved his students though a number of other programs throughout the class, programs and websites such as to Khan Academy, CAHSEE (California High School Exit Examination) Prep, NoRedInk.com, and Quizler.com. At each switch, students struggled to access the designated content via a web browser or app. For the most part, Mr. Tyler had to repeat the instructions to each student and visually verify that a student had successfully accessed a prescribed tool. He guided them through a number of logins, asking from across the room, "What screen are you on?"

Toward the end of the class, the students worked on CAHSEE preparation, a set of web-based tools designed to help students with the state-mandated exam. The lesson at hand focused on "functional documents," such as employee manuals. The students struggled to understand what kinds of documents qualified as functional documents and were mostly unable to answer a multiple-choice question about how to increase the amount of information in a document (e.g., by the addition of a chart). Mr. Tyler described an aspect of teacher evaluation to demonstrate a point about functional documents, participating in an extended imaginary conversation with the principal about grading procedures and rules for teachers. For the most part, the students did not display any understanding of the categories of documents being used on the exam and in the lesson. Recognizing this gap in knowledge, Mr. Tyler unveiled a final activity, the design of flash cards using Quizlet.com.

Mr. Tyler struggled at one point to get the smartboard in the class to work. Dumping the proposed demonstration on the fly, he instead used a document camera to project a sample question and set of responses. Of his own teaching via iPad, he said later, "I don't use it as much as I should."

In a follow up interview, in December of 2015 after he had transferred to another Academy Schools high school in East Los Angeles, Mr. Tyler reflected on his use of tablets:

> Mr. Tyler: It was so much more work than I thought. I had no idea it would be so much work to use them. You have no idea. It's better now, and sometimes I've figured out little tricks that actually can save me some time here and there, but figuring out…the learning curve was steep.

Still, when I asked to evaluate how the need for such work affected his own approach to teaching, he sounded a different note,

> I mean, teaching is hard. It takes a ton of work to reach every student and every student is different. I could get mad that I'm spending all my time trying to print the stupid file or get the app to let me do something, but if it wasn't that kind of work, it would be something else. There's never enough time to do anything the way you want.

The challenges that Mr. Tyler faced, in particular the management of numerous sets of permissions and the multiple interfaces that might branch out from any given point in an activity, were encountered by all the teachers. Teachers felt obligated to use tablets, partly out of their own curiosity, but also because students and administrators expected it. The question for teachers became, "What can I do with the tablets that will work?" Among themselves, teachers found ways to develop instructional techniques that could produce tablet-enabled classes without any professional training using the resource they had in greatest abundance: their own labor.

An emerging norm

It is my position that the logic of one-to-one tablet program and the vision of educational use it enacts, in particular its emphasis on the provision of multimedia content via apps, in some sense superseded the previously established ordering of public education via the forms of work tablet computers demand in order to function. The forms that work infrastructure takes beget some actions and preclude others. In this section, I describe the transformation of the work of teachers by the on-to-one tablet computer program, the ways that the tablet directly and indirectly required unexpected kinds of prep work and delivery of instruction by teachers. In short, the introduction of tablet computers interrupted extant patterns of work in the area of document management; moreover, this work of document management and creation in preparing curriculum for class instruction joined with technologically necessitated work in the area of

recordkeeping and front-end web development. A great deal of these new and altered work routines focus on the format of particular documents, on taking whatever resources a teacher has decided to use and converting it into some format upon which tablets can operate. In order to illustrate how these transformed work practices emerged, I describe a history class I observed early in the first year of the one-to-one program. The following description, adapted from a field note created on February 4, 2014, describes an important class observation, an observation suggested by the school principal and the staff themselves.

Mr. Patron, a teacher of history, is, in the terminology and description of administrators at Number Seven, a "highly effective teacher"; in the second year of my study, he was promoted to a job at Home Office that deals with technology implementations, among other duties. Mr. Patron was an important figure in the school, an exacting taskmaster known by other teachers for his facility with technology and by students for his high expectations and exacting discipline. Many teachers I talked to about tablets suggested I talk to Patron, as he was a person in the school known to use them frequently and well. I observed Mr. Patron's class early in February, in the winter of the program's first year, roughly a month after the students returned from their winter break.

Mr. Patron warned me that his class would be standing-room-only. He was wearing a tee shirt with a mash-up graphic on the chest: Darth Side of the Moon. The bell rang and he promptly launched in to his instructions as 36 students (roughly two-thirds male) noisily took their seats and slowly got to work: he talked over the slowly receding din for several minutes. His initial instruction called for students to download a set of documents in PDF format from a class website he maintained. "Who doesn't have an iPad? Come get one of these papers." One student, who had lost iPad privileges, came forward to get the documents. The students settled in

and began to work quietly, individually on the "Do Now," a warm-up activity common to every alliance classroom. Mr. Patron called attendance as students worked.

After roll, Mr. Patron addressed the class as a whole about their collective performance on the previous day's test. Using a control box on the wall, he projected from his laptop the roster for the class and grades on the quiz: "40% of the class is failing on the standard where you got an NP. You need to bring this up to at least a C." In a singsong voice, he explained what students could do to bring up a failing grade (NP stands for "Not Passing," a failing grade in the language of the school).

Next he projected from his laptop a document that listed the contents of the upcoming unit as a table, a unit that concerned the Russian Revolution and various aspects of the Romanov dynasty. Students collected from various shelves and bins their own individual three-ring binders. "This is not going to be a simple, easy unit," he warned ominously, referencing their collective failure on the last one.

Mr. Patron lectured to the whole class, previewing the three weeks they would spend on Russian history. He guided them through the reading of a short text which would serve as the core of the day's lesson, a quote attributed to a Russian woman explaining why she joined a 19th Century anti-czarist movement. Using related documents and working in groups, the students would develop the historical context that would allow them to understand the issues that informed the woman's statement. Students shared notebook paper and took notes without prompting. Mr. Patron instructed the students, "Open up the PDF, please." He also moved students around the room to form groups. He demonstrated a technique for taking notes on the various documents students would be reading using a piece of paper, a note-taking sheet he had distributed earlier: "You should have picked it up on your way in." He directed the students in using the documents he had distributed in both electronic and paper form, saying, "You need to

learn to annotate secondary sources." A few students had already begun color-coding their paper documents using a technique he had developed earlier in the school year. Others used the Adobe Acrobat app, which contains an annotation function that allowed them to type notes that would be stored with a local copy of the document on their own individual devices.

Throughout the activity, Mr. Patron directed a number of computing and analog tasks related to the lesson: "Use your iPad to find out what 'Romanov' is and what 'dynasty' is, please." He also demonstrated how to take notes on a document using a pencil, a gridded piece of paper, and the document camera. "Who wants to be timekeeper? You can use the timer on your iPad," he reminded. He also interrupted his lesson to discipline a student in the back: "Hey, no hoodies."

During a period when students were working, Mr. Patron explained some of the rationale for his teaching to me. He said that the "lexile level" of his students was a challenge, so he designed lessons to build vocabulary and to give test-takers a chance to pass a test even if they did not know a particular word. He also explained how he had created a quiz using Google Forms, the completion of which would constitute the students' "check out slip." He showed me how the results of the quiz allowed him to generate individual scores and to gauge class learning. He also developed an idiosyncratic test design: each multiple-choice question had two correct answers, both required for credit. He developed this system in recognition of students' extensive experience with multiple-choice tests and their skill at guessing, which he termed "one of the pitfalls of online testing." He explained that he had instructed each student to use Acrobat so that they could "annotate PDFs in the cloud."

At one point, during a class activity, a student lost his iPad. "Somebody find Delgado's iPad. We won't be able to leave." It turned out that another student had accidentally picked it up, an understandable error since all the cases are identical.

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At the end of the class, Mr. Patron administered the quiz he had designed and had students complete it using their iPads. He counted down the time to completion, warning students that he would terminate access to the quiz. The last few minutes of the class, students returned their folders and binders to their storage places and packed up their tablets to leave for the afternoon.

The following table highlights some of the kinds of work Mr. Patron did before, during, and after the class I visited to make course materials and activities available to students. It is also important to note that at each phase of the lesson plan, Mr. Patron made allowances for students who did not have tablets: students who had recently transferred in or had been subject to disciplinary measures would not have tablets to use for any class activity. The tablets then represent a literal doubling of effort, since each digital deliverable must be accompanied by an analog equivalent.

Activity	Required materials for Students	Required Labor by Teacher
Lecture.	Presentation in PDF format.	Create slides. Convert slides to PDF.
Download a set of documents.	Worksheets in PDF format.	Create documents. Convert documents to PDF. Create pages on class website. Upload documents to class website. Share link for class website.
Take a quiz.	Multiple-choice quiz in Google Forms.	Create a quiz. Publish the quiz on Google Forms. Distribute a link to the quiz. Copy scores from quiz into grade book.
Look up unfamiliar terms.	Wikipedia or Google.	None.

Figure 2.10. Summary of some kinds of format-related labor undertaken in Mr. Patron's class.

Mr. Patron's strategies, as seen in the single history class described above, became a model for how teachers should use iPads, one encouraged through informal mentoring, shared in weekly professional developments sessions, and lauded by the school administration. This strategy effectively became a norm against which all other teachers could compare their own efforts. For example, at least four other teachers built websites using the same web-based platform as Mr. Patron (Weebly.com). The work required to build, update, and maintain websites and other web-based resources fell to teachers themselves, who used these sites and the affordances of student tablets just as Mr. Patron had: to distribute PDF documents, to administer quizzes and other kind of assessments, to provide links to websites and apps for self-paced learning, and to collect in-class writing. These activities produced new demands on teachers, particularly in the form of file management. In order to use the features of the tablets in the manner of their identified leader in the area (Mr. Patron), teachers had to juggle various tools, devices, and systems to collect a set of documents and interfaces that student tablet users could access at a given time in a given class. As Ms. Wilson, an English teacher put it,

> Ms. Wilson: When you do Google Form or Google Doc I have to make a Google Doc for each period and then maybe even drill down more, so per period, per group. So maybe I've got 18 Google Docs, and I don't want that. So if I could find a way that kind of makes it a little less cumbersome, then yes, I'd probably choose that aspect of it to improve. You can essentially end up having seven copies of a "Do Now" because you're doing, you're creating it. 'Cause it depends, do you want them to see what each other is writing or not? Or do you, 'cause they have a tendency to get real stupid. They'll erase what people are writing and write stupid stuff. So then, you have to figure, is this an assignment that they can manage or do I not want them to see? So then, you've got 17 Google Docs and you're like, "That's too much."

The changeability of interfaces in particular became difficult. Speaking of the "dubious ontology" of digital artifacts such as profiles, interfaces, and other kinds of digital documents, Ekbia (2009) describes them as "quasi-objects":

> [T]hese artifacts exert a force of desire in the specific historical circumstances of our times. These properties, which differentiate them from stabilized objects of everyday life (such as rocks, chairs, and pencils), are closely tied to the processes that they mediate, with certain elements of purification in science, representation in art, and imagination in psychoanalysis (p. 2558).

This points to a tension in the expertise of teachers, whose extensive education and practical classroom experience contrasted greatly with their relative inexperience using tablet computers in their educational routines. In some sense, school administrators (and teachers themselves) presumed that expertise in teaching generally translated into some kind of expertise in the specific software and hardware provided at the school. However, given the mutability of digital documents and interfaces and the great variety of situations in which student computer users might find themselves, the limits of how teacher were prepared to use software and hardware in their work soon became apparent.

Format theory and doing tablets

As Bowker and Star (2000) famously observed, although they are often invisible to the casual observer, standards "impinge in myriad ways on our daily lives" (p. 147). For teachers, tablet computers introduce a measure of "computer control" into work, taking the relatively esoteric processes of instruction and converting them into a series of inputs and outputs of technological systems (Elliott and Long, 2015). At least in its most idealized form, as envisioned by ed-tech proponents, makers of educational hardware and software, and CMO administrators, tablet computers and their educational apps promote the goal of personalization, but it accomplishes this goal through standardization. That is to say, individual students would, in this idealized and powerfully normative schema, progress through various units or parts of a commercially produced, Common Core-aligned curriculum (via the Pearson app, for example). Based on their progress through these units, students might receive different units to complete, presumably to help them gain mastery of topics or areas where their performance had indicated poor understanding. In this way, each student in a class could potentially be working on something different, although all would be working toward accomplishment of the same academic standard. Such a scheme, never accomplished during the time of my study, promises personalization and

individualization, but relies of a great number of standardizations: of curriculum, of learning objectives, of student activity, and so forth. However, even as practiced by those teachers who developed extensive techniques to use tablets in instruction (Mr. Patron and Ms. Tasha, for example), such a vision remained mostly unrealized.

Overall, the most common response that teachers gave in interviews when asked how they had been using tablets in instruction was that they were largely *not* using them. Or as Mr. Craig put it, in a formulation common to many other teachers, "I don't really *do* tablets." As Ms. Wilson put it, when asked about her approach to using tablets in her English classes, "I don't use them as much a I should. I want to, but I don't know as much about them as I should."

Ms. Tasha, the only teacher in the school during the second year of my study widely reported to be using tablets regularly by both teachers and students (as Mr. Patron had left the school), put it another way:

> Ms. Tasha: I just try to figure it out. Lots of trial and error. I don't have a lot of experience with the iPads, not like Ms. Quezada. I'm just making it up as I go along. I'd like to get better with them, maybe have the kids make a website or something.

Ms. Tasha's use of tablets is important for a few reasons. First, of all the classes I observed, her use most closely resembled how Home Office staff described tablet-based instruction, i.e., the delivery of Common Core-aligned multimedia instruction via an app produced specifically for this purpose by educational publisher Pearson. Much of her class consisted of various interactions with the Pearson app (by both Ms. Tasha and students). This app was widely discussed during the first year of the tablet program, but did not become available until the second. In contrast to what Ms. Tasha and other teachers imagined, this interaction was multimodal: Ms. Tasha projected her own tablet onto a screen at the front of the class for the entire class to watch, she directed students to read passages and complete activities individually, and she broke the class into small groups to work on tasks together, either by

sharing a single tablet or accessing the same content simultaneously. But more importantly, her use of tablets was atypical. According to teachers, students, Ms. Tasha herself, and my own observations, she was the only teacher in the school who routinely used the Pearson app in her classes.

Taken together, these observations and interviews point to a common strategy at work in the school in response to the ideal of individualized learning, one based on a fairly prescriptive and specific vision of tablet use epitomized by Mr. Patron's class (and subsequently touted by the administration and reinforced via informal mentoring and formal professional development activities). This norm relied on teachers to deliver learning in formats that could become the input and output of tablet devices. Handouts became PDFs; pop quizzes became Google Forms; and discussions became PowerPoint presentations. This transformation in format was accomplished by the work of teachers in the absence of useful software. The sometimes difficult or time-consuming work of filling the gap left by a lack of suitable software was not viewed as such by teachers, who tended to think that greater knowledge or skills would automatically lead to the use of tablets that had become a powerful norm.

Absent suitable course management software or multimedia textbook-like resources, the production and circulation of PDF documents in particular took on a special prominence. First, teachers could produce PDF documents on the laptop computers to which they had become accustomed and to which they had access both at work and at home. This practical consideration allowed teachers to work with the sources to which they were already familiar (Google images, Library of Congress images, Project Guttenberg repositories, and so on), using means of input and output with which they were familiar. Second, PDF documents could produce something that could be viewed on tablets; that is to say, the affordance of PDF technology —its easy transmissibility from the site of production via Internet to multiple sites of reception and the

replicability of particular layouts of text and images across devices and platforms— matched the requirements and affordances of tablets (i.e., a screen in need of educational text and images). Likewise, the resource requirements of PDF technology matched the available resources of teachers. Teachers could produce documents in PDF form without buying any additional software for their laptops or tablets. This resort to PDF came entirely as response to the availability of tablets and to the unavailability of curricular apps: no teacher I interviewed expressed any pedagogical goal for supplying educational content as PDF or mentioned any particular aspect of PDF technology that appealed to their instructional aims other than its price and ubiquity.

The lack of software then necessitated a workaround, some way to make tablets instructional in the absence of any educational software or media. By the second year of the program, many teachers had adopted Mr. Patron's technique for distributing PDFs via a personal website: every class I observed in the second year of my project, even in cases when the Pearson app was in use for part of a class, involved the distribution of documents via PDF. Indeed, according to interviews, this was the only use to which tablets were put by classroom instructors for the first six months. As Ms. Crause put it, by the end of the second year the tablets had become boring to students and cumbersome: "It's just another thing they have to carry around with them."

This use of PDF, unplanned, unexamined, and unregulated, introduced to the teaching situation a technology that had not been vetted in anyway, assumed as it was by teachers, administrators, and students alike to be inert and without consequence. But like all digital technologies, the use of PDF inserts into the world if its users an artefactual politics and, in so doing, opens up the question of how a particular object manifests in material form assumptions about the world and a horizon of possible relations (DiSalvo, 2014). The PDF format can be

viewed as an accomplishment of both a de jure and de facto standard, an accomplishment repeated in each act of creating and circulating PDF documents and in the adoption of the formal standard The International Organization for Standardization (ISO) and by software publishers. Little scholarly attention had been paid to the history and politics of the PDF format as it grew to prominence in the last decades and became one of the most popular and widespread file formats of the digital economy. Like many technical specifications and technological models, the PDF format represents a pragmatic means to achieve a solution and therefore, a judgment about what problems exist to be solved (Gitelman, 2014). The PDF standard, originally conceived as a platform-agnostic way to present documents, began its life as a pet project of John Warnock of Adobe Systems Incorporated. Notably, files in the PDF format can be generated by a variety of software environments and, when read back in, can generate functionally similar display documents on a variety of computer operating systems, including tablet computers and smartphones. PDF became an ISO standard in 2003. The standard represents a certain kind of demand for documentary verisimilitude from the perspective of the user and the designer alike: it allows a document reproduced on screen or in print to bear the same approximate spatial arrangements, fonts, and graphics, although rendering on screen varies greatly by screen size, proportion, and color settings. Additionally, the PDF format may be read in and rendered by a number of applications, but, depending on how the PDF is produced, the application may not be able to edit, append, or annotate the PDF file. Such functionality is critical for schoolwork, particularly as class instruction prior to the tablet program included specific techniques in how to take notes, how to read, how to solve math problems, and so forth, all assuming the students' ability to write on a printed surface.

The use of the PDF in instruction presumes a general equivalency in the printed page and the electronic text, an equivocation made material by teachers' presentation of all class

curriculum in both analog and digital form. This assumption ignores several decades of research on reading and on the specificity of reading practices linked to specific media, attention, and the body. As Gitelman (2014) points out, the PDF document collapses into a single conceptual space the document and its image, creating a hybrid that "is experienced as a picture of itself online" (p. 134). More, the PDF format makes material a series of ontological divisions occasioned by the needs of white collar office management, a split of reading from writing, of author from page: "Because PDF technology was designed with the practices of corporate authorship in mind, it works partly by imagining hierarchical labor relations in which readers above, below, or beyond the authoring process passively receive its fruits" (p. 130). The uses to which PDF technology can be put (and, perhaps more to the point, the functions it prevents) express a specific vision of what actions exist be taken in the first place, the ontological grounds upon which work rests; this a view of reality structured by specific workflows of "printing, sharing, reading, filing, copying, and archiving…the gerunds that animate the myth of the paperless office" (p.128).

If there is such a thing as media theory," Sterne (2012) quips, "there should also be format theory" (p. 7). Citing Bolter and Grustin's construction of remediation, the idea that the incorporation of older media is a feature of digital media, the author turns to a contrasting approach, mediality, to frame his work: "mediality simply points to a collectively embodied process of cross-reference" (p. 10). The critical thing to note, according to the author, is not that media refer to other media; rather, it is that digital culture incorporates a set of relations within it that refer to other entities as a matter of course, and the definition of these referents shift and change over time in a constant process of *see* and *see also* references. Put another way, "the mediality of the medium lies not simply in the hardware, but in its articulation with particular practices, ways of doing things, institutions, and even in some case belief systems" (p. 10) Using

this concept of mediality, the author argues that we should instead focus on format, since a study of media will only reveal the totally expected presence of other media: "If there were a single imperative of format theory, it would be to focus on the stuff beneath, beyond, and behind the boxes our media come in, whether we are talking about portable MP3 players, film projectors, television sets, parcels, mobile phones or computers" (p. 11). Provocatively, format theory rejects the idea that some copies are more authentic than others. Instead, Sterne suggests that changes in format augur changes in relationships; in the case of audio, a change in format "occasions a different relationship between listener and recording" (p. 12).

Here, in the case of public school teachers and the formats they have been asked to incorporate in their lessons, we see this change in relationships that Sterne's format theory and Gitelman's media history predict. Most obviously, the creation of curriculum in formats that can be operated on by tablets alters the relationship of teachers and students. Indeed, according to a great deal of the marketing material produced by educational technology companies, this is not an unintended consequence of such an intervention, but the desired end. Teachers become enablers and coordinators of learning, learning that is planned, written, and programmed by distant, largely unknown authorities. But these changes in formats also change the relationship of teachers and students to the corporations that produce digital technologies, positioning them not as the collectivity of a class, but as individual agents and users of personalized services, particularly with respect to the great many providers of software in the form of educational apps. Like users of Facebook or purchasers of iPhones, students and teachers are immediately enmeshed in a number of market arrangements, perhaps most conspicuously as consumers of digital services via apps. The use of tablets by students and teachers also creates data, which becomes a resource for these same providers. I do not suggest that public education has ever been some realm beyond marketing; to the contrary, many of the largest businesses in the sector,

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corporations like Apple and Pearson, have decades-long tenures in the business side of public education. I only suggest, via Sterne's work on format theory and Gitelman's media history, that the current wave of innovation represents a specific form of these relationships. To wit, the configuration of business interests, users, and intellectual property in the one-to-one program at Number Seven captures considerable value from the work of teachers, value that is not accounted for in determining the costs and benefits of the program.

CONCLUSION: INFRASTRUCTURAL DIVIDES?

> When we first embarked on the CCTP, we had a vision to have a device in the hands of every LAUSD student to close the digital divide. This is still our vision. All of our students – not some, but all – should have the same access to the learning tools they need to achieve in the 21st century. Ultimately, we want to close the digital divide and level the playing field, not only with educational access but technological access. That is what we committed to when we began, and what we continue to strive for as we move forward.
>
> —Bernadette Lucas, Director, Common Core Technology Project,
> Los Angeles Unified School District, Press release dated September 17, 2014

For two decades, education and development policy have prominently featured the concept of the *digital divide*. According to this durable narrative, marginalized communities lack access to desirable technology (e.g., Internet access, ownership of a personal computer, multimedia editing software), thereby limiting their civic, educational, and economic opportunities. Critically, the digital divide narrative takes lack of information and media technology as both a *cause* of future economic marginalization and social exclusion and as an *effect* of current inequality. Education researchers and those in cognate fields eventually countered this view with several criticisms: firstly, that access to technology is not simply a binary question of having or not having; secondly, that skills and other kinds of knowledge are required to use technology; and finally, that this model presumes a deterministic view of technology that distorts the relationship between a given technology and some putative action on society (Hargittai, 2002; Sims, 2014). Another critique used material analyses of the status of cloud-based services, payment systems, and online cultures to point out the complexity of information and media technology that a

digital divide framing papers over (Burell, 2012). Empirical analyses of the status of Internet access for American users show that Internet access has spread continuously and unevenly over various demographic groups in the last two decades (Warf, 2013). Although these works dispute various aspects of the central premise of the digital divide narrative, it remains remarkably durable, especially in education policy, information policy, and ed-tech circles. The digital divide narrative depends on the implicit moral premise of a minimally acceptable level of technological development, one rooted in a normative, Rawlsian vision of information as a primary good, "a good that is universally required by persons as a condition for their well-being" (van den Hoven and Rooksby, 2008,p. 380). The digital divide is merely one way of framing questions of information equity, a broader concern with "the fair or reasonable distribution of information among individuals, groups, regions, categories, or other social units, such that those people have the opportunity to achieve whatever is important or meaningful to them in their lives.' (Lievrouw and Farb, 2005, p. 503).

As the preceding infrastructural and material analysis has shown, however, any ethical consideration derived from such moral interests, however formulated, will remain incomplete and irresolvable unless the very real burdens and constraints such technologies might impose are themselves considered, apart from the information they mediate. Information and media technologies themselves, whatever their benefits and however valuable the communication they enable, establish reciprocal demands on users in the form of time, money, and attention: this is the inescapable physics of the new media economy. Access means capture. If we allow that a particular group, person, or community has a right to information and media technology, we simultaneously affirm the resource demands of that technology and open up a site for digital technologies and their designers to pursue their interests. With these costs and burdens in mind, empirical investigations of technology applied to the educational domain can never bear out the

claim that justice requires access to digital technology by those who already suffer from an unequal position in society unless the material forms of that technology and its attendant infrastructural entanglements are placed center stage.

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CHAPTER THREE: THE VALUE OF YOUTH

INTRODUCTION

In this chapter, I focus on the student experience of tablet computing. To describe the experiences of students, I work with the same ethnographic methods as the previous section, including participant observation, semi-structured interviews, documentary analysis, and photographs. This chapter has two aims. First, it contributes empirical nuance to debates around new media economics. Second, it seeks to sketch out dimensions of affective labor and intellectual capital to describe the very real value derived from information and media technologies, especially in terms of the much studied habits of the kinds of young users who figure in this chapter as both end users and laborers. In combining these two parallel research trajectories, digital youth and digital labor, I seek to develop a more comprehensive analysis of technological interventions that aim for social justice, however such a goal might be articulated or operationalized.

The first move of this chapter concerns a critical reinterpretation of the digital youth research paradigm. I present this material to show a double bind that emerges for the project of public education in light of the kinds of valorized uses of information and media technologies upon which this research paradigm rests. I argue that such a project, rightly concerned as it is with debunking a moral panic over the encroachment of technology into childhood and a debasement of social interaction more generally, has focused almost exclusively on potential benefits of media usage, to the exclusion of critical perspectives. A vision of use in terms of economic exchange of various forms of capital challenges research in communications, education, and library and information studies on digital youth, bringing to the fore previously unacknowledged dimensions latent in the relentlessly laudatory account of young people's uses of media and information technologies. In this section, I offer in counterpoint a series of brief

portraits of students with whom I worked closely, all of whom described themselves as frequent

and expert users of information and media technology. In describing these students, I point to

particular challenges they face in their academic lives that challenge the disinterest of the digital

youth paradigm in thee aspects of the students I studied, including economic, cultural, and

documentation issues common to many students in South Los Angeles. It is my position in this

chapter that the digital youth paradigm contradicts itself and misses an opportunity to evaluate

broader expectations about technology when it ignores demographic, racial, cultural, and

socioeconomic aspects of digital technology, particularly since this body of research proceeds

from a demographic distinction and is, in many cases, interested in societal equity.

Second, I take up a specialized use case from my research: the students who worked most

closely with tablet computers as part of the Student Technology Leaders (STL) program. STLs

were charged with a number of duties that made tablets available for instructional use and were

integral in the gradual adoption of these computing devices in the various functions of the school

over a period of two years. In exchange for their work, STLs were granted greater autonomy

over their own technology usage and enjoyed considerable social status within the school. I draw

on scholarly conversations around new media economics and the incorporation of human labor

into the critical functioning of technological systems. I begin with a general description of the

prominence of unwaged work in the digital media economy and Marxian[8] critiques of this

widespread phenomenon that attempt to draw out and characterize "digital labor." I attempt to

refine the move toward a political economy of the digital by questing a central tenet of this

critique, the idea that the extraction of monetary value from digital labor equates to the

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[8] I differentiate the term Marxian in this chapter from Marxist. I distinguish here between an interest in the entities and methods of Karl Marx and his successors (Marxian) and a philosophy based on belief in the eventual revolution of the proletariat (Marxist). Of the moment of the failure of European communist regimes around 1989, economic historians Howard and King (1989) write, "Marxian political economy had clearly come of age in terms methodological rigor, and this allowed substantial agreement about what was invalid both in Marx's own economics and in early neoclassical theory, even if that agreement did not extend to modern versions of these paradigms" (p. xiv).

exploitation of industrial workers by capital. Instead, I suggest that the affective value and intellectual capital some users of information and media technologies accumulate in their unwaged work should not be dismissed, but must be incorporated into any model that seeks to characterize the economics of contemporary digital media. As Federeci (2011) writes,

> "Affect" does not signify a feeling of fondness or love. Rather it signifies our capacity for interactivity, our capacity to move and to be moved in an endless flow of exchanges and encounters presumably expanding our powers and demonstrating not only the infinite productivity of our being but the transformative and thus already political character of everyday life (p. 64).

There are benefits to the unwaged forms of labor, meaningful experience and affirmation in entirely different registers of value, that new media and information technologies entail, benefits that, although non-monetary, are not insignificant. This approach suggests that not all uses of unwaged labor are equal in terms of exploitation, an important distinction that is lacking from digital labor critiques (and, it should be said, of public unease over various forms of new media business models more generally).

In both the reinterpretation of the digital youth research paradigm and the questioning of the digital labor concept, this chapter turns on new forms of labor required of students. I show how the one-to-one tablet computer program demanded new forms of work, particularly in the areas of interoperability, maintenance, connectivity, and inventory control, work that was accomplished primarily by Student Technology Leaders (STLs), unpaid student workers. I describe this labor in terms of the technical processes it accomplished and also in terms of the affective dimensions of this kind of work. The unwaged, uncompensated work of students generated significant social capital for the school and intellectual capital for student workers themselves. While this work was understood as technical in nature, affective dimensions figured prominently in its constitution, both in terms of the pleasures it offered and the demands it made.

To conclude, I unite these two threads with a question about the subject of political economy and digital youth perspectives. I seek here to insert the economic analysis of the

previous section into research on the information and media technology usage patterns of young consumers. This analytical focus on visibilization of labor reveals considerable challenges to both the state of the art of educational technology and research into the habits of young technology users. I suggest that further exploration of the subject presumed by and shaped by information and media technologies will be necessary for either a robust political economy of the digital or a realistic sense of the habits of digital youth.

WATER COOLER TALK

On June 10, 2015, during the last week of classes at Number Seven, I visited Ms. Quezada's room: she had invited me to stop by to talk about year-end procedures. At the sound of my entrance, a few of the dozen or so Student Technology Leaders (STLs) at work in the room looked up, then quickly turned away from my interruption, engrossed in their work. Ms. Quezada was not in her classroom at that moment, having ducked out to run an errand elsewhere in the school. Florence and the Machine played quietly over the classroom's speakers, a rather adult choice given the relentlessly up-tempo party music kids in school tended to play from their phones, hip hop and cumbia, mostly. A few students talked intermittently in hushed tones, using the "indoor voices" they were so often enjoined to employ when they became raucous.

The school year was wrapping up. Class announcements over the PA system were full of last minute arrangements to be made and logistical details in need of attention, the rental of caps and gowns, the distribution of graduation tickets. Final exams still loomed, although almost everyone seemed too exhausted from the spate of standardized tests that took up all of May to muster much anxiety. Students school-wide had recently returned their tablets to their designated carts for the last time: they would no longer be available for instruction. The STLs had wheeled the carts in from all over the school and lined them up outside Ms. Quezada's room. A queue of carts stretched all the way down the second floor, a row of angry-looking droids sitting idle. Ms.

Quezada, communicating demands from Home Office, had charged the STLs, working in small groups of two or three, to prepare the tablets for summer storage. The STLs would need several days to verify that each returned tablet was in working order, that each serial number matched its assigned student, that the headphone jack worked, and that no unauthorized apps had been downloaded. After this check, STLs would erase individual student data from the tablet's flash memory, place each newly blank tablet in its labeled slot in a cart, and finally, when all the tablets in a given cart had been completed, lock up each cart for safe keeping. The carts themselves would be parked in locked classrooms. Students worked through this inventory control and update project unsupervised, with remarkable focus and methodical intensity. They had stacked up all the desks and chairs to make room for carts and had divided the work into a sort of assembly line. Using the class projector and a tablet that had not yet been erased, they had accessed the iTunes Music Store and, using their superior permissions, set up a playlist of work-appropriate music. Even this spontaneous listening party was orderly: students had cleverly designed a queue for the shared resource of the speakers, such that each student got a turn to play music.
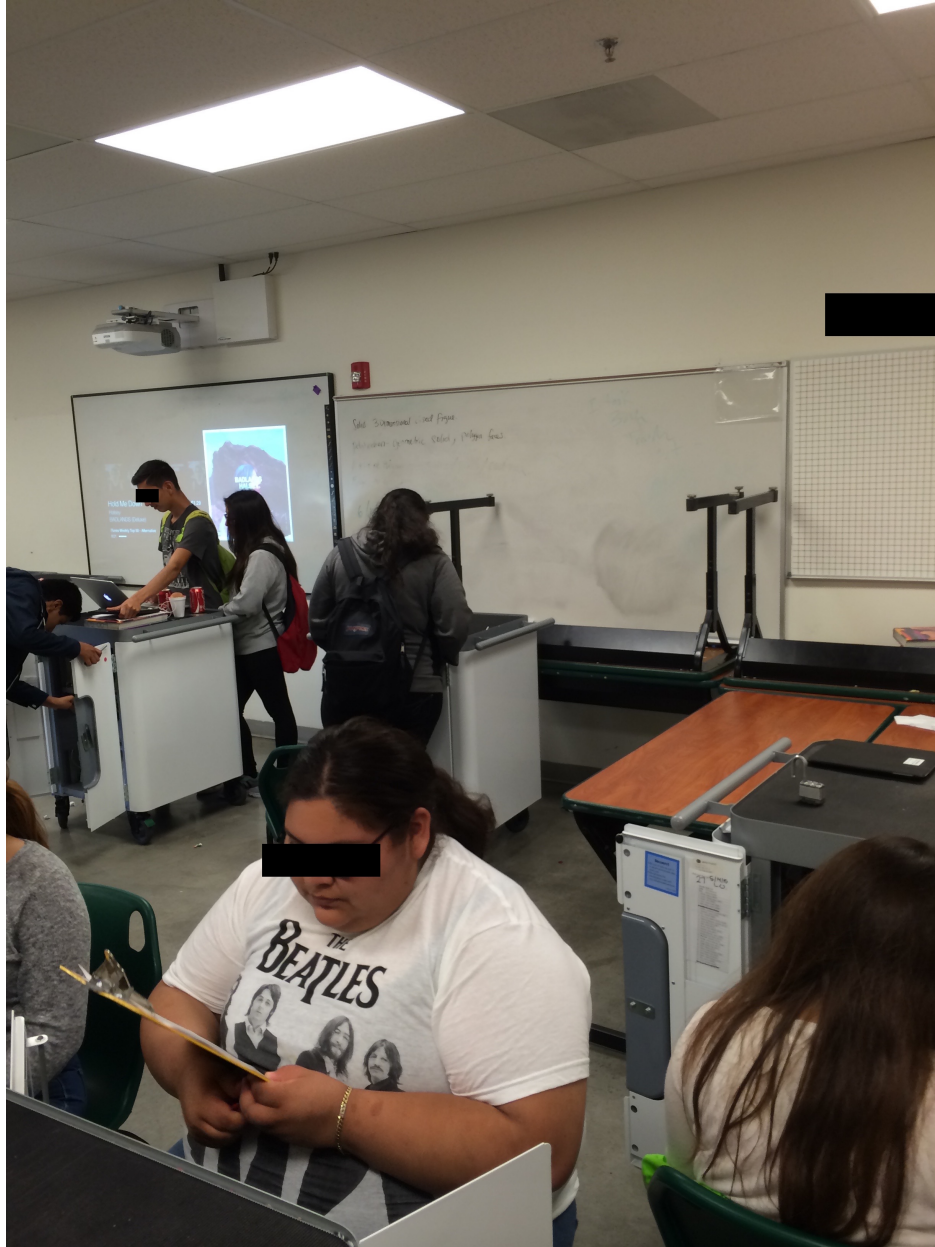
Figure 3.1. Student Technology Leaders at work on a year-end accounting of tablets. The classroom in which they are working has been commandeered for several days. Classes that normally met in this space would have to work outside until the inventory was complete. STLs spent all day in this room working with tablets. Behind the students at the left edge of the photo, an improvised video jukebox that shares the single set of speakers in the room is visible.

I watched the STLs work for over an hour while I waited, snapping photos unnoticed.

Ms. Quezada informed me via text message that she had been called away from school

unexpectedly, so I spent the rest of the day watching the STLs. In contrast to the looseness and

chaos that had encroached on the highly ordered daily routines of the school as summer vacation

drew tantalizingly nearer, or even to the normal brouhaha and slackness that Ms. Quezada's self-

described "maternal" teaching style permitted in her math classes, a sense of focus and order pervaded the room. STLs had divided the work up into several steps and delegated a student to work on each step. One student inspected each tablet, read the serial number aloud, and looked for damage. A partner acted as recorder, filling out a paper document that indexed each student in school to a designated tablet. After completing this sheet, the recorder brought it to a third student, who typed the answers to the questions on the forms in a shared, cloud-based spreadsheet. Ms. Quezada herself was to copy the data from the collaborative workspace and paste it into an Excel document for Home Office, but in her absence, an STL had taken over that duty as well. The students joked as they worked and engaged in small talk, but for the most part, they limited their conversations to the work at hand. This was water cooler talk, unlike the chatter I had seen between other students in the absence of adult supervision, which tended to gravitate toward those topics and modes of conversation otherwise forbidden, toward violence, pop culture, sex, or gossip. They conferred over finer points of distinction (How big would a stray pen mark on a tablet case have to be before it was reported? Who had the password for the primary account linked to a Google Doc?). Outside, in the courtyard, Principal Montoya had organized an ice cream party. All the students in the school (and their teachers with them) were dismissed to eat sundaes and socialize until the end of the day. One STL took orders and went down to fetch ice cream for the rest of his colleagues. Because there was not enough space in Ms. Quezada's room for all the STLs to work on the tablets for which they were responsible simultaneously, the STLs present had agreed to say in the room and work until their carts were complete. When one set of STLs competed their carts, they would give up their space in the room so another group could come in. It might take a team of STLs a day or more to complete this process: during this time, these students did not attend their other classes. Some of the

students I watched that day stayed after school. One trio was still working when I left for the day.

They promised to lock up and turn out the lights when they finished.

This episode, coming as it did after two school years of interaction with tablet

technology, showed a complex affect at work among these students. In their written self-

description of their work in the STL program, students were quick to praise the program and

write about its benefits. When asked to describe their own feelings, STLs all gave pleasant

accounts their experiences (although, at the point of the school year when they were writing, in

May of 2015, any student who did not like the program or had not met its obligations would

likely have quit or been asked to leave already):

> STL Student01: The work that I do as an STL is so much fun. Each duty that I'm assigned to leads me to new skills that would be useful and experiences that would look great in my resume.

> Another wrote,

> STL Student02: I feel like we learn something new each day because we find new things out that we didn't know before.

> Another student spoke of the work of STLs as freedom from emotion:

> STL Student03: I like the work. It's pretty easy and fun to me and it doesn't have to do with any emotions so that's good.

This talk of emotional states and feelings (or the absence of them) contrasts with statements

many students made about how this work was viewed by others in the school:

> STL Student04: Some of the students are thankful we are there to help when they need assistance for technical issues. While there is some that believe since we are STL, we make it seem we're stuck-up from the rest of them, just because were in the club. But if they would of applied to join the STL program then they would see we're not stuck-up. It's just their supposed beliefs.

What emerged from STLs' descriptions of their own work was a complicated mix of joy

and pleasure in the work, a description of an elevated social status, and a mix of defensiveness

and superiority over their privileges. The chapter that follows will try to reconcile the presence of

these affective states, states brought on by an elaborate and ongoing engagement with

maintaining and caring for tablet computers.

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A PERPLEXING MOMENT FOR DIGITAL YOUTH

What kind of relationship do adults generally expect school-aged people to have with computers? While this framing of the question reads rather awkwardly, it brings to the fore the strong sense of rectitude and parochialism that runs through much writing about technology, a sense of ordering the desires and attentions of the young that could be felt in my observations at Number Seven as well. A folk wisdom or commonsense pervades discussions of information and media technology use by the young. While the popular conception that young people are naturally more capable of using media and information technology has certainly taken hold of popular media (and the assessments of most of the teachers and administrators I interviewed, to be sure), this idea does not hold much water with experts. Still, scholars interested in studying the media habits of the young have been unable to break completely with this notion, nor have they been much interested in empirically debunking an essentialist notion of the young and their technological proclivities. Crook (2012) acknowledges this ambivalence and argues that although youth are voracious users of digital media, their use tends toward consumption and does not correspond to higher engagement with Internet-mediated learning when such tools are available (p. 65). In short, the digital natives so often talked about are not especially native: use is always a context-dependent phenomenon. While I will ultimately orient my evaluation of usage patterns of the young toward the realms of new media and consumer economics, I want to briefly visit the literature of digital youth, a successful and multidisciplinary research paradigm that influences communication studies, psychology, education, and library studies.

Health researchers assure us that adolescent development incorporates various kinds of media, including text messages, apps, phones, tablets, computers, chats, social media network sites and all manner of things digital. These digital media are merely recently developed aspects of the cultural apparatus incorporated by adolescents to express and accomplish their

development (intellectual, emotional, sexual) magpie-like, in the same manner that previous generations used the media of their time (Subrahmanyam and Šmahel, 2010). A health-based approach focuses on the continuity of human adolescent developmental needs as much as it does on calming the nerves of parents concerned about their children's digital preoccupations. Like earlier research from the advent of television, this research begins with a focus on the putative effects of media consumption on the development or learning of the young (for example, Keith et al., 1986; Moschis and Moore, 1982; Clark, 1983). In what follows, I want to describe a number of implicit orientations towards the young and their use of information and media technology. Powerful norms about what children should know about computers structure debates around public education, but these feelings conflict with a concurrent sense of unease around technology and how its use might cause harm (Turkle, 2012). So on the one hand, an air of moral panic around the young and their media and information technology use, "an ongoing culture of fear," clings to any treatment that broaches this subject (boyd, 2007, p. 135). But on the other, a contrary, commonsensical sentiment that digital technology is the natural and exclusive province of the young permeates popular culture (Selwyn, 2009). These dueling anxieties are not so easily dismissed as error. They produce tangible results in the policy realm and exert strong influences over the possible meanings and interpretations given to computers of all kinds. Researchers in education, communication, child psychology, and library studies working in the digital youth paradigm have been interested in assessing the qualities of youth and adolescent media use, particularly in the United States. There are, broadly speaking, three themes of interest to the discussion of one-to-one tablet programs in the digital youth research literature: character of use, education, and social equity.

Character of use

In terms of character of use, Ito et al. (2009) conducted a three-year ethnographic, multi-sited study of American young people's media practices using four key terms to characterize what they observed: *new media ecology*, referring to the everyday practices related to overlapping technologies, platforms, media, devices, and infrastructures commonly used in complex combinations by their research subjects; *networked publics*, referring to the confluence of mass media and participatory media; *peer-based learning*, referring to loosely organized, informal transmission of skills or knowledge; and *new media literacy*, referring to the competencies skills, and knowledge that make everyday media practice possible (xiv – xvi). The study included rural, suburban, and urban participants, schools, libraries, and after-school programs, as well as home visits and online spaces. Critically, these authors looked for descriptions of everyday media use that ignored demographics beyond age, that is, *which* teens were engaging was not of interest, only *how* such engagement took place (xvii). The authors developed a typology of the motivations for and methods of youth activity within the new media ecology: *hanging out*, *messing around*, and *geeeking out*, terms which indicate an increasing level of attention and engagement, each with an attendant set of statuses, intellectual demands, and hierarchies of expertise (ibid.). As it concerns the use of new media and information technology technologies for learning, "the focus of learning and engagement is not defined by institutional accountabilities but rather emerges from kids' interests and everyday social communication" (xxi); this caveat about learning is of great importance in evaluating digitally mediated learning activities such as Number Seven's tablet program, as it cautions against conflating formal and informal learning. The authors used existing practices to describe the conditions under which informal learning could take place and emphasized that teens could develop robust, peer-driven learning, but that such learning took place in non-scholastic settings and was driven by the

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interests and social interactions of participants, not by the priorities and values of the adult-centered world.

Education

Education is of central interest in this literature, owing to the central role public education plays in the lives of most American teenagers. The popularization and diffusion of the World Wide Web in particular has captured the imagination of researchers and policymakers who are eager to harness new technologies to address continuing inequalities of opportunity and of outcomes via scalable and replicable instructional designs in various educational settings (Bannan-Ritland, 2002). This sense of imperative runs through Collins and Halverson's (2009) description of the stakes of technological transformation of public education:

> The central challenge is whether our current schools will be able to adapt and incorporate the new power of technology-driven schooling. If educators cannot successfully integrate new technologies into what it means to be a school, then the long identification of schooling with education, developed over the past 150 years, will dissolve into a world where the students with the means and ability will pursue their learning outside of the public school (p.3).

In perhaps the most influential scholarly work on one-to-one laptop programs (mentioned in the introductory chapter) Cuban et al. (2001) first described the pattern of "high access and low use," a pattern that holds for Number Seven's use of tablet computers as well. While this aspect of the authors' findings is discussed elsewhere in this dissertation, I want to focus for a moment on a curious secondary finding of this research. The authors identified two kinds of students whose access to technology changed their status within school: open-door students and tech gods. Open-door students are those to whom access to technology encouraged better academic performance (i.e. those for who computes opened a door to better learning). The authors also identified tech gods, those students who were esteemed by fellow students and by teachers for their expertise in using computers. Seiter (2005), in her own multi-year qualitative study of children's computer usage, found that the status of tech good was reserved for male

students and that female students were rarely or never given such status. Peck et al. (2015) proceed in a similar vein, inventing three types in a study of two high schools: digital rebels, who use digital technologies in ways that buck authority; cyber-wanderers, who, like open-door students, used technology as a means of socialization and academic improvement; and e-learning pioneers, self-motivated, highly competent students who used a verity of technologically mediated modes of education (p. 15 - 20). These authors were interested in changes to the general learning situation caused by the increased prevalence of computers and computer-like devices. They found that, while teacher-student interactions still dominated the learning environment, and while learning was still a paper-and-pencil, brick-and-mortar affair, the proliferation of phones and devices in the student population had produced the simultaneous need to incorporate technologies into instruction and to limit the use of technologies viewed as intrusive or non-educational. These authors conclude on a note of ambiguity, suggesting that public schools were still in transition, stuck in a "perplexing moment" where old norms had been unsettled but new ones had not yet emerged (p. 27).

A more careful reading of this scholarship shows that the claims of benefits of digital technology applied to learning are in fact quite limited and highly contingent. Presumably, the need to incorporate technology in learning is more a question of engaging students where they live, so to speak, of meeting students' interests. It is precisely such an overstatement of the interest of students in technology that Philip and Garcia (2015) dispute. They argue that student interests in smartphones corresponds to particular context in their lives, not necessarily to learning, writing that "youth interest that involves smartphones is not tied to the device, but exists in the relationships or activities that the device facilitates—dimensions of their lives that often do not have a place within the formal curriculum of the school" (p. 681). The authors again emphasize the primacy of teachers in encouraging deeper engagement with learning and reject an

essentialized notion of what it is that young people think about technology. They use a focus group to demonstrate that the smartphone-based learning intervention they studied generated considerable excitement and enthusiasm among students, but it ultimately became boring and de rigueur to students, likely because use of the device was highly restricted. Ritzhaupt et al. (2012) developed a path model to show that various contextual factors beyond students' generational affinities for technology explained use of technology by students: students who had teachers with higher levels of education and more experience teaching with technology used more technology in their learning. Likewise, if teachers used technology more often in instruction, so too did their students.

In terms of public education specifically, the allure of the digital has been quite profound. However, public education also suffers from a pervasive anxiety about the intrusion of digital devices into learning spaces. This results in a contradictory compulsion to include these technologies, to update both the goals and practices of public education to accommodate digital technologies. In this way, public education itself is trapped in a double bind that, accordingly, produces a policymaking schizophrenia: digital devices then are both ameliorative and injurious, vital to public education and destructive at the same time. Such a contradiction is manifest in the means by which officials at Number Seven provided devices to students, then systematically proceed to eliminate or curtail the capabilities of the devices they required students to carry.

Social equity

Still, if many researchers are responding to the anxieties of use, others seem taken with the potential of technology to accomplish the broader goals of social equity that would help the young. In particular, some scholars working with the digital youth paradigm have not been so quick to turn away from demographic realities. Barran et al. (2014) studied technology-based projects in Chicago middle schools that sought to use technology in pursuit of social equity.

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Again, this work focused on informal learning, on various kinds of new media, poetry, robotics, and software explorations that aimed to encourage critical and analytical skills in economically disadvantaged youth in minoritized communities. This project used the specific interests and demographic cultural competencies of students to establish relevant goals and techniques, a strategy the authors suggest that, though difficult to replicate, could lead to an inclusive approach to media literacy (Ryoo, 2013, p. 763). Garcia and Morell (2013) argued that new media and information technologies could alleviate social inequality if embraced within a framework of participatory, activist media, that is, one that valorizes those aspects of technology that favor emergent practices of "manipulation, response, critique, and remix" (p. 124). These practices have real-world consequences that extend outside of media spaces and also depend on a set of political end economic commitments inherent in media technology itself. Although this work embraces various kinds of technological interventions in service of social equity, they hold that "[t]hough helpful, smartboards, tablets, and digital wizardry should simply augment the powerful lessons that teachers and peer mentors can instill in today's classrooms around the world" (p. 126).

Library and information science practitioners have been eager to incorporate these finding in their own programming, and to some extent have achieved success in piloting programs that create the conditions for peer-centered, technologically mediated learning (Trip, 2011). In particular, libraries have been eager to capitalize on the informal aspects of learning, freed as they are from many of the constraints and norms of public education and schools, where "access is routinely constrained by institutional policies and norms that emphasize adult-driven assignments and task-oriented activities" (p. 332). Libraries have expanded the traditional ambit of their general mission to encourage public literacy onto new technologies of reading and inscription, including media literacy (Silverblatt et al, 2014;). Media literacy is itself a complex

and unsettled term, one that suggest both a normative orientation toward particular kinds of technological use (e.g., citation, copying, intellectual property) and a larger framework that concerns how media are created and how young people are trained to experience them (e.g. representation, economics, distribution) (Gibbons, 2013).

Taken together, this body of work suggests that youth media activity, in its participatory, active mode, occurs primarily in informal settings, when groups of friends or classmates cultivate shared interests or pursue projects. Likewise, learning associated with media and information technologies are highly dependent on a number of factors beyond the brute fact of access, including the presence of adequate infrastructural resources and various kinds of conducive social relations. Finally, when applied to formal educational settings, many other factors have been shown to determine positive learning outcomes more directly, including teachers' training and education, family socioeconomic status, and individual personality traits. (Ritzhaupt, 2013, et al., Ackerman, et al., 2013; Altschul, 2012; Masten et al., 2012).

ETHNOGRAPHIC PORTRAITS

As Coleman (2013) writes in her work on hackers,

> A life history, by definition, belongs uniquely to one person, textured by innumerable details, instances, events, idiosyncrasies, and happenings. As such, the writing of a "typical" life history is an impossible, quixotic task, seeking to standardize and represent what evades such a neat distillation.

In the section that follows, I want to take up this question of representation and ethnographic method. As this chapter primarily concerns students and their use of media and information technologies, I want to spend some time giving a sense of my interactions with students. Admittedly, my experience with students was highly constrained: I mostly met students at school or at school-related activities. Infrequently and by chance, I ran into students in the neighborhood, or, in one instance, at a student's place of work. Still, I did befriend many students and spent two years in their school during a notable time in their lives and during a

major technological initiative. Rather than synthesize a single narrative to serve as a general biography, an archetype of what students at Number Seven are like, I will instead present three brief portraits of some of the students. In no way do I mean to present their individual stories as universal. I offer these stories of my interactions with these students to give sense of the character of life in the school and to point out that many of the situations youth encounter at Number Seven involve community and cultural issues that are mismatched to some extent with the culture the school so strenuously promotes.

Eska

Eska is a tall girl, Latina, Class of 2015, who wears the thick, black eyeglasses that are in style among the students. She always wears her hair in a single braid down her back: in two years, I rarely saw her take it down. Eska identifies as a nerd, a term that carries with it a certain kind of cachet. Students at Number Seven wear uniforms, but Eska embellishes her uniform with toys or props that show her interest in young adult fiction and anime: once, during final exams, she brought a giant stuffed animal with her from class to class for support. She chose the nickname Eska from a cartoon character in an anime-inspired series; the character whose name she has taken as her own is a sardonic ice princess voiced by a famous television actress. Eska, in groups, likes to adopt this affect, being aloof and slightly arch, but one-on-one, she is quite warm. Everyone at school calls her Eska, even though her given name is a common one shared by many other students. Eska is a popular student with teachers and other students, although she describes herself as "not really that popular." Eska is definitely "involved," as teachers and administrators use the term: she is active in the Student Technology Leader program, Junior Statesmen, Cadets, and the Gay-Straight Student Alliance. Junior Statesmen is a debate and civics club led by Coach: in the second year of my study, the school's club was named Chapter of the Year by the national association. In a surprising coup, they beat out much wealthier

schools with longer traditions of JSA activity. Eska attended a summer school at UCLA sponsored by the JSA. She came back from the week-long event early, so that she could help Ms. Quezada with inventory work in preparation for the STL's fall iPad distribution. The Cadet program functions as a feeder for the military. Cadets are given uniforms — grey pants, slacks, and hats — and perform various flag and marching drills, for which they are sometimes excused from class. At community functions such as the school naming ceremony or graduation, the Cadets march in to great fanfare to lead the Pledge of Allegiance. The Gay-Straight Alliance was founded in the first year of my study by one of Eska's best friends. Eska identifies as lesbian; her friends wanted to have the club so that students like Eska would feel included in school, but Eska told me that, although she appreciates the club, she is too busy with her other activities and schoolwork to give it much time. She lends her support to the GSA when they have important activities, but she doesn't often attend their meetings. Eska views the GSA as an opportunity for some of her less involved friends to develop accomplishments they can list on college applications. At the end of her senior year, when I asked Eska what accomplishment she was most proud of at school, she responded "Being the first person in my family to go to college."

Eska's dream school was the University of Michigan, because she heard it was the best. She was waitlisted there, so instead chose to attend Kent State University, where she had been offered a scholarship. When she started high school, she did not know much about college or think of it often, although she had cultivated an intense interest in college during her four years at Number Seven. Gaining admission to college went fairly smoothly for Eska, but her plans to attend college out-of-state proved more complicated than she had imagined. Eska is an only child. She lives with her mother and has no other immediate family. The plan to move away from home provoked tension between Eska and her mother, who pressured Eska to continue to live at home. Eska went through several attempts to mollify her mother while pursuing her own

ambitions. At one point, Eska agreed to go to Kent with the understanding that her mother would to move to Illinois, where a relative lived who might help Eska's mother find work. Eska was under the impression that Illinois and Ohio were close together, close enough that her mother could still visit while leaving Eska to live semi-independently. This plan failed when Eska figured out that the drive between states would take several hours. I talked frequently with Eska, who had never been outside of California, about her expectations for college life, what it would be like to experience a cold winter, live in dorms, make new friends. Although she had nor real frame of reference, she was optimistic. She said, "I'm scared, but I'm excited." Ultimately, Eska decided to move to Kent State alone, a decision that strained her relationship with her mother, but one that Eska felt she had to make in order to fully experience her freshman year of college. She planned to do well in her courses so that she could transfer to Michigan after two years, to participate in their mathematics program.

In some ways, Eska typified the kind of student Number Seven exists to serve: she was from a single-parent home, the daughter of an immigrant, a kid with few middle class, college-educated models or mentors. Eska improved academically at Number Seven and successfully completed many activities that no doubt made her a more attractive candidate to many college admissions committees (like most Number Seven students, she got a score of 0 on the AP exam she was required to take). The norms established at Number Seven certainly gave Eska options she might not have had otherwise, especially in terms of applying to and gaining admission to selective colleges. But this strategy, imposed on Eska by the school and internalized, created tensions in her personal life specific to her own cultural identity, concerns common to students in similar situations.

Henry

I met Henry, Class of 2015, on one of my first trips to the school: he came up to where I was sitting in the courtyard, introduced himself, and offered his hand for me to shake. Henry describes his own knowledge of technology as "excellent"; this is unsurprising, as Henry frequently describes his own accomplishments and general excellence quite matter-of-factly, without the hint of insecurity that arrogance never quite masks. He has the demeanor and bearing of a professional politician. Henry is an African American kid, tall and prone to wearing a red tie to school (he seemed to have only the one). He was handily the most popular student in the school; teachers jokingly called him Mr. Mayor. This nickname was not meant to mock Henry: he was class president and frequently announced that he would like to one day be the first African American mayor of Los Angeles. When I told him there had already been a black mayor of Los Angeles, he retorted, "I'll be the first mayor from South Central, then." This was a set up he used as an ice breaker, one I heard him use again later. Besides student government, Henry played basketball and participated in National Honors Society.

Henry lived with his older sister: he never mentioned what happened to his mother, but he often spoke of his father. Henry was quite open that he had never had a relationship with his father, but thought college might give him a chance to start one. Henry was offered admission to both UCLA and James Madison University. Over the weeks that he agonized over his decision, he updated me frequently, telling me what particular fact had swayed him toward one school or the other at any particular moment. I asked him if he thought he might be able to do better at one school over the other. Without hesitating, he said, "I'd do better at UCLA. I have more support here." Still, when the deadline to commit arrived, he chose James Madison. He said that ultimately he wanted to be an adventurous person and the prospect of a more challenging experience appealed to him. I brought Henry an article from *The New York Times* about the

difficulties poor and first-generation college students face in completing undergraduate degrees, even when they have preformed well in high school. After reading the article, he said, "Sounds about right." Still, when he emceed the graduation ceremony a few weeks later, his tone was hopeful, inspirational, even: "Who would have thought that 163 kids from the ghetto could get this far," he said. This applause line was greeted enthusiastically by all present.

Henry's statement about the prospects of his fellow students, influenced as they are by the realities of shared socioeconomic and domestic situations, demonstrate a conflict with the meritocratic orientation of the school. As Number Seven's administrators and the parent CMO state in all their public appearances and promotional documents, the culture of the school—as the term culture is used by administrators and teachers as the general values of the school and those activities and policies enacted in pursuit of them— place high expectations on students. The emphasis at Number Seven is on gaining admission to a four-year college or university, a strategy that is promoted with claims about the future higher earning potential of four-year graduates. Simultaneously, the school ignores the throroughly documented difficulty of lower socioeconomic status and first generation students of completing four-year degrees. In some sense, students are expected to ignore the reality of their own lives. They are sent off to colleges and universities near and distant to pursue academic success on their own, without the constant discipline and intensive structure of the school, encouraged to believe that they will have good academic outcomes without any personal or familial support networks.

Alma

Alma, Class of 2016, is a small Latina girl, barely five feet tall, with thick glasses. Alma describes her own familiarity with technology: "I'm pretty good. You know because I'm young and young kids know how to do stuff , I guess." She likes watching YouTube videos and does not consider her familiarity with smartphones exceptional for a teen. Alma lives with her

boyfriend Pedro, another Number Seven student, and his family. Alma and Pedro are both

Resource students. The education of Resource students is governed by the IEP, a document

created by a certified Resource specialist to identify academic goals, accommodations, and

strategies for struggling students or those who have certified learning disabilities. Learning

disability, diagnosed by credentialed, certified experts using a variety of tests, covers a variety of

pathologies and experiences. The Individuals with Disabilities Education Act defines "specific

learning disability" as a term that includes "perceptual disabilities, brain injury, minimal brain

dysfunction, dyslexia, and developmental aphasia," but does not include conditions that are the

"result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance,

or of environmental, cultural, or economic disadvantage" (Cortiella and Horowitz, 2014, p. 2).

Still, despite the relatively narrow set of conditions meant to restructure curriculum for

individual students, IEPs have proliferated at Number Seven and in schools more generally,

especially among students of color (Harry and Klingner, 2014). The IEP, signed by the Resource

specialist, the student, and his or her guardian, entitles a student to alter the standard curriculum

given other students. Resource teachers are assigned cohorts of students that they teach in small

group settings throughout the day to give homework help, review lessons, work on general study

habits and so forth. Alma's IEP allows her to visit the Resource room frequently. She can also

ask for permission to spend more time there, if she should feel overwhelmed or have trouble

keeping up. Alma's reading and mathematics scores are among the lowest in her grade and in the

school. Alma's goal is to graduate from high school, get a job, and get married to Pedro so they

can get an apartment. When I asked her if she thought she might like to go to college as Number

Seven students are encouraged to, the entire Resource room went quiet. In the pause that

followed, she said, "Sure." Later, she explained to me that her teachers had fallen quiet because

no one believed that she would graduate. Alma was in danger of being expelled for her poor

academic performance and at risk of dropping out due to frustration. Alma was also unusual among Number Seven students in that she was struggling academically. Number Seven's teachers and administrators demand passing grades from all students. If students fail to keep passing grades in all of their classes, they are subject to being "transferred out." Alma's IEP protected her to some extent from this action, but the pressure for her to become college-ready would grow as she approached senior year and her college plans might conflict with the school's emphasis on matriculation rates.

Alma often talks to resource teachers about her personal life. Once, she lingered in the Resource room after her lesson was over. Ms. Crause asked her several times if she wanted something else, but Alma demurred. Eventually, Ms. Crause drew out of her that she wanted to ask if using someone else's social security number was a crime. Concerned that Alma herself was involved in fraud or identity theft, Ms. Crause, two other resource teachers, and the school's psychologist spent over twenty minutes convincing her that such behavior was illegal and should be immediately reported to the school's principal and to police. Grudgingly, Alma shared the situation that had prompted the question: her mother had sold Alma's social security number to a realtive years before, when Alma was an infant, and this family friend had been using that number since. Alma wanted to get a job to start to save money, but was afraid that using her own identification documents would get her, or her mother, or a relative in legal trouble. At the end of the conversation, Ms. Crause counseled Alma to notify her mother that she planned to start using her own social security number. Alma said she would try to find her.

Alma's situation, although atypical, points to the complexity of life in the immigrant communities of Los Angeles, even for students who are themselves citizens. The status of documentation in immigrant communities is incredibly complex and complicates efforts to find afterschool jobs, enroll in college, or qualify for various forms of financial aid. As Garcia (204)

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writes, the classificatory and documentary power of U.S. government authorities exerts a powerful influence over the lives of immigrant workers and their communities (ibid.). The power dynamics engendered by documentation status have direct and indirect consequences and can involve any number of states beyond a binary description of having or not-having. Many students in the school ended up in complicated situations that involved the possession and circulation of documentation, their own and that of those around them.

The Educational Situation

The preceding passages serves to locate the reader in particular place in time, in a particular school setting in a South Los Angeles community. As these brief looks at the lives of three of my informants shows, some of the problems that students at Number Seven have to address come from the interplay of complex factors: cultural competency, educational demands, family responsibilities, government action and so on. These are difficult terrains to navigate, even for adults. This ambiguity stands in contrast to the focused culture of the school, a culture that rewards a certain kind of success and punishes every kind of shortcoming. As Ms. Wilson, herself an aspiring school administrator, put it,

> Ms. Wilson: Generally, we serve under-served families in low SES backgrounds, minorities, usually second-generation Hispanic students, mostly. Most of them are English language learners, bilingual. I think sometimes leadership gets a little focused, so they have one end goal in mind and I think they just get a little tunnel vision.

The one-to-one tablet program then was merely one aspect of the school's "tunnel vision," a very specific view of what public education should do. This vision is largely pragmatic, focused on using a single strategy (college matriculation) to create the conditions for improvement and economic stability in the lives of its students. In the rest of this chapter, I will focus on student computing more specifically, on tablet computer use in the school, especially by a core group of student IT specialists, the STLs. But to describe this use, I need to switch gears and introduce a question about the value of work.

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EVERYTHING IS FREE IN THE NEW MEDIA ECONOMY

The following section draws together several threads from discrete bodies of literature in new media economics, feminist Marxism, science and technology studies, and information studies to contextualize the role of information and media technologies in public education. I visit, successively, scholarly and popular descriptions of the emergence of a sharing or commons-based economy and responses from critics to foreground the prominence of unpaid work in global regimes of computer-enabled capital accumulation. Next, I move from a purely economic critique to one that incorporates notions of affect, particularly as affect concerns work in global digital capitalism. I visit here a particular episode in feminist Marxism and its contemporary incarnation as a critique of social media networking sites to make productive use of an apparent conflict in economic thought over the value of unwaged, unpaid work. As opposed to Marxist interpretations, I will argue that the although the benefits of unwaged labor accumulate disproportionately to large, complex, technologically sophisticated corporations, such unwaged work in and of itself does not constitute a general condition of alienation and exploitation.

Recent thought on the economics of digital media has been hugely influenced by the general sense of newness and novelty surrounding digital technologies. To summarize, I will juxtapose two points of inflection in the development of the consumer-based markets enabled by the near ubiquity of networked computers and computer-like devices. As a starting point, I begin with a brief sketch of the advent of the "sharing economy," which I discuss here as both a scholarly and consumer phenomenon. While the term "sharing economy" capitalized on a number of ideas about computers and knowledge production, its circulation invited sharp critiques from scholars interested in labor. I visit this literature to orient analysis of educational technological interventions back toward the realm of the economics of consumer electronics and mass media, the domains in which these artifacts and materials become prominent. I present next

the second point of inflection, the critique of scholars interested in digital labor, with a particular

emphasis on the seeming contradiction between forms of digital activity that uncomfortably

combine paradoxical elements: user activity is a form of consumption that is productive, both

unwaged and highly valuable, leisurely but highly structured. Finally, I address these

contradictions in the nature of labor captured by contemporary digital media using ideas from

feminist Marxism, especially the Wages for Housework movement. Rather than attempting to

resolve lingering questions over the centrality of unpaid labor to the digital media economy, I

insist that digital technologies position their users in multiple kinds of markets simultaneously,

that the affective pleasures a user receives at the level of the interface becomes *both* the saleable,

valuable resource of data inside the black box of consumer platforms and a form of social or

intellectual capital (Coleman, 1988; Nahapiet and Ghoshal, 1998). Just as the home served as a

site to point out the gendered and racialized workings of capital for earlier scholars (Fortunati,

1995; Lefebvre, 2008; Jarrett, 2013), I hold that the digital interface of mobile computing

constitutes another such circuit of exchange, one that has, so far, been largely absent from

discussion of education technology.

On the joys of unwaged work

Like many other aspects of technology, the economics of media and information technologies are

wrapped up in ideas about the future. From the perspective of some scholars and pundits, the

emergence of the Internet and the steady decline of in the price of transferring and storing digital

data was the realization of a new kind of economics. Of particular note was Yochai Benkler's

(2006) description of a new kind of commons-based, peer-to-peer mode of non-monetary trade

that resulted from these technological changes:

> These newly emerging practices have seen remarkable success in areas as diverse as software
> development and investigative reporting, avant-garde video and multiplayer online games.
> Together, they hint at the emergence of a new information environment, one in which individuals
> are free to take a more active role than was possible in the industrial information economy of the

twentieth century. This new freedom holds great practical promise: as a dimension of individual freedom; as a platform for better democratic participation; as a medium to foster a more critical and self-reflective culture; and, in an increasingly information dependent global economy, as a mechanism to achieve improvements in human development everywhere (p. 2).

Although these claims sound grandiose in retrospect, of a piece, perhaps, with other Information Society abstractions, Benkler was particularly interested in a narrow set of phenomena, the kind of voluntaristic, collaborative, "non-market and nonproprietary" production of which Free/Libre Open Source software, SETI @home and Wikipedia served as exemplars (ibid.). From this perspective, networked computing was poised to bring new forms of economic organization to a global public based on the seeming inexhaustibility and non-excludability of human knowledge. Critically, Benkler argued that these knowledge-producing forms, although not entirely new, emerged because networked computing made possible collaboration at a scale impossible via traditional, industrial organization. Benkler's valorization of particular kinds of collaborative knowledge projects served as the intellectual edifice for the concept of the sharing economy, a broad description of the digital economy begat by Web 2.0 technologies that describes everything from crowdfunding, to social media, to ride-sharing services. As Belk (2014) summarizes in an analysis based on both scholarly and popular accounts, the great variety of businesses considered to be part of the sharing economy include those enterprises who sell temporary access to some good or service or any business that relies on the Internet, especially Web 2.0 and mobile applications, to connect to customers (p. 1595).

Despite the enthusiasm of international media and the establishment of many multinational firms who describe themselves as participating in the sharing economy, many scholars have disputed the central premise of the sharing economy concept. For example, Bardhi and Eckahardt (2012) distinguish between sharing, a non-commercial activity practiced among intimate social relations, and access-based consumption, where customers "are able to access objects or networks that they could not afford to own or that they choose not to own due to

concerns such as space constraints or the environment" (p. 881). On different grounds, Schiller (2015) argues for greater continuity between the previous three centuries of global capitalism and the present. For example, Schiller disputes the commonly held propositions that the proliferation of computer technology indicates a fundamental "informationalization" of the world economy or that "digitally engaged labor possesses qualities that are both singular and paradigmatic" (p. 3). Instead, he suggests a focus on the working classes as a whole and "integrating, rather than neglecting, the manifold concrete labors that are drawn into production and that are co-participants in the contemporary political economy as it actually exists" (p 8). Brown (2008) explains a number of digital enterprises based on unpaid labor in terms of a historical connection to the roots of Internet culture, to a "hacker ethic" based on a conception of freedom that "allows for collaboration and encourages members of a community to build upon the work of others, " often without regard for monetary value (p. 401).

Still, scholars had to develop some kind of explanation for the epic fortunes generated by companies and entities that harnessed various forms of collaboration and the triumphalist manner in which their owners and investors were portrayed in international media, particularly as the appearance of some new, technologically fueled economy became a kind of commonsense and took on a life of its own (Hamari, et al., 2015). Scholars took issue with the aspect of the digital economy that turned on unpaid contributions to digital projects, particularly the commercial sort. Critics, particularly Marxian economists, sociologists, and theorists, countered the assertions of novelty and inexhaustibility with a staid and decidedly un-novel concept, that of labor (Negri, 2008; Fuchs, 2011; Peters and Bulut, 2011). Generally, these scholars sought to locate those "newly emerging practices" of interest to Benkler and others within existing frameworks, to account for the seemingly one-sided nature of value capture in the ever-expanding digital economy. While these Marxian and Marxist scholars agreed that new forms of technology (in

particular, the Internet and newer apps or services that run on its infrastructure) and related

economic developments such as peer-production troubled previous categories used to understand

macroeconomics — such as the distinction between producer and consumer, or between culture

and work— they argued that these developments were not just sites of cultural work and

knowledge production, but were in fact sites of an intensified form of informational capitalism

that relied on numerous forms of unpaid labor (Terranova, 2003; Scholz, 2013). Peters and Bulut

(2011), synthesizing Marx, Foucault, Negri, and Deleuze, write,

> Digital and web-based technologies have enhanced productive capacities that are now based on
> the human intellect rather than raw materials, which means that the production processes are more
> difficult to standardize, especially and in so far as they are based on forms of net*working* that often
> require the individual freedom and consent of the worker…Under the new labor regimes processes
> of peer production become increasingly essential and by contrast old forms of direct control
> become less important (p. xxii) [italics in original].

This critique, based on Autonomist Marxism, held that users of Internet based businesses from

Google to Facebook are not involved in some new economic relationship based on sharing but

are in fact engaging users as inputs of value into economic systems that generate huge profits

through a kind of a bait and switch, by convincing users to contribute data or attention and

consolidating the profit of each micro-transaction. Networked computers, aside from providing

the interfaces through which users could access web-based platforms and service, served a

critical role in aggregating, transferring, mining, and transforming user-generated data. The

growth of smartphone computing expanded this accumulative regime, giving people more places

to access these networked interfaces, but also inserting digital technology into spheres of

everyday life where consumer-level computers were not commonly used (Boczcowski et al.,

2015). This is a key feature of the spread of computers and computer- like devices that scholars

in a variety of fields have struggled to understand: in their mobile incarnations as smartphones

and tablets, information and media technology threaten to obviate economic and sociological

distinctions between leisure and labor, online and offline. For example, Taylor et al. (2015),

recognizing this difficulty and the general unreliability of such previously trustworthy

distinctions, instead focus on the "relations of production" that exist between users, corporations,

other users, and the economy at a variety of scales. In the context of a the massively-multiplayer

online game role playing game (MMORPG) they studied, the authors point out the variety of

informational and communicative work that players in the game do that produces value both

inside and outside the game environment and how such work uses many of the same tools that

form the basis of white collar work: spreadsheets, phones, email and so forth.

This blurring of categories and domains perpetuated by computer use is a central

preoccupation of a great deal of digital labor literature over the past decade. Fuchs (2013)

integrates several related terms — prosumption, a portmanteau that describes productive

consumption; playbour, the combination of play and labor; and digital labor, a catchall for the

various forms of user activity that generate value — that pertain to the production, use, and

circulation of digital media in a Marxist framework based on the concept of time in a capitalist

society. He argues that all of these forms of labor are symptomatic of large-scale changes in

global capitalism, specifically the extension of the working day into leisure time via putatively

recreational pursuits that produce value, many of which involve the use of information and

media technology. He argues that the spread of computers, both their physical dispersal and their

integration into the various milieus of contemporary sociality, represent an expansion of the

control of the capital-owning classes: end users constitute a kind of labor that is both "unpaid and

uncoerced," carefully managed by media companies via "protocological control," methods of

structuring and controlling user behavior "through (digital) code, algorithms, and protocols" (p.

475). Here, the value of what is generated for the user can never equal what is extracted by the

media corporations that run software platforms; in effect, the house always wins. Writers of this

school have continued to sketch out a broader political economy of digital technology and its

spread to various realms of life by updating Marx's notions of alienation and class exploitation (see, for example, Andrejevic, 2012). In these works, users who seem simultaneously to experience exploitation and pleasure are afforded little capacity for understanding the value of their own contributions and depicted as unwitting dupes of Internet snake oil, modern correlates of the factory workers of the past century:

> Exploitation remains a central aspect of the capitalist production of social media just as it was a central part of capitalist production in the factories of Marx's era. However, exploitation has been adapted to the new conditions of immaterial production. Rather than keeping most of the exchange value of the commodities produced and returning a small amount in the form of wages, the capitalist keeps all of the exchange value from the lease or sale of information commodities, whereas the user, simultaneously, derives use value from the very same commodities (Rey, 2012, p. 415 - 416).

Scholars also found resonance with older Marxian critique of mass media, with works that focused on the action of audiences and their attention. In audience labor theory, "to audience" is a verb. Audience labor theory would hold that users of commercial social networking sites, apps, and other forms of new media are alienated from the surplus value of their labor (and the data that carries and represents it) (Fisher, 2015). This account of audience and the value produced by its attentions precedes the work of scholars interested in the participatory aspects of Internet-related cultural projects, who have it that new media affords opportunities for expression, communication, creativity, and enjoyment (Jenkins et al., 2013). In other words, the key dissonance here is about the economic value of consumption of media. While other kinds of value (participatory, democratic, personal) are clearly present, Marxian new media economic critiques allows only that such value is not equal *monetarily* to whatever value is captured by the owners of software and platforms, a point that must be conceded and reiterated.

This conflict between the joys of unwaged work and the obvious financial value of such work depends, at least implicitly, on an appeal to classic economics, to a model of a human agent

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who functions rationally. This understanding of economic exchange ignores the prominence of emotion and sentiment. As Illouz (2009) writes, such an assumption about the nature of contemporary consumer society, although common, flies in the face of scholarship, history, or even, the actions of businesses themselves. Contemporary consumer culture is suffused with affect and emotion: "[C]ommodities themselves are not so much material objects as they are cultural meanings that in turn provide access to emotional categories and experience" (p. 380). Likewise, entire sectors of the economy exist to create, manage, and manipulate the emotional connections of consumers to the goods and services they buy (or aspire to buy). Arvidsson (2005) described brands and brand management as the extraction of ethical surplus, "a social relation, a shared meaning, an emotional involvement that was not there before" (p. 237). While these affective dimensions of consumer culture are well understood, digital labor scholars tend to discount these realities in favor of an emphasis on more easily quantifiable units of value.

There remains as well significant ambiguity over the extent to which labor can ever fully be digital, or, conversely, non-digital. Many forms of technology, including computers, robots, and artificial intelligences, succeed not by automating human labor, but by incorporating human labor and making such labor invisible in the end product (Ekbia et al., 2014; Ekbia and Nardi, 2014). Digital systems then constitute a particular kind of division of labor between human and non-human agents. The spread and proliferation of digital technologies themselves pose significant challenges to a conception of any inherent or essential quality of certain kinds of digital work. Nearly all forms of work in Western economies rely directly or indirectly on computers to function: the system of international currencies is itself highly dependent on computers and software and has been for decades (Golumbia, 2009). Labor markets can be mediated by information technology in a variety of ways; multinational corporations were among the first and most eager users of computers since before the invention of the personal computer.

There are few places in the world untouched by computers directly or indirectly. Bergvall-Kåreborn and Howcraft (2014) make this point explicitly in a review of Amazon mechanical Turk, a platform that matches low paying jobs with low-paid workers. Mechanical Turk takes advantage of the geographic distribution of workers around the world, their physical location, to bring them into many kinds of industry:

> The micortasks of "clickwork" are tedious, repetitive and poorly paid, with remuneration often well below minimum wage…Amazon's platform enables an array of companies to access digital labor at low cost and without any of the associated social protection or moral obligation (p. 213).

Other scholars have looked at labor conditions in enterprises that use digital technology without specifically differentiating between digital and non-digital labor, particularly as it concerns the working conditions of women and people of color. As these works insist, in contrast to the digital labor research paradigm, the conditions of digital workers are powerfully conditioned by their lived experiences, including their racial, sexual, and gender identities. Nelson et al. (2001) write:

> [F]or disadvantaged communities, technologies have been used to address historical exclusions and continuing inequalities—sometimes to offer more democratic alternatives, other times to manufacture profit, most often to simply fill a need, This is of course not to suggest that these are all progressive undertakings. Contradictions abound here; often lines blur between a self-interested search for pleasure and profit and a movement for a more equitable distribution of technological resources and knowledge (p. 5).

In another work that refuses to separate the conditions of work from the bodies of workers, Eubanks (2011) shows how public policies aimed at fostering growth in high-tech sectors exacerbate existing inequalities and further marginalize racial and socioeconomic groups already living in economic precarity. Through interviews with women based at a YWCA in Troy, New York, Eubanks depicts a working life of low pay, insecurity, and relentless surveillance and argues that "exploitation of poor and working-class people — especially women — makes the information economy possible" (p. 78). Her attention here is to the actual lived experiences of economically vulnerable women as they attempt to survive on call center

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and data entry work, vital occupations whose lack of status, freedom from poverty, or autonomy belie the "magical thinking" of Sharing Economy capitalists, policy makers, and misguided digital divide scholars (p. xvi). In another work, Eubanks warns that the increased surveillance among the poor augurs increased deployment of surveillance elsewhere in society. She suggests that the "low rights environments" she studies, where women, people of color, and the poor struggle to resist corporate and government surveillance in the course of low-paying or unpaid work, is a model for the future of the rest of the economy (Eubanks, 2014). Nakamura (2009) examines the grey market in the immersive MMORPG *World Of Warcraft* to describe widespread racist animosity toward the worker/players who sell virtual, in-game goods for real world currencies (p. 132).

As such criticism makes clear, although the work is often mediated by computers and might not directly involve the production of any physical good, the systems that manage such work rely on the disbursement of workers and corporate entities around the world; it is such physical distribution that partially determines the price of labor. Likewise, demography, race, ethnicity, gender, and other human qualities are persistent and undeniable factors in determining a person's place in the economic order. This focus on labor is not particularly technical and bears little resemblance to the commons-based knowledge production lauded by optimistic scholars of the Information Society or Sharing Economy bent. Still, the primary value of digital labor critique is not in its description of reified categories of the digital or non-digital, as in a description of reality, but in its contribution to establishing a political economy of the digital more generally. Critique should aspire to imagination rather than mimesis.

Sites and circuits of exchange

At issue here is the status of labor that is both unwaged and seemingly rewarding, with all the ambiguity such a term implies. That is to say, the question of *who* precisely is being rewarded

with *what* is the subject of ongoing dispute and exists in a state if indeterminacy and ambiguity.

One fruitful avenue for examining the status of users of contemporary media and information

technology with respect to this paradoxical labor comes in the unlikely form of a decades old

protest first instituted in Padova, Italy by the Veneto Committee for Wages and Housework

(Fortunati, 1995). This campaign, organized by Marxist feminists, formulated a shrewd and

cohesive critique of "social labor" that raised fundamental questions about the role of unpaid

work in capitalist economies. Day (2015) describes this movement as concerned with the role of

"reproduction," and the idea that these activities, which included such duties as biological

reproduction, outfitting and maintaining a home, and raising children to become productive

members of society, constituted a kind of unwaged work that women were required to perform.

The attitudes and affects of women who performed such work might vary by individual, but this

work occurred amid coercive gendered norms and very real economic conditions that limited

alternatives to performing this labor. Secondly, this critique pointed out that the economic

devaluing of women's work occurred outside the home as well, when women, who often still

were responsible for the aforementioned domestic chores, went out to work in the few

professions where they were allowed to work, such as primary education and healthcare. Finally,

this critique connected these first two points to argue, quite forcefully, that the low wage status

of women workers produced a "massive reserve force" of cheap labor (ibid.). The Wages for

Housework movement connected the unwaged work of a particular class of people (women) to

broader patterns of exploitation in the capitalist system:

> The problem was that of an overall social organization of work, and how the exploitation of
> women was foundational for the overall devaluation and exclusion (theoretical and practical) of
> social labor within the formation and determination of the wage (p. 38).

This final point then indicated a fundamental weakness in global capitalism from the

point of view of human flourishing. Harvey (2010) puts this fundamental neediness of capitalism

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quite succinctly: "[T]he perpetual accumulation at a compound rate depends on the permanent availability of sufficient accessible reserves of labour power" (p. 58).

Joining this reconstruction of the Wages for Housework movement and situating it within contemporary political economy critiques, Jarret (2013) usefully joins contemporary scholarship of digital media economics and Marxist Feminist thought on "women's work", a term employed here somewhat polemically to refer to unwaged, undervalued "social, reproductive work typically differentiated from productive economics of the industrial workplace" (p.2). First, she carefully disputes the mutually exclusive characters of agency and exploitation using affect as a critical means of disambiguating these concepts in both digital media and in "women's work":

> While forms of capital accrued in these economies may be converted into economic capital, they are also forms of currency in their own right, the possession of which affords power and agency to the possessor in specific realms of society (p. 5).

Second, she describes how unwaged work — aside from creating multivalent value — serves to condition and reproduce the relations and affects required for capitalism to function and, vitally, also introduces elements of contestation into social relations (p. 12). Third, she reminds readers of the clear parallel between digital labor and women's work and of the importance of feminist thought around labor to understanding seemingly novel technological formations.

The resonances of this episode in feminist activism to the situation of contemporary users of information and media technology has been made explicit by a number of scholars, particularly as it makes clear how the vagaries of affect connect to and determine economic realities. The artist and curator Laurel Ptak draws attention the power of new technological entities to monetize cognitive and affective forms of labor in an adaptation of the original "Wages for Housework" manifesto as written for American audiences by Selma James, reworked as "Wages for Facebook" (Jung, 2014).

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TO DEMAND WAGES FOR FACEBOOK IS TO MAKE IT VISIBLE THAT OUR OPINIONS AND EMOTIONS HAVE ALL BEEN DISTORTED FOR A SPECIFIC FUNCTION ONLINE, AND THEN HAVE BEEN THROWN BACK AT US AS A MODEL TO WHICH WE SHOULD ALL CONFORM IF WE WANT TO BE ACCEPTED IN THIS SOCIETY. OUR FINGERTIPS HAVE BECOME DISTORTED FROM SO MUCH LIKING, OUR FEELINGS HAVE GOTTEN LOST FROM SO MANY FRIENDSHIPS.

CAPITAL HAD TO CONVINCE US THAT IT IS A NATURAL, UNAVOIDABLE AND EVEN FULFILLING ACTIVITY TO MAKE US ACCEPT UNWAGED WORK. IN ITS TURN, THE UNWAGED CONDITION OF FACEBOOK HAS BEEN A POWERFUL WEAPON IN REINFORCING THE COMMON ASSUMPTION THAT FACEBOOK IS NOT WORK, THUS PREVENTING US FROM STRUGGLING AGAINST IT. WE ARE SEEN AS USERS OR POTENTIAL FRIENDS, NOT WORKERS IN STRUGGLE. WE MUST ADMIT THAT CAPITAL HAS BEEN VERY SUCCESSFUL IN HIDING OUR WORK.

BY DENYING OUR FACEBOOK TIME A WAGE WHILE PROFITING DIRECTLY FROM THE DATA IT GENERATES AND TRANSFORMING IT INTO AN ACT OF FRIENDSHIP, CAPITAL HAS KILLED MANY BIRDS WITH ONE STONE. FIRST OF ALL, IT HAS GOT A HELL OF A LOT OF WORK ALMOST FOR FREE, AND IT HAS MADE SURE THAT WE, FAR FROM STRUGGLING AGAINST IT, WOULD SEEK THAT WORK AS THE BEST THING ONLINE.

Figure 3.2. Detail of Laurel Ptak's "Wages for Facebook," an Internet-based art project that consists of a scroll of text on a screen. As it was originally presented in a gallery as a work of art, the piece features a slowly scrolling manifesto that repeats. A version is available at http://wagesforfacebook.com.

By substituting words that pertain to social networking sites for words in the original text that deal with emotional and domestic labor, this work connects a concern with the political economy of contemporary digital media to this older and more established critique about the global economy's simultaneous demand for and dismissal of "women's work" in its voracious appetite for labor.

Taken together, this movement and its contemporary successor provide an incredibly powerful way to conceptualize labor in the context of contemporary media and information technologies. Critically, it situates digital platforms and artifacts as the site of exchange between affective or emotional value and monetary value. The circuits of digital computers function in the engineering sense, performing the millions and trillions of operations that constitute the computing environment, but they also function as another kind of circuit in financial, communicative, or educational transactions as well. Thus, we cannot ignore the affective or

emotional aspect of this work or dismiss it as trickery, rather we should take it seriously as a powerful motivating factor, a kind of currency, and a pillar of the new media economy. In other words, users contribute valuable resources in a variety of contexts not in spite of their emotional, intellectual, and aesthetic interests, but because of them. Moreover, just as these earlier theorists identified the home as the site of the exchange, contemporary theorists have located the computer as another such site of this trade. Digital platforms, hardware, and software of all kinds make such exchange possible by, in effect, inscribing the necessary and predicted affective concerns of users into digital media, transmuting the momentary and ephemeral communications into a durable, saleable form. That is not so suggest that affective life should be reduced to its monetary exchange value, the reductive move of some digital labor scholars. Quite the contrary, it is the reverse. As Day (2015) opines, "Affect is not simply a means for market value and isn't simply one sphere of human expression that is commoditized along with others, but rather , it is the basis for all human relationships" (p. 42). As Fortuani (2011) writes, affective capacity

> not only creates value in the process of reproduction of the labor force but also generates directly capital. One only needs think for example of Facebook, Twitter, Myspace, and so on. They are basically enterprises which extract value directly from sociability, friendship, and emotion for producing capital (p. 431).

BUSY WORK FOR STLS

In the next section, I return to my empirical material. Specifically, I want to describe the work of Student Technology Leaders, those students who worked most closely with tablets. Keeping in mind the development of the value of affective labor form the preceding sections, I will describe in both text and photo how these students interacted with tablet computers.

Background of STL Program

Academy School's STL program, originally created via a $4,989,786 U.S. Department of Education grant for a program called "College YES," exists not in the context of any specific curriculum (e.g., American history, geometry, or physical education), but to "incorporate

powerful uses of technology into teaching and learning and open up the virtual world of information, resources and tools for students" (College YES i3 Development Proposal, p. 1). In this way, the STL program, ostensibly instituted as part of a college-preparatory, STEM (science, technology, engineering, math) education project, came to exist at Number Seven (and its sister schools) as an trans-curricular entity, a standing reserve of technology experts detached from the traditional organization of the normal high school. Funded in 2010 for a five-year period, the successful grant that instituted the STL program sketches out a project that will also involve professional development for teachers, project-based learning, and peer education. This specific document does not spell out the duties of STLs, although it refers to them continually both as a resource for other kinds of learning and as an example of the kinds of competencies the school's technology program aims to create. Notably, the STL program predates the school's one-to-one tablet program, instituted three years after the STL program. Throughout the two years of my study, STLs performed needed duties in the installation, maintenance, and repair of Number Seven's educational computing infrastructure, including the school's one-to-one tablet program. Theses duties included inventory control, daily check-in and checkout of all 500 student tablets, troubleshooting, software installation and update, and occasional repairs. STLs also worked with the school's other computer resources: they controlled carts of laptops available for classroom use, produced content for the school's YouTube channel, and effected teacher requested technological deployments, such as installing a specific app or feature.

The STLs are highly regarded by teachers for their technical savvy and serve as "first responders" whenever issues related to teaching technology arise. Teachers commonly turn to STLs for help during class instruction. This means that in the routine occurrence of technical difficulty, an STL working in a class might be asked to correct the problem by fetching hardware, configuring a device, finding out specific information such as a password, or installing

a particular application, all of which I observed over the course of my study. As Coach Morales put it, ""When I see one of them [STLs] in class, I feel good because I know they can help if I need them to. I can just grab one of them and go, 'Hector, run go get me a charger.' I can trust them."

Many teachers expressed this appreciation of the STLs' competence as a consequence of demography. In this common framing, adults couched STLs' skills and experience in terms of an innate of natural ability exhibited by the students themselves, but also present in high school students more generally. As Mr. Michaels, an American Government teacher and assistant principal, put it, "These kids are digital natives. They know computers better than me. They grew up using computers. It just comes more natural to them because they're younger." Or, as Assistant Principal Balboa put it another way, the lives of young people and digital technology were bound up in some way, that they shared some common destiny, perhaps. When asked what goal the tablet computer program met at the outset of the one-to-one program, Mr. Balboa spoke of the technical abilities of young people in more ominous tones:

> Mr. Balboa: My son has in iPad. He's only two year old, but I see him get on there and...[He makes a swiping motion and then a tapping motion to imitate the operation of a tablet interface]. I don't even want him to have one, but what can I do? It's the future.

Still, despite the popularity of the program with teachers and student participants and shared presumption among the whole school community that children were naturally expert at using technology, the amount of work that the school's tablet program required could inspire resentment. As one STL wrote during the meeting I held with them in May of 2015, "Most teachers like the STL Program because they don't have to do much anymore." This sentiment, although representative only of a single student's opinion at a certain moment, indicates a more complex affect at work than many of the more sanguine and triumphalist descriptions of the program by documents, teachers, students, administrators, and Home Office staff.

The academic and bureaucratic situation of the STL program itself changed over the time of my study. The STL program at Number Seven originally ran as a special interest advisory. Advisory is a short, non-instructional period where students start their days, deal with school-wide recordkeeping, attendance, or announcements, and complete other needed technical and administrative functions, as opposed to a normal class period, where students learn a specific subject. In this original configuration, Ms. Quezada supervised 23 STLs over the 2013 – 2014 school year, nearly evenly split among males and females (none of her students identified in any other way). The STL program had been in place Academy-wide since before Ms. Quezada arrived at the school. During the second year of the program, the STL program was reorganized. The STLs still reported to Ms. Quezada, but they no longer met daily as an advisory. Instead, they were granted the status of an afterschool club and dispersed to other advisory classes all over the school. This change did not interrupt the work of STLs who continued daily IT work throughout the administrative change, over the summer, and into the new school year.

To be an STL, interested students who meet academic eligibility requirements and obtain the signature of a parent or guardian apply to the program, which consists of up to 25 students at a time. STLs may serve more than one consecutive school year: at the 2015 commencement ceremony, Principal Montoya gave the five seniors who had served as STLs all four years of school gold chords to adorn their graduation gowns. Ms. Quezada herself approved or denied applications, in consultation with faculty and administrators. She described her deliberative process as centered around the determination of "fit." On one occasion, Ms. Quezada showed me an application of a student she planned to refuse entry to the program. As Ms. Quezada put it, "I don't think being an STL would be right for her. I don't think her grades could handle it."

STLs spend a portion of every day they are at school involved in IT work. Deeply immersed as they are in all manner of typical modes of student life — working in groups,

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reading, taking notes, filling out worksheets, accessing class documents via Internet, and so on

—many students had difficulty distinguishing between when they were working and when they

were studying. In effect, STLs were always on-call, making it difficult for them to account for

their time. "It depends what we are told to do. There can be times when we just don't go to class

for half of a day," wrote one student.

Of the 20 STLs who completed a follow-up survey to our group interview, students

reported spending an average of three hours per day on technology work, although many

students commented that the number could vary widely depending on circumstances. Students

reported a range of one to eight hours per day spent working on STL-related projects. On several

occasions, I was present when students came in on vacation or a school holiday. As one student

wrote, STL-related work takes "[A] ll day because many people seem to have trouble with

technology. I'm always there to help those in need."

Another student, perhaps made mindful of the size and scope of IT-related work

performed by STLs via my research activities, wrote, "Even though we are teens in a club we do

a lot for the school and I don't think anything we do would be possible without us." The STLs

were a conspicuous group on campus. For example, a bulletin board in the main hall dedicated to

their group stayed up for the entire second year of the study. Like the billboard for the National

Honors Society, Student of the Month, and Class of 2015, the STLs' billboard listed the names

of participants and celebrated their accomplishments. As one STL put it, "A lot of other students

say we get special treatment, but what they fail to understand is that we work for what we get.

Others say they want to become an STL but it's too much work."

STLs' most frequent duties concerned the distribution and collection of student tablets.

The mechanism of collecting and distributing tablets evolved over the first year of the program,

but had become a firmly established set of protocols by the end of the first year of the study.

These procedures evolved over the first year through trial and error, but ultimately came to form a pair of familiar and fairly automatic routines to start and end the day. Student tablets were stored in armored charging carts, one for each advisory. STLs carefully indexed the carts, creating a series of spreadsheets that included the name of each student, his or her student identification number, the serial number of his or her iPad, the advisory to which the cart belonged, and the number of each slot within a cart. In this way, every tablet was given a designated resting place so that, according to school rules and contracts of behavior, every student tablet could only be in one of two places: in its designated slot in a cart or on its student's person. Rarely, this scheme, although generally sufficient and largely effective, proved susceptible to failure.
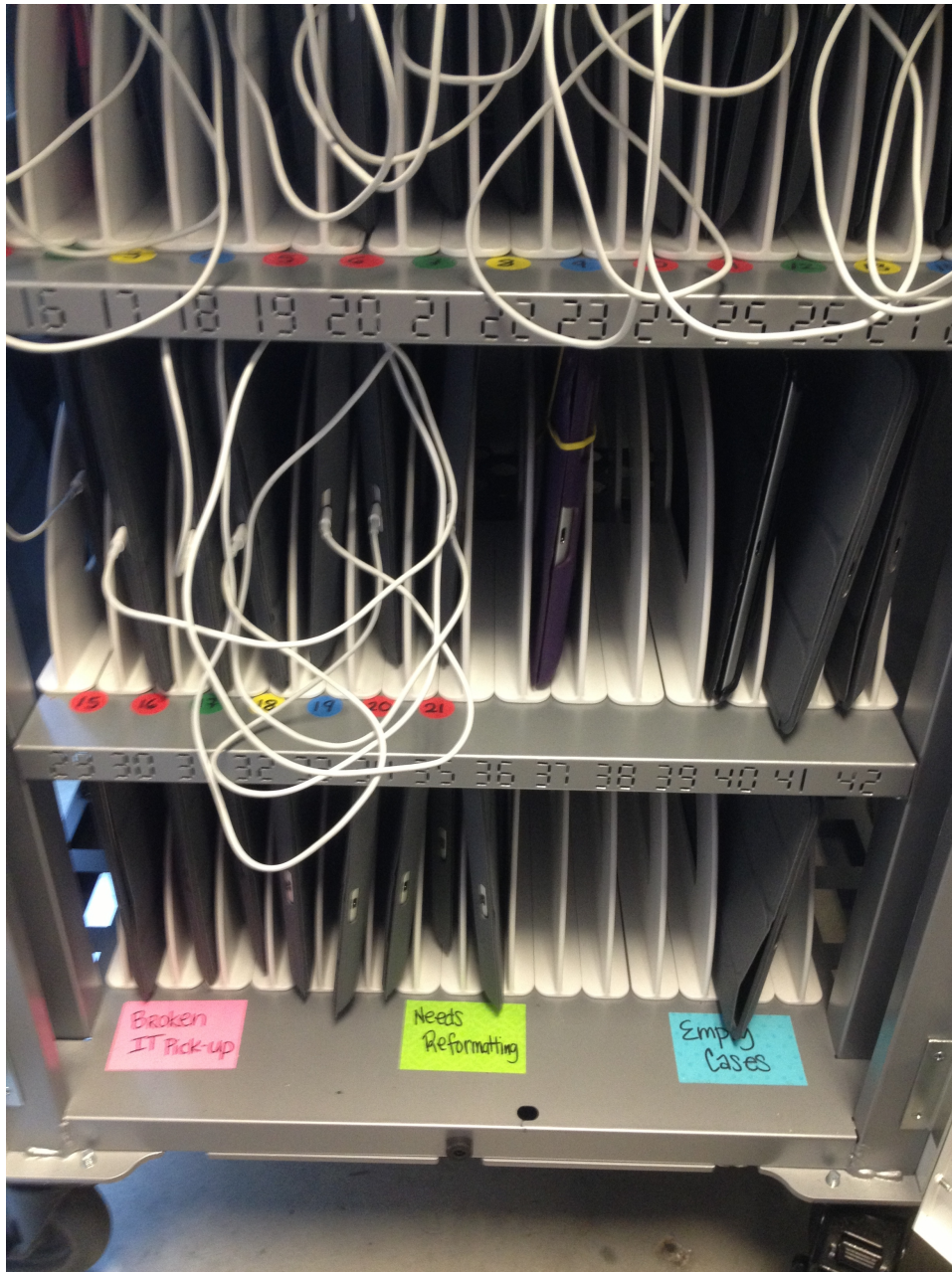
Figure 3.3. A view of the inside of a charging cart. Only STLs and Ms. Quezada have keys to the charging carts. Each spot in the cart has been assigned to an individual tablet and matched to a single student. A master spreadsheet managed by Ms. Quezada lists each tablet in the school by serial number alongside the identification number, email address, and advisory teacher of its corresponding student. Tablet power cords are affixed to the cart and in this way assigned to a single user.

Advis
Zaca
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USE a Y for Yes, and N for no, do not use check marks!

Marisol Rubio

ID Number	First	Last Name	Grade Level	Checked by	Working Device	Case Written on or Stickers?	Case Stretched?	Cracked Screen	Headphone Jack ok	Additional Charges
22758	Ja		9				N	N		
39090	M		9							
22467	B		9							
39069	N		9							
48011	L		9							
39099	D		9							
22760	F		9							
22727	E		9							
39105	A		9							
39074			9							
39292			9							
22694			9							
22720			9							
22725			9							
39116			9							
39119		ado	9							
39120		ado	9							
39122			9							
22795			9							
39133			9							
39136			9							
39137			9							
39142			9							
39293			9							
47977			9							
39151			9							
42162			9							
22742			9							

Figure 3.4. This photo, taken by an STL, depicts some of the "behind the scenes" work that students did to support the one-to-one tablet program, work that often involved analog means of inventory control.

Figure 3.5. This image depicts the hallways of the school during the afternoon check-in procedure. The green cards hanging from the lintels indicate that a given classroom has accounted for all of its tablets and that the designated STL for that room has verified that accounting. In cases when a class cannot find an iPad, they hang a red card from the lintel and the school "goes red": the school's exits are sealed and no one may leave his or her designated advisory classroom, except for the STL in charge of the missing device and administrators.

Unboxing

The image below, submitted by an STL in response to a questionnaire I submitted to students via their tablets after a townhall-style meeting, came in response to my invitation for student workers to send images that describe their work. During the same activity, another student summarized what Number Seven's experience with tablets should teach other schools considering tablet programs: "I would tell them to take care of the devices good because they cost a lot and it is a privilege to have this type of device."

Figure 3.6. A photo taken by an STL to explain her work. Task that would be relatively simple for individual users (such as taking a keyboard out of its box, charging it, and pairing it with a tablet via Bluetooth) proved complex and required the coordinated labor of many workers.

The "privilege" of and high cost of working with tablets was a recurring theme in my interviews with teachers, students, and administrators. Although cost was generally associated with the sticker price of the tablets themselves, this sense of their being demanding of resources

(e.g., money, time, energy) ran throughout the school community's discussion of the one-to-one program. In the photo, student workers are engaged in receiving new inventory, in this case a set of keyboards. In order for keyboards to be made available for student tablet users, a number of tasks must be accomplished, in this case, by STLs. Each tablet must be unboxed, indexed, configured, and distributed, a complex set of tasks directed by the Ms. Quezada, in her role as Technology Coordinator. Additionally, a classroom must be dedicated to this project for the duration of the project.

This photo points to the difficulty of using consumer technologies in class instruction, a mismatch between devices designed with an individual user in mind and the provision of services and equipment to the hundreds of users in the school. This is, in the most immediate sense, a problem of scale: the time, space, expertise, and patience to set up a device or one of its accessories is considerable and increases a great deal when many identical devices are put in the mix. Student workers used a number of digital and analog means to differentiate between the hundreds of identical tablets, keyboards, and cases they were charged with delivering, maintaining, and troubleshooting. But more than any particular technique or technology, STLs made the program work through the application of the resource they had in greatest supply: their own labor.

During an unboxing like the one depicted, STLs working on the project might spend entire hours of the school day setting up the keyboards for the advisory classes to which they have been assigned, leaving the room only for class activities they feel they should not miss (such as tests or other important learning activities). Unboxing was an ongoing activity that disrupted a number of other routines and was complemented by larger-scale activities the revolved around decommissioning devices for students who had left the school, storing tablets for vacations, configuring special software or accessories for stte-mandated tests, or adding new

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kinds of devices or tablets (as when Principal Montoya purchased a set of Lenovo tablets for the senior class to use).

Going Red

During a week in January 2014, I was present at the school for a pair of incidents related to inventory control. Students passed through the crowded halls to go to their afternoon advisories and return their tablets as they did daily. On the day of the first incident, a Wednesday, the afternoon advisory period dragged on beyond the designated school day. Students milled about their classrooms, laughing, playing with their phones, or talking over some personal or academic event from the day. Mr. Tustin, who generally addressed the school in the afternoon with the greeting, "Good afternoon, Scholars, Here are your afternoon announcements," instead took to the PA to order that the halls be cleared of teachers and students. In a loud and strident tone, he said, "The school should be silent right now." The ardency in his voice put the students and teachers on notice that something unusual was occurring, something likely to provoke a stern disciplinary response. As the minutes dragged on, a student opened the classroom door to peek out into the second floor hallway. He ducked his head back inside and said, "Morten went red," meaning that the STL assigned to Ms. Morten's afternoon advisory had hung a red piece of paper from the lintel to indicate an iPad was missing. In the hallway, assistant principals could be heard communicating with one another via their walkie-talkies, coordinating their sweeps through the school. The sound of the beeps, static, and chatter of their walkie-talkies recalled the sounds of police at a traffic stop. Mr. Tustin again took to the PA: "Teachers and students. I repeat, there is to be no talking right now. BE SILENT." Outside, in the hallway, Ms. Quezada shouted orders to a few STLs, sending them to check various places that a tablet might be mislaid, such as the media center or the office. Finally, Principal Montoya himself could be heard in the hallway, shouting to his principals to give him the name of the student whose tablet was missing or the

name of the STL who had miscounted. More tense moments passed in the classroom. Finally, nearly twenty minutes after the end of the school day, Mr. Tustin took to the PA and gave his standard greeting, reminded students that all iPad procedures had to be followed, then excused the school. On this day, it had happened that the advisory teacher herself had confiscated a student's tablet for disciplinary reasons, but failed to replace it in its designated spot. The device, powered down, sat on the teacher's desk, on top of her own iPad, in the same grey case. As a consequence of this incident, Ms. Morten's advisory was denied use of their iPads for a week. All students in her advisory were required to leave their tablets in their charging bays until Principal Montoya decided they could again use them. As Ms. Morten put it when we discussed it later, "Montoya got pissed so I was in trouble for a week. I have to hang the red card now. I will always have the red card. [Laughter]."

Of such incidents, an STL wrote, "There was a time when we believed that a[n] iPad was missing. We had to go on lockdown and our principal did have some suspicion and anger towards the students and in turn, the STLs in general. But we resolved the situation and we managed to stay on good terms with the principal."

The second incident, coming just two days later, followed much the same pattern. In this second incident, I observed the action from the hall, despite orders that all teachers and students should vacate the hallways. From this vantage, I could see how the principals worked; each chose a section of a floor and waited for all the advisories in their zone to go green. After a principal had visual confirmation, he or she stood in the hallway to watch the classrooms and used his or her walkie-talkie to announce that a section was green. A principal in a zone that had gone green would announce, "All clear," so that the other principals, listening in, could keep track of what part of the school had successfully completed check-in procedures. On the day in question, STLs discovered a missing tablet and quickly identified the student to whom it

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belonged. They hung a red card from the lintel of the student's advisory and all four principals

converged on that spot. Again, Principal Montoya came out of his office to investigate. For tense

minutes, he and the other principals roamed the hallways outside Ms. Garcia's classroom,

communicating with one another and with other staff elsewhere in the building via walkie-

talkies. It was determined that the tablet in question had been assigned to a student who had left

school with permission earlier in the day because she was feeling unwell. Mr. Balboa suggested

that she had probably forgotten to return her tablet and gone home with it by accident. Principal

Montoya ordered his staff to find the student's sister, a Number Seven sophomore, and to ask her

to get the student on the phone. Unable to reach the student with the missing tablet by phone,

Principal Montoya instructed his principals, "No one is leaving until we find it. I don't care if

you have to go to her house. Find it." The sophomore continued to text and telephone her sister.

She stood in the hallway surrounded by several principals, her face flushed with embarrassment,

Eventually, Mr. Michaels came bounding down the hall from the direction of the office with a

tablet in his hand, speaking simultaneously to the principals and STLs gathered there and into his

headset, "I got it. I got it."

Later, after school was released, I approached Mr. Michaels to ask him what had

happened. He would say only, "There are some kinks we're working out. It's too bad you saw

this today, because this is pretty unusual." In this case, the missing iPad was found in the office.

The student to whom the iPad belonged had, according to procedure, given her iPad to a staff

person in the office, who had mistakenly failed to place the tablet in a designated spot so that it

could be returned to its designated cart by the STL in charge of collecting devices from the

office. As in the previous case, it was an adult working in the school who had inadvertently

frustrated the protocols of inventory control. Similarly, various forms of disciplinary action

against students, staff, and faculty were discussed by administrators as the incident unfolded, although in the second case, I was unable to determine if anyone was punished.

Echoing a well known scholarly truism about the invisibility of infrastructure, Graham (2009) writes, "Infrastructure disruptions bring fleeting visibility to the complex practices and technologies, stretched across geographic space, that continually bring the processes of urban life into being" (xi). Likewise, the use of student labor to manage the one-to-one tablet program can be seen in these incidents of breakdown. The entire inventory apparatus rests on the labor of STLs. In effect, the steady supply of free labor provided by student workers has become a feature of the school's IT infrastructure. First, the entire system of daily inventory control must be instituted and accomplished by STLs. Although in the course of a typical day these routines of inventory control and the work that precedes them would become visible for only few minutes, moments of technical breakdown offer glimpses of the degree to which school instruction delivered via tablets requires and depends on such labor. This includes several weeks of work before school starts, when student workers unbox, count, register, format, and index hundreds of tablets. This work involves technical aspects, such as reimaging tablets, as well as less sophisticated forms of accounting, such as making labels, counting cases, or filling out paperwork. Second, considerable work goes into maintaining the system. The system must produce records that can be consulted on the fly (such as when a tablet goes missing) and can accommodate changes over time, such as when students transfer out or in. Third, STLs must perform their twice-daily inspections, meticulously counting tablets and physically inspecting the hundreds of devices daily to verify that each tablet had been correctly placed in its required slot, that each tablet has been plugged in to recharge, and that a device and its case are physically intact. The entire one-to-one tablet program then is supported by the labor of student workers,

who were brought together as a collective prior to the deployment of the tablet program and were, therefore, not specifically mentioned as the intended beneficiaries of the program.

That such labor occurs does not necessarily mean that it is unethical or exploitative. Schools have traditionally run other kinds of unpaid vocational learning opportunities such as internships, apprenticeships, and onsite office or library work. These programs are traditionally tied to particular kinds of learning objectives and specific forms of supervision. The STL program, by contrast, is tied to a grant request, not a course description or curriculum of any kind. While this labor earns student workers social capital, the "educative dividend," the knowledge, skill, or democratic experience that participation offers, remains difficult to assess, particularly since the tools used to evaluate learning have not been attached to this particular educational intervention (Kelty et al., 2013). Public education in the mode of the normal high school focuses on vocational training, civic competency, or, increasingly, college preparation (Apple, 1995): these are the legitimating goals which public education claims to serve, although the valorization of these goals has varied over time and the adherence of any specific school program to such lofty goals remains contested. Individual subjects assembled into curriculum carry their own means of evaluating student accomplishment of objectives: the familiar procession of quizzes, papers, projects, presentations and so forth that collectively constitute the character of daily life for students, each pedagogical tool ostensibly keyed to a particular rubric that claims to operationalize what is to be learned and how a learner demonstrates such cognitive capacity. The STL program, as stated earlier, has no fixed bureaucratic home (morphing over time from a class, to an advisory, and finally, to a club) and is not attached to any means of assessing learning: students do not get grades, take quizzes, earn degrees, or even self-report. In this sense then, the distinction between the educative dividend of the program and the value of the labor performed by students collapses, such that STL program as a whole need not

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demonstrate its educational effectiveness in any way. This stands in marked contrast to other parts of the school's curriculum. Teachers, for example, are evaluated based on an index that includes components of parental satisfaction, student test scores, and peer evaluations. Students are daily subjected to all of the types of school assessments mentioned above and a great many more. Even school administrators are subjected to various forms of evaluation and assessments in the form of performance reviews and contract negotiations. The STL program operates from a position of presumptive effectiveness, granted then a special status beyond assessment or empirical discovery. The one-to-one tablet program itself enjoys this same status: despite vague reference to literature, the whole enterprise of giving students computing devices in public charter schools in Los Angeles is likewise unevaluated and need not produce evidence of its own efficacy. That students in urban schools benefit from the use of tablet computers in public education remains taken for granted by this non-curricular curriculum of technology in schools.

THE DEAL WITH TABLETS

This chapter has looked at tablet use from the perspectives of both digital youth and digital labor. In juxtaposing these parallel research programs, I have implicitly argued that one presents a rather pessimistic view of use (digital labor), while the other offers a provisionally salutary assessment (digital youth). In my observations at Number Seven, I felt deeply ambivalent. I was frequently disturbed by the amount of work that STLs were doing, often to the detriment of their other academic obligations, and impressed by their ingenuity and industriousness. This chapter presents an attempt to keep open this fundamental tension, to makes sense an ongoing, elaborate routine based on child labor that is unforced, unpaid, uncredited and utterly vital. The "success" of Number Seven's one-to-one program (that no tablet was lost, broken, or stolen in the two years of my study) was accomplished via this continuous work, without which, the program as configured could not have continued.

This conflict turns on affect, its status and significance. As one student worker wrote, "The feeling I have is that I love the work I do. Although, sometimes it can be stressful, I do it because I love it." Early computer scientists predicted various kinds of fusions of humans and machines, always with the assumption that such couplings would produce increased cognitive capacity; Bush's (1945) "supplement" to human memory or Licklider's (1960) man-computer symbiosis, for example, predict a machinic extension of problem-solving and recall, reason freed from its bodily constraints and made durable through time and space. The relationship of students to tablet computers, by contrast, has very little to do with extending (or even developing) cognitive capacity, based as it is on the cultivation, maintenance, and exchange of various kinds of affects. When teachers look out and feel the reassuring presence of one of their self-described "tech geeks" in class, they feel calmed and supported ("They say we are really helpful and we take a lot of stress off of their shoulders."). When student technology workers troubleshoot a misbehaving projector, they communicate authority and competence ("Other students think its cool."). When they negotiate access to otherwise forbidden materials, they train up and trade in professional modes of expression ("We resolved the situation and we managed to stay on good terms with the principal."). It is not enough to say that the work of STLs involved emotions: this work hinged on the management of emotions engendered by rapid and unpredictable changes in work infrastructure and produced as compensation a feeling of satisfaction and competence. It is a complicated and multivalent exchange, but a fairly direct one.

This is not simply a question of the attitudes of users with regard to their own behavior, rather this is also question of broader economic relations. In the exchange of skilled services for emotional states, the material basis of tablet computing—the tablet, its architecture, its software, its permissions— positions users in several kinds of markets simultaneously. Digital youth are

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digital laborers are digital youth. This exchange is certainly not equal, in any sense. Any monetary benefit to be had will be had by technologically sophisticated corporations, not by students (or end users of any stripe). Earlier in this chapter, I asked rhetorically what kinds of relationships we expect young people to have with computers. In view of the economically informed model of tablet architecture offered here, the needed inquiry looks quite different: what kind of value do we expect computers to produce and what are we willing to trade for it?

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CHAPTER FOUR: SMALL DEFIANCES

> Every person in the system is held accountable for student success and uses data to appraise improvement efforts.
>
> —Academy Schools Overview

> It's an event, a small defiance of rule, so small as to be undetectable, but such moments are the rewards I hold out for myself, like the candy I hoarded, as a child, at the back of a drawer. Such moments are possibilities, tiny peepholes.
>
> —Margaret Atwood, *The Handmaid's Tale*

TELLING STORIES ABOUT SCHOOL

A year after the tablet program began, a wealthy donor who had been contributing to Academy Schools for several years earned, through his charitable giving, naming rights at Number Seven, which would be rechristened in honor of this patron and his wife. Starting in December, Number Seven became known as Charles and Carol Peterson Leadership School[9]. The letterhead, the website, the sign out front: all of it had to be changed over Christmas Break to mark the commitment from the Petersons, who were said to have donated one million dollars to Academy Schools. Principal Montoya's staff mailed out invitations weeks in advance, inviting members of state and local government, reporters, school advocates, parents, and representatives from both Los Angeles Unified School District and Academy Schools to attend a ceremony in the courtyard followed by a buffet lunch of beans and rice in the parking lot across the street. Students were instructed to wear their formal uniforms: polo shirts that indicated grade rank by color, khaki pants, not shorts. A rented stage went up in the courtyard. The ceremony took place on December 5, 2014, but for weeks leading up to the event, normal routines were disrupted for rehearsals and run-throughs: the whole school was involved. Principal Montoya wanted to use

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[9] This name is also an alias to protect the anonymity of the schools, staff, and students.

the occasion as a neighborhood event, a time to showcase the accomplishments of his students and teachers to the community.

The day of the event, student ambassadors greeted visitors at the gate and walked each guest to an assigned folding chair, acting as ushers. The program included speeches by visiting state and city government officers, an a cappella singing group, a presentation of the flag by the Cadets (a junior ROTC-like organization for students who planned to go directly to the military), the National Anthem, the Black National Anthem, and the Pledge of Allegiance, first in English, then in Spanish. A mother of a current student took the stage. In imperfect and halting English, she described how grateful she was for the caring teachers that kept her son safe from gangs and helped him to adhere to his studies. At one point, she called for her son Javier, to point him out. She scanned the crowd for him, but because the courtyard was crowded, seats jammed in at odd angles to make room for all the guests and students, she could not see him from her vantage on the stage. She interrupted her speech for a long moment, searching the crowd, and cried, "Where are you Javier? I can't see you." That plaintive cry, the mother calling out to her child, evoked laughter and tears from the sympathetic audience. Finally, at the end of the courtyard, near the dumpsters and the fence where feral cats played, a freshman stood up, stoop-shouldered and blushing, simultaneously proud of and embarrassed for the attention. "Mi hijo," she said, her voice cracking with affection, "My son."

Next, a member of Academy Schools' Board of Directors talked. He specifically invoked nearby Washington High School as a kind of bogeyman, a "failed school" that could not offer the same quality education that Academy offered. His speech included the reminder that the Directors of Academy could afford to send their kids to schools anywhere in the city, but had committed to working to assure that every child in all of South Central had similar access to a quality education. In contrast to the overwhelming charm and pathos of Javier's mother's speech,

he spoke with corporate banality of Academy's effective management team, of its successful record of securing federal grants and private donations, of its active support for Teach for America.

> Board Member: We should insist that all 600,000 students at LAUSD deserve the same education that the kids here at Academy are getting. We are going to keep at it until every child gets the same education that these kids get.

July Bertram, founder and CEO of Academy Schools, parent, and former teacher, welcomed the community to the school and thanked those present for their interest in students. She reminisced on the founding of Academy Schools, how her actions came as a response to conditions in LAUSD. This second invocation of the failure of the public school system, a brazen political position and a rebuke of the work of the LAUSD official seated near her on the dais, did not cause any noticeable discomfort, either in the audience or on stage. They'd heard it all before. These frequent jabs were common at such functions.

> July Bertram: We are a family here, a big family, We take care of the students here like we would care for our own kids. Unlike, LAUSD, 100% of Academy Peterson Leadership School Students are accepted to college. We have the same high expectations of all of our students and we practice accountability.

This assertion of statistical data, merging as it did the past year's matriculation rate with the school's new name, seemed to hover in time, referring simultaneously to the past, present, and future. This statistic, a sturdy fact that could hold the weight of the audience's collective anxiety about the ultimate prospects of the students, reassured the audience. Ms. Bertam's brief, warm talk also contained an unambiguous evocation of a seemingly indisputable educational value, the "practice" of accountability.

Principal Monotya, who had served as the school's first and only principal, followed Ms. Bertram. He described his own experience at the school in starkly emotional terms, with a sincere and moving tone, a pointed contrast to his customarily fearsome and disciplinarian bearing. He positioned his tenure at the school as a "journey," his voice and body language

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indicating a charming insecurity: he was nervous, unused to public speaking in front of adults.

He related the experience of founding the school in 2007 and recognized some of the school's

graduates and parents in the audience. In a solemn and reverent tone, he expressed his pride at

the courage of his students in resisting a public education system that had failed them and placed

this conflict firmly within what he called "a fight for social justice":

> Principal Montoya: Here we have a really special classroom culture. We are a true educational environment, the kind where students can really learn. Most importantly, we practice accountability of ourselves, our teachers, and our community. Accountability is in everything we do. We graduate 100% of the kids and they all go on to attend a two- or four-year school.

The donors for whom the school would now be named were given the last word, referring

to Principal Montoya by his first name:

> Carol Peterson: Once we met Dan and learned about the place he was making here, we were hooked. We are proud to be able to be a part of this wonderful community. We appreciate today, but we should be thanking all of you. We want to thank you for giving us so much happiness.

The naming ceremony was a chance for the school to tell stories about itself, a ritual that

gave all present a chance to get on the same page, as it were, about the politics, practice, and

meaning of school. Principal Montoya (and Academy founder and CEO Bertram) invoked the

matriculation rate of students both as an unequivocal indictor of success and as an axiomatic

statement that a particular version of school reform had succeeded. Numbers persuade. Indeed,

the implicit promise of the statistic to parents of potential students (like Javier's mother) is that

any specific child will get into college if he or she enrolls at Number Seven/Peterson Leadership

Academy and follows the school's way of doing things. For parents in the neighborhood, a good

many of whom are poor, lack formal education, and fear for their children's prospects, this is a

promise that is nearly impossible to resist. This argument through the seemingly irrefutable

power of numbers functions as both a legitimating principle and a foolproof selling point.

Number Seven's pedagogical and ethical raison d'etre rests entirely on the assumption of the

failure of public schools and a multivalent appeal to accountability as a solution to this failure. In

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this framing, urban schools have failed to "practice" accountability and, in absolute contrast, Number Seven (and its sister schools operated by Academy) can perform accountability because of their superior techniques and values. Accountability and its attendant practices form a central object deployed in this assiduously deracialized story about urban schools, all of which are failing, all of which are racially segregated, and all of which are in poorer neighborhoods.

Accountability, what it means and how to do it, serves as an entry point here into scholarly conversations that have approached the practices of accountatbility from an entirely different perspective: that of surveillance. What appears as accountability in high-minded or self-congratulatory talk about the needs of poorer students sets conditions on the ground for surveillance, and lots if it. As I will show in the chapter that follows, the practices to which Principal Montoya, July Bertram, and Javier's mother all referred include, in fact, practices of surveillance, extended throughout the school in a dizzying variety of forms. In a school culture that asserts a strong sense of order over educational techniques and personal behavior, surveillance is not merely a common activity, it is one of the few constants of everyday life. Love of children, fear of the future, the precarity of economic life, philosophies about learning, the economic interests of educational publishers and technology manufacturers: all of these powerful forces find expression in the collection of data about students, much of it captured by tablet computers.

This chapter explores Number Seven's one-to-one tablet computer program through the analytic lens of surveillance. Specifically, I look at how various tablet-enabled surveillance practices emerged during the two years of my study, routines of classroom discipline, advising, and testing legitimated and impelled by the concept of accountability. In what follows, I argue that accountability is the virtue that spawns the creation, maintenance, and application of multiple systems of surveillance. As I will show, a significant paradox emerges: despite the

spread of numerous forms of surveillance technology and techniques, an ostensible increase in the capacity of school authorities to exert control over the behavior of students, teachers, and administrators, this increased, intensified gaze occasionally served to undermine the ethic of accountability. This paradox points to an unresolved tension in surveillance studies that concerns the agency of those subject to surveillance and the role of performativity in Foucauldian discourse.

SURVEILLANCE AND THE MECHANICS OF ACCOUNTABILITY

In the contemporary context of American public education at all levels, the rhetoric of accountability has been successfully deployed by a variety of actors to advocate for the allocation of resources, argue for reforms or changes, and to legitimate (or to make illegitimate) longstanding practices, especially in the case of the spread of charter schools (Gawlik, 2012). The rhetoric of accountability underpins over a decade of national outcomes-based education policies promoted by both major parties (e.g., No Child Left behind, Race to the Top, and the adoption of the Common Core State Standards):

> *Accountabilit*y is a word frequently used in connection with education but is rarely defined. Sometimes, accountability is used synonymously with responsibility and other times it is associated with oversight authority, as is the case with most charter schools…Accountability may be directed toward either a process… or outcomes such as standardized test scores (Gawlik, 2012, italics in original).

This talk of accountability differs entirely from the traditional pedagogical interest in assessment, the systematic measurement of student learning (e.g., tests, pop quizzes, evaluations, critiques, and so forth): accountability relies on decontextualized quantification, lacks any coherent methodology, and has been appropriated by decision-making bodies distant from the classroom and the work of teachers (Stassen, 2012). Accountatbility rhetoric is also common in higher education, as part of an "audit culture" that transforms learning into the exchange of various kinds of reckonings, evaluations and measurements (Strathern, 2000, p. 2).The

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prominence of accountability rhetoric in public education signals economic, cultural, and political changes in the United States; these changes entail "the intensified injection of market principles such as deregulation, competition, and stratification into public schools" (Bartlett et al., 2002, p. 5). In a detailed history of accountability in American public education, Cuban (2004) distinguishes the contemporary definition of accountability, one that uses measurements associated with individual students to define quality in schooling, from a traditional definition of the term as the virtue of efficiently spending and managing public funds used for schools. That is to say, the virtue of accountability as it is currently deployed in education discourse corresponds to a specific set of circumstances in the history of American public education, circumstances that determine who or what is made accountable, the presumed relations of authority and submission, and the vehicle by which such relations are to be made manifest. Specifically, accountability rhetoric corresponds to the mid 20th century push for American scientific supremacy in the wake of the success of the Soviet space program and the subsequent importation of various industrial business management techniques into public school administration, including PPBS (planning, programming, budgeting systems), PERT (program evaluation and review technique), and MBO (managing by objectives) (ibid., p. 23). Cuban describes this deployment of management techniques as a sea change in public expectations for American schools:

> The convergence of these unlikely (and unpredictable) circumstances helps explain the dramatic shift in school accountability and definition of a quality education, from providing access to an adequate schooling and efficient use of resources for well over a century and a half — the earlier definition of a good school —to a heightened responsibility for student outcomes and a performance-based definition of high-quality education (p. 23).

Accountability clashes with older, more communitarian conceptions of public education, and, to some extent, with earlier notions of public education more generally (ibid.). Accountability has been an important, nearly universally lauded rhetorical strategy for the growth and promulgation of charter schools, particularly as they are contrasted to their

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conceptual opposites, failed urban schools (Mirón and St. John, 2003). Accountability claims to function as a kind of quality control of public education, but this function, although superficially sound, masks deep conflicts. Accountability regimes implicitly promise to test every element of public education for its absolute and relative educational value. But educational value is a contentious and unsettled norm, one not obviously commensurable with the idea of accountability as the collection of self-evident data. As Kucirkova et al. (2014) write, "Despite its wide use in research and practice, the term 'educational value' is a contested and context-dependent concept, essentially justified as a value judgment" (p. 176).

Ambrosio (2013) links increased emphasis on accountability with the rise of neoliberalism. In this framing, accountability discourse uses the logic of optimizing the inputs and outputs of public education to mask a program of subject formation, a transformation of all of society into a set of market relations, "a neoliberal political project of cultural reconstruction and moral reform" (p. 317). Later in the text, the author defines neoliberalism as the use of "centralized state power to create the social and economic conditions needed to engender forms of subjectivity that justify and legitimize its presuppositions about human nature" (p. 321). The neoliberal subject then must adopt cultural sensibilities that support an atomistic view of society, one that pushes collective risk into the realm of individual morality. While the invocation of neoliberalism in relation to accountability rhetoric in education policy is frequent (Lipman, 2011; Hursh, 2007; Gibson, 2007), this is not an avenue I will explore.

Instead, for the purposes of this chapter, I will focus on two related aspects of accountability. Accountability as it is used here is doubly articulated: first, it is the frequently invoked ethic in a school that promotes individual responsibility with respect to any aspect of academic performance. Accountability as it is invoked in Number Seven's official self-description at the top of this chapter, for example, is a loose value system that can be brought to

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bear on teachers, students, administrators, and the entire public school system itself. The logic of accountability holds that every person involved in a student's education (e.g., the student himself or herself, teachers, administrators, parents, or community members) must produce needed contributions to a student's academic performance and, critically, that such contributions *will be measured*. Measurement is assumed to be the collection of data that are both categorically equal to these mandated contributions and self-evident. Second, accountability refers to various forms of surveillance, to modes of data collection meant to assure accomplishment of specific educational outcomes and general norms of behavior. Accountability, either in the form of a value or in the form of surveillance, presumes a meritocratic universe: individual students, regardless of their position in society, life experience, personal attributes, or educational history, are made responsible for their own sorting via the outcomes-based hierarchy, a hierarchy that ignores documented contributors to performance inequality such as institutional racism or poverty (Lack, 2009, p. 143). In both of these forms, as an ethical value and as the surveillance that enacts this ethic, accountability shapes the action and agency of individual actors; it is this relationship that explains how the "practices" of accountability come to exist and why they look the way they do.

In the school context, practices refer to the daily routines of students and teachers, and also to the protocols and rules that govern behavior. These are the primary vehicles of accountability, but there are others. Tablet computers were deployed in the school amid a variety of configurations of people, documents, devices, ideas, and software that worked in concert to create, maintain, and police educational computing. Control of student computing, what students could and could not do with tablets, was put in place via technological and non-technological elements: monitoring software, transactional logs, search histories, contractual agreements, physical observation, and data collection, among other elements. Collectively, the school's

efforts to use tablet computers in the work of schooling (and use them in a narrowly defined, specific way only) constitutes a "surveillance assemblage," a heterogeneous collection of discrete systems working in unison, a complex of flows and multiplicities, fractally organized and always in movement. Assemblages

> comprise discrete flows of an essentially limitless range of other phenomena such as people, signs, chemicals, knowledge and institutions. To dig beneath the surface stability of any entity is to encounter a host of different phenomena and processes working in concert. The radical nature of this vision becomes more apparent when one realizes how any particular assemblage is itself composed of different discrete assemblages which are themselves multiple (Haggerty and Ericson, 2000, p. 599).

School authorities permitted and denied certain kinds of computing via any means at their disposal as the one-to-one program went on, but all of these efforts were met with resistance and produced unintended results. The term assemblage allows me to look at the whole tangle of these entities and their relations, a way to account for the messiness and contradictions of life in an urban high school where a novel form of computer technology has dramatically, suddenly proliferated. I want to emphasize some of the conflict contained within the surveillance assemblage in this chapter: the speed and chaos of the attempt to transform the mode of public school to include tablets alongside periods of repetitiveness and frequent boredom.

In this chapter, I look at several different kinds of systemic, repeated behavior that demonstrate the processes of the surveillance assemblage at work within the school in the areas of instruction, advising, and testing. In the first part of this chapter, I take a dramaturgical focus on the ceremonies and theatrics that constitute surveillance at the level of the classroom, the banal, everyday declarations and actions that specifically mark student computing as a site of surveillance. By doing so, I want to make use of a contradiction in this mode of surveillance, namely that showy displays of surveillance capacity enacted by authority figures over students were met with equally theatrical performances of obedience. While these displays served to establish norms of surveillant relations and of student computing, these theatrics also contained

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elements of paradox that undermined claims about accountability. In these performances of surveillance and obedience, the limits of the power of school authorities to police student computing became apparent to both teachers and students, although the vast power of the school to discipline students and teachers made this micro-political resistance quite risky. In the next section, I look at data collection associated with college advising, systematized methods of collecting data that were enabled by the increased numbers of computing devices within the school. Here, I contrast this mode of surveillance, a data capture and processing model, with the previous section. Although school counselors characterized the tablet program as successful because it allowed greater supervision of students' college applications, the tools of accountability used to enforce rules revealed fundamental problems in the whole system of mandatory college application to both students and teachers, namely that the focus on college matriculation metrics failed to address the needs of many students. I look next at administration: principals used the newly available tablets to create metrics of performance that could circulate in novel ways, resulting in new regimes of student and teacher accountability. Although this mode of surveillance was relatively difficult for students and teachers to cheat or evade, administrators themselves devised means to mitigate sanctions their data collection regime called for, particularly as it came to pay raises. In effect, the administration balked at using the data it had collected and instead used other inputs to offset any measurement that might mandate punitive action. I conclude by describing how the architecture of student tablet computing connects these everyday behaviors to regimes of surveillance beyond the school and suggest ways that a methodological emphasis on practices, behaviors, and interpretation might lead to a better understanding of contemporary surveillance and, perhaps more hopefully, of meaningful resistance, or, less hopefully, of appropriation.

SCHOLARLY APPROACHES TO SURVEILLANCE

The term surveillance as it is used in interdisciplinary research can refer to many different objects or processes. The ubiquity of surveillance has prompted many scholars to describe the contemporary world not as an information society but as a surveillance society (Gandy, 1989), a critique that incorporates the multivalent affects evoked by this wide variety of activities, both the "good" and the "bad" of surveillance (Dryburgh and Fortin, 2010, Epling et al. 2003). Broadly, surveillance refers to "a vast array of techniques and technologies that are designed to watch our bodies, to monitor our activities, habits, and movements, and, ultimately, to shape or change our behavior" (Staples, p. 3). Although many scholars study surveillance as an activity or process unto itself (Jones, 2015; Malacrida, 2009), surveillance (especially as it the term is used in surveillance studies) refers to the collection of records, video, data, images, and texts that refer to and provide evidence of the activities of individuals for the purpose of achieving some goal through individuals or groups of people, for effecting social control. Aided by new legal instruments and public-private partnerships, Western democracies have experienced an intensification of surveillance activities by government and industry (such as those associated with air travel, for example) since the creation of new national security bodies in response to perceived terrorist threats (Lyon, 2006). These surveillance activities have incorporated aspects of racial and religious profiling, particularly in terms of the increased scrutiny placed on those perceived to be Muslim (Sian, 2015).

Scholars have generally been more interested in the use of technologically sophisticated surveillance by government and industry, by the "presumptuous ambition of both state and non-state organizations to see and to know everything, and of the ways in which data collection and knowledge are intertwined" (Walby, 2005a). These technological means include closed-circuit television cameras, interception and monitoring of electronic communications, and aggregation

of multiple sources of consumer data, sometimes called "dataveillance" (Green, 1999, p. 33).

Surveillance operates at a variety of scales, from the intimate spheres of domestic life (a baby

monitor) to the global scale of networked communications (government monitoring of Internet

traffic to pursue international anti-terrorism efforts). Surveillance studies theorists have focused

on human aspects of surveillance systems, describing surveillance as a circuit between observer

and observed, "with human surveillance agents at one end of the circuit and human surveillance

subjects at the other "(Walby 2005b). By contrast, science and technology studies scholars have

conceived of this circuit as an amalgamation of human, non-human, and/or technological agents,

i.e., as an actor-network, in order to emphasize the automatic and involuntary nature of

contemporary surveillance, the "general and systematic tendency for data gatherers to categorize

information gleaned from surveillance technologies, and then automate the application of these

categories pursuant to the reduction of risk, and the increase of profit" (Ball, 2002, p. 574).

Theorizing that "surveillance at root is founded on sorting and categorization, not on vision,"

Introna and Wood (2006) place the rise of facial recognition systems (FSRs) and other forms of

digital biometric technologies in the context of a post-9/11 conceptualization of security that

takes surveillance as a solution to the problem of global security (p. 195).

Fictions of Surveillance

Popular and scholarly descriptions of surveillance often begin with fiction: Dick's *Minority*

Report, Orwell's *1984* and Kafka's *The Trial* figure more prominently in surveillance discourse

than do canonical case studies or even thoroughgoing definitions; surveillance studies as a field

features an ongoing engagement with speculative and fictional works, a methodological tenet

which has been supported by theorists such as Stanley Cohen, James Rule, and David Lyon,

among others (Marks, 2005, p. 223). This engagement with fiction brings to the fore the

imaginative and interpretive aspects of contemporary surveillance technologies as they are

understood by the great many people who are subject to various kinds of surveillance in the course of daily life, bringing a sense of what is and is not possible out of the ambiguity of the present. This interest in fiction, incredibly useful for locating the political, moral, and historical specificity that constitutes surveillance as a cultural situation, can have the perverse effect of limiting the observational capacity of research. Detailed description of surveillance as it unfolds in situ tends to complicate rather than verify fictional perspectives (Timmons, 2003).

The growth and success of various kinds of electronic surveillance, defined here as various means of data capture, aggregation, processing, profiling, and analytics enabled by computerization in all its guises, alongside the hugely successful works of Michel Foucault and his respondents, have resulted in the predominance of a single speculative creation in surveillance studies and related fields, in both scholarly and popular works: Bentham's Panopticon (Blanchette and Johnson, 2002). The success of the Panopticon as a guiding imaginary for scholars interested in surveillance is manifest in Mark Poster's work on databases. Poster (1996) explicitly makes the argument that the affordances of distributed, networked databases extend Foucault's articulation of the Panopticon into every conceivable aspect of life in contemporary capitalism: "With the advent of computerized databases, a new discourse/practice operates in the social field, a superpanopticon if you will, that reconfigures the constitution of the subject" (p. 182).

Numerous scholarly works exist specifically addressing Foucault and various responses to his articulation of Bentham's Panopticon in terms of how well the idea suits contemporary surveillance (for a thorough review of dozens of major examples, see Allmer, 2011). For the purposes of the current inquiry into surveillance, I will revisit only a few relevant points of contention in this area in order to generalize on how this particular imaginative construct functions in scholarly work on surveillance. Briefly, the Panopticon is a plan for a circular prison

with a single watchtower at the center. Prisoners, housed in solitary cells arranged around the

observation tower could be under constant observation, visible at all times from the privileged

vantage of the guard tower at the center should it be occupied. Always possibly subject to

surveillance, prisoners, according to Bentham's theory and Foucault's later interpretation, would

learn to monitor their own behavior in response to this threat, to the benefit of their own

rehabilitation and, as Bentham's original plans made clear, to the benefit of prison owners. So in

this formulation, the very possibility that surveillance could be occurring makes those who are

subject to surveillance internally regulate themselves. The meachanism of control becomes

internalized and is effectively delegated to the prisoners themselves. In Bentham's work, the

self-regulation of prisoners ends in rehabilitation: once removed from the Panopticon, prisoners

have newly developed moral capacity. Foucault took up the Panopticon as an illustration of the

historical process whereby institutions create governable subjects in the "disciplinary societies"

of the 18th and 19th centuries as opposed to an earlier age of "societies of sovereignty"; the late

20th century saw the development of "societies of control" (Deleuze, 1992. P. 3 - 4). Its

connection to modernism (and not postmodernism) notwithstanding, wherever it exists, as a

fixed building or as a less confined regime, the panoptic architecture (again, it should be

repeated, a fictional construct) has it that prisoners change their own behavior to meet the

expectations of the central authority: "Panopticism, the social trajectory represented by the figure

of the Panopticon, the drive to self-monitoring through the belief that one is under constant

scrutiny, thus becomes both a driving force and a key symbol of the modernist project" (Wood,

2003, p. 235). The logic of panopticism infiltrates an increasing variety of sites, such as schools,

barracks, prisons, and factories: "What for Bentham was an aspiration is for Foucault a social

reality - the panoptic principle diffusing different institutions" (p. 66). Foucauldian scholarship

turns to other organizing metaphors in its historical analysis of the late 20th century, in particular

biopolitics: "Biopolitics, understood as a government-population political economy relationship, refers to a dynamic of forces that establishes a new relationship between ontology and politics" (Lazzarato, 2002, p. 102), or, put another way, the dominant mode of the state's power shifts from bodily, custiodial control to the management of the life processes of the polity via documentary, statistical, and bureaucratic means.

To summarize, the "panoptic principal" takes for granted a logic of self-regulation of the observed in response to the demands of a central, privileged position of authority from which surveillance is effected and applies this architecture not in the closed world of a singular, insular institution, but the out in the broader world of contemporary capitalism. The position of authority exists in an asymmetrical relation of power to the observed and in a state of probabilistic uncertainty. Critically, uncertainty works to the benefit of the observer: if a person believes she might be under surveillance and risks punishment for misbehavior, she, as a rational actor, will avoid punishment by always behaving as if she were being observed. The surveillant gaze defines the subjectivity of the observed since "the gaze and surveillance of authorities can go straight into an individual's home, school, or workplace and can evaluate, assess, and enforce, if necessary, the person's 'progress' on the road to becoming a model citizen" (Staples, 2014, p. 50). This space of coerced self-regulation challenges the potential for agency in the observed, who according to the panoptic principle, must necessarily come to modulate her own behavior. The Panopticon, dispersed all throughout society, presumes some central vantage from which all knowledge of monitored humans may be observed, an omniscient guard at the center of the universe. This runs contrary to lived experience, where "power is contested and agency never completely closed down" (Green, 1999, p. 26).

Performativity and agency

In a sense, ideas about the nature of performativity begin where the story of the panoptic principle ends and reflect an ongoing and unresolved debate about the possibility, nature, and significance of agency in contemporary, technologically mediated life. The dominant notion of performativity (conceived in reading and interrogation of Foucault's work) is identified with Butler and is of particular interest to scholars in philosophy, cultural studies, gender studies, and science and technology studies. Butlerian performativity theorizes a processes of subjectification via language and ontology: "[P]erformativity works, when it works, to counter a certain metaphysical presumption about culturally constructed categories and to draw our attention to the diverse mechanisms of that construction" (Butler, 2010, p. 147). Speech acts, thoughts, writings, and deeds constitute a menu of discursive actions that, in order to achieve intelligibility to others, must reference and thereby ontologically verify a world. But in bringing forth a set of possible states of being, we simultaneously negate a universe of potential communicative acts: ontology excludes as much as it orders (idid.). What cannot be categorized and fixed in language can no longer exist. Via language, the totality of the selection and performance of discursive acts constitute a particular subjectivity. Butler focuses in particular on gender, on how the supposedly inviolable, natural separation of two potential anatomical states into male and female sexes comes to constitute an ontological separation of the genders via language, one that is always in the process of being made and remade through discursive action (Butler, 2006). This Butlerian sense of performativity troubles the panoptic principle in the sense that it focuses on the agency, or, more accurately on the potential for agency, of the observed subject. In Butler's work, language can be a prison, one which humans cannot escape. Agency, such as it is, is found only in the selecting of items from a limited set or in making choices that criticize and draw attention to ontological exclusions.

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Performativity as it has been used in academic work specifically focused on surveillance in schools has been defined in several ways. The first sense of performativity comes primarily from Lyotard via sociology of education and refers to a critique of administrative and bureaucratic powers brought over human endeavor, specifically over public education (Perryman, 2006). The performance referred to here has to do with evaluation, as in the manner of annual reviews of employees commonly performed in white-collar workplaces. Ball (2003) writes,

> Performativity is a technology, a culture and a mode of regulation that employs judgments, comparisons and displays as means of incentive, control, attrition and change — based on rewards and sanctions (both material and symbolic) (p. 216).

Importantly, this use of performativity comes as response to the increasingly metrological mode of administrative oversight of education, the production, circulation, and creation of various kinds of measures that stand in for and, in many cases come to replace, the enterprise of learning. Increased regulation and oversight of teachers via the institution of performance culture has been a key feature of late-capitalist liberal-democracies (Thompson and Cook, 2013, p. 379) While this sense of performativity is relevant to this chapter, for the purposes of clarity, this is not the sense in which I will deploy the term, although I will revisit this interest throughout this chapter through reference to the ethic of accountability. In this chapter, I am interested in the degree to which theories of performance might account for resistance to or obfuscation of surveillance and how such theories color (or impede) empirical decriptions of surveillance at work in public education.

Performative regulation, the final theory of performativity, comes from scholars interested in Goffman's concept of the total institution, an important sociological predecessor of Foucault:

> Performative regulation occurs where groups of people submit themselves to the authority of an institution, internalize its values and enact them through mutual surveillance in an inmate culture.

Power operates horizontally as well as vertically, as members monitor each other's conduct, sanction deviance and evaluate their own progress in relative terms. The disciplinary gaze is not merely transmitted but reticulated: dispersed and refracted through an agentic network (Scott, 2010, p. 221)

This view of performance holds much in common with Butler's work, since "both theories suggest that performances rely on audiences for their interpretation and validation, and are oriented towards this evaluative context" (Scott, 2010, p. 222). At issue in the difference between these theories is the existence of an essential self that organizes its performances (performative regulation) or as an alternative, a non-essential self, one constituted entirely by the repertoire of its performances (Butlerian performativity). While this question is largely metaphysical and well beyond the scope of this chapter, in the section that follows I will use the model of performative regulation to emphasize the agency of the teachers, students, and administrators subjected to surveillance in the course of public education and the various ways that digital technology redistributed that agency.

By watching surveillance as it happens, ethnographic approaches are particularly well suited to exploring the role of performativity and locating the agency of individual users. Ethnography as applied to studies of surveillance seeks to observe the processes of surveillance as they occur in the field and also to determine how people involved in surveillance interpret or understand these processes. Institutional ethnography, "a sociological method of inquiry which problematizes social relations at the site of lived experience, while examining how series of texts contribute to the coordination of actions, consciousness, and forms of social organization" has been a useful approach for understanding how people in a community bounded by a specific institution live with surveillance (Walby, 2005b, p. 190). Institutional ethnography attempts to follow the texts (documents, data, images, et al.) that govern, mediate, and order people who function together as institutions. Likewise, ethnographic approaches have been used to explore the various domains of everyday life that become subject to surveillance through the introduction

of technology. Green and Zurwski (2015), addressing exactly this methodological question, write,

> Our argument is that what may be classified as 'surveillance' is created and produced within social interactions in everyday life, as much as it is located by particular socio-technical networks or organizational institutions—and hence we also need to look at those everyday life relations as processes and practices, in contrast to a normative understanding of surveillance (p. 29).

Surveillance in schools

As Barnard-Wils (2012) observes, education policy, especially as it pertains to computers in schools, "is an explicit strategy of political actors involved in the politics of digitally mediated surveillance" (p. 239). Surveillance plays an important role in the privatization of public services and the introduction of market incentives into educational systems (Lorenz, 2012). Beginning from a persuasively documented observation that schools are significantly safer for children than are private homes, cars, or streets, Monahan and Torres (2009) list a number of "socio-legal" changes that legitimate regimes of surveillance and social control which include disproportionate disciplinary measures such as zero-tolerance policies, embedded police units in schools, metal detectors, standardized testing, and all manner of audio and video capture. These changes are described as a "neoliberal ideological climate" that traffics in media representations of violence, valorizes private over public institutions, and exists to advance state military agendas and the financial interests of security concerns. Placing this work within the field of surveillance studies, surveillance here defined as "watching, monitoring, tracking, or data analyzing for purposes of control" and "the dominant organizing logic of modern institutions" (p. 6), the authors make note of Foucault's biopolitics — the creation of a population and the categorization and control of life processes through systems of administration — as a key reference (p. 7). Surveillance from this point of view is ubiquitous and coordinated, so that every aspect of the dragnet works to build the neo-liberal panoptic gaze. From this perspective, surveillance technologies strucutre work and sociality via "computer control" in the workplace and wherever they are deployed, via the

creation of "unobtrusive, micro-level task control and an individualized experience" (Elliott and Long, 2015, p. 1). While this perspective addresses the macro scale of the world system, particularly with regard to the economic interest of private software companies in producing security, we should also be attentive to the ways that surveillance is theatrical, incomplete, or incompetent.

Taken together, these works point to a few problems in studying surveillance. First, by reducing surveillance to questions of power and control, we overlook the very aspects of the phenomenon that might provide the means for its own contradiction or undoing. As I will show, some of the variety of activities that are called surveillance produce many opportunities for students and teachers to escape or resist the mandates of school administrators, state officials, or technology companies; such opportunities for creative resistance might be exploited to frustrate other surveillance regimes as well. Second, the success of surveillance methods does not always result in the control sought after by authorities in establishing such measures; to the contrary, the satisfaction of various surveillance regimes can distract from institutional goals, satisfying momentary goals and procedures but leaving a space for resistance in the shadow of the showy measures of control (as anyone who has recently passed through security screening at an American airport can attest). Third, as a sort of obverse to the last point, resistance to surveillance might succeed on the micro scale of an individual interaction, while the surveillant assemblage itself succeeds on the whole. This means that just as we should not imagine surveillance to be all-knowing, we should also not make the mistake of reducing surveillance in schools to series of decisions by individuals and, in so doing, miss out on overall tendencies and trends. It is with these cautions in mind that I will proceed to look at three general situations in school—teaching, advising, and testing—and describe how the presence of tablet computers

enabled new kinds of surveillance, routines of observation and rituals of obedience that only

sometimes achieved control.

ACTING OUT IN CLASS INSTRUCTION

In this section, I use participants' descriptions of their own behavior and class

observation to show surveillance functioning in daily instruction, focusing in particular on the

use of tablet computers. As Ball (2001) points out, educational institutions exert their control

through both spectacular rituals and banal routines. I show that electronic and physical

surveillance was announced to students via a variety of frequent, repeated theatrics and

performative scripts. Despite the panoptic principle's insistence that knowledge of being

observed should produce self-regulation and compliance in the observed, performances meant to

telegraph control over tablets sometimes had the effect of highlighting a lack of administrative

control over student computing resources. In effect, students, inured to all manner of

surveillance, began to tease out breaks and gaps in the surveillance apparatus. Taylor (2011),

using British schools as field sites, concludes that over time, closed circuit television becomes

"normalized to those who experience it on a routine basis," who come to assume that the target is

surveillance is always a member of an outgroup, a projected Other (p. 316). From the perspective

of teachers, increased familiarity of students with surveillance techniques introduced elements of

circumvention and resistance and limited the ability of teachers to coerce or prevent particular

kinds of behavior.

At Number Seven, school officials talked about surveillance often, but always in the

context of allowable uses of computers. The architecture of surveillance of tablet computing (see

Table 1) by the school functioned primarily via three separate software systems. First, ZScaler

Web Security, a system largely administered by district personal, filtered Internet traffic. This

system had already been in use to filter traffic for the roughly 100 laptops and dozen desktops in

use at the school. This system was supposed to prevent access to websites designated as non-educational and included, rather conspicuously, a number of social media sites such as Facebook, Tumblr, and Twitter. Second, a rather coyly named system called the Casper Suite controlled the configuration of each individual tablet, specifically what apps were installed on student tablets. Ms. Quezada used this system to push apps to student tablets. Finally, the internal settings of each tablet were to be controlled via Profiles, a feature of iOS that governs network passwords, disk space allotment, and location services. Notably, this final software solution would limit student access to the controls of their individual tablets.

Architecture of Tablet Surveillance			
Software	*Publisher*	*Function*	*Accessed by*
ZScaler Web Security	Zscaler	Analyses both inbound and outbound web traffic. Promises "real-time" alerts and responses to perceived threats such as viruses or malware.	Configured by Home Office. Incidents of unauthorized access attempts are reported to Principal Montoya via reports, which he shares with Ms. Quezada.
Casper Suite	JAMF Software Solutions	Device management. Updates and maintains software. Controls what apps can be accessed via tablets.	Configured by Home Office, but permissions allow Ms. Quezada and STLs to make changes. A dashboard allows class teachers to lock particular apps or functions on the fly.
Profiles	Apple	Controls individual device settings, such as stored passwords, camera access, and deveice preferences.	Configured by Ms. Quezada and STLs.

Figure 4.1. List of software used to monitor student tablet computers.

Despite this relatively robust, tripartite strategy for controlling student computing, much of the monitoring, filtering, and directing of student computing took place through analog means. A great deal of surveillance at Number Seven depended on a conspicuous theatricality, the enacting of particular rituals aimed at bringing the observation of students and student computing activities to the fore, of reminding students that school authorities monitored their computing with an inerrant electronic gaze. These actions threatened, reminded, cajoled, and —

administrators and teachers hoped — conditioned. While such performances had the effect of normalizing invasive surveillance regimes, reciprocal performances could also function as pro forma compliance. These moments of performance on the part of teachers, administrators, and students created the appearance of perfect, ubiquitous, panoptic surveillance, and, when deployed as a response, as perfunctory signals of submission. In many cases, students responded to shows of surveillance power with shows of obedience, but these mutual displays only sometimes altered student behavior with regard to rules for student computing. Electronic evidence of student misbehavior was often produced after a disciplinary infraction had been noted and addressed by administration. Electronic surveillance, although it was described to students as ubiquitous, continuous, and immediate, was in fact only invoked to produce evidence of known infractions.

Surveillance theater

The ritualized, ceremonial invocation of surveillance began before students had even received a tablet computer. In the fall, before the tablets arrived, Principal Montoya invited parents to the school for a mandatory introductory session that explained the tablet plan, described how tablets would be incorporated into the school's instruction, and required that parents sign a form that, among other provisions, assumed financial responsibility for tablets in the event of loss, theft, or damage. Because not all parents or guardians were able to attend the event, the same form was sent home, in both Spanish and English language versions. Parents did not have the option of amending or refusing the contract: should a parent refuse to sign, the parent's student would not have been allowed to use a tablet nor, conceivably, allowed to attend the school. As Ms. Quezada put it, "It wouldn't work. They [students] wouldn't be able to do their class work without a tablet." This display of the school's authority was met with no meaningful or effective resistance. However, the contract was never invoked to force a parent to pay for damage to a tablet. The

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display of the school's bureaucratic and legal power, while not exactly a bluff, functioned to portray the school to parents as a powerful but ultimately benevolent manager. It is also unclear if the school could have successfully used the contract to force a parent to pay for anything: the validity of the contract was never tested during the two years of my study.

Just as parents were convened and expected to sign a binding agreement, students were assembled and read a more extensive document, a nine-page contract called "Student Pledge for Computing Device Use." The document details a number of rules and policies for the use of tablets by students, ending with a sixteen-point summary that begins, "I will use my tablet in ways that are appropriate, meet Academy School's expectations and are educational."[10] This single clause accounted for the bulk of disciplinary action related to student computing. In contrast to the banal and self-evident manner in which the term is invoked in the contract, what constituted "educational" content proved contentious and difficult to establish. Students were also reminded, in writing of the constant surveillance to which they would be subject: "I understand that my tablet is subject to inspection at any time and without notice and remains the property of the Academy School."

Taken together, these two contracts and the conditions under which they circulated show how rituals and routines were meant to establish control over student computing and, to a lesser extent, over parental behavior. The use of contracts recalls the terms of service familiar to technological systems of all kinds and primes student computer users to accept the provisions of contract without negotiation, not as the settling of terms between equal parties but as a sign of obeisance by an inferior to an unquestioned superior. The maintenance of conspicuous disciplinary control over student bodies, behavior, and speech form an "orthopaedics of affect," a

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[10] See Appendix.

continual shaping of children's feelings, sensations, and dispositions into a repertoire of discrete, socially acceptable modes of self-expression (MacLure et al., 2012, p. 462).

This emphasis on surveillance continued throughout the process of distributing iPads to students. After an advisory got their set of iPads, a rather detailed process that involved registering each device to an associated student identification number, pairs of STLs (one boy and one girl) went to each room to instruct students how to set up the devices using a highly choreographed presentation that included a PowerPoint slideshow and a document called "iPad Setup Script for Students (Facilitated by Advisory Teachers and STLs)." STLs guided the entire set up process: I watched a girl named Liliana guide the class through turning on the iPad, connecting to the schools' network, and opening apps for the first time. Another student, Pedro, went around the room to troubleshoot. The teacher (Ms. Gregorio), chatted with other visitors to the class and directed all questions to the STLs. As she delivered her presentation, Liliana twice reminded students that the iPads were under surveillance via the Casper Suite and other electronic monitoring software:

> Liliana: Remember you guys, this is a tool. It's just a textbook. You have to use it right or we won't get to have them. And of course, remember: we are keeping surveillance on them. We have surveillance on everything you do on here, so follow the rules so it won't be a problem.

Liliana asked students to watch a video that the STLs had made and published to their YouTube channel. The video showed a few skits that portrayed unacceptable behavior, such as watching forbidden content or damaging a tablet, each episode of playacting punctuated by the student "getting busted." Ms. Gregorio then had the students go through a self-guided list of 42 activities called "Getting to know your iPad" that included reading the battery display, opening Google Earth viewer, copying text, and taking screenshots. I asked Ms. Gregorio how she thought the new tablets would help with instruction and, before she could answer, a student chimed in: "It'll be a distraction."

This episode shows a few important aspects of the iPad program. First, much of the work of the program, including teaching students about surveillance, is accomplished by student workers. This work is choreographed and ritualistic, involving scripted readings, videos, and visual cues. These student workers act as characters in miniature morality plays, recite statements describing the surveillance regime's workings, and create posters and other artifacts to inculcate students to the surveillance power of the school. These constant reminders are meant to deter students from misusing computer resources and to prevent them from accessing forbidden materials, but they do so by characterizing the school's ability to effect these rules by monitoring as absolute.

Any use of computer resources that violated any rule was described as "hacking." Hacking then could include almost any conceivable (and predictable) use of an iPad: copying a forbidden file from a readily accessible source, downloading multimedia content to which a student had not purchased access, or logging-in to an individual iTunes account to access legally acquired media. School administrators, teachers, and STLs described these incidents as if they were legal violations. Most often, incidents of hacking involved an abrogation of the school contract students signed as a necessary pre-condition of using a tablet. Hacking them became the category opposed to and therefore constituted by educational use: anything deemed non-educational was hacking and vice versa. This use of hacking to describe illegal behavior turned some of the justification for the tablet computing program on its head. As Principal Monotya explained at the very beginning of the program, one promised goal of the one-to-one program was to familiarize students with technology, to get computers "in their hands" so that they could learn computer-related skills that would be useful in a future job market. This framing draws heavily on the rather idealized version of hackers in popular media and hagiographic Hollywood biopics, as geek geniuses such as Zukerberg, Jobs, and Gates, men who turned their technical

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skills and unconventional sensibilities into vast fortunes (for example, Levy 2010). From this perspective, hacking would be a desirable skill. Coleman (2013), writing of this other, more favorable valence, writes "In pushing their personal capacities and skills though playing around with and making technologies, hackers experience the joy that follows from the self- directed realization of skills, goals, and talents" (p. 12). Hacking is a term that inhabits a zone of cultural amibuity to be sure, but Number Seven tolerated no such ambiguity.

Hacking as non-educational use

The first episode of hacking took place less than two hours after the final group of students had received their iPads. A student gained the ability to download apps by changing the time and date settings on his iPad. Based on the instructions provided on a game developer's website, he installed a videogame on his tablet. Rumors of the video game hack circulated quickly. An STL informed Ms. Quezada, who in turn informed Principal Montoya. The offending student and his iPad were summoned to Ms. Quezada's room so that she could determine how the hack had defeated the school's elaborate security. Ms. Quezada's monitoring software could not detect the unapproved software. Exhausted from the intense day's labor, she repeated in frustration, "I can't see it," meaning that the interface of her monitoring software (the Casper Suite) could not register the non-educational software. From her vantage, the offending tablet had only the standard set of apps installed, although by physically inspecting the tablet, she could see an icon for the game on the home screen. Principal Montoya informed the offending student that he would be punished for violating the student contract, but that the punishment would be suspended as long as he did not tell anyone else about the hack.

This particular episode began a long series of conflicts between students and school authorities over use of computing devices. School administrators experimented with a variety of disciplinary measures to prevent access by students to materials deemed "non-educational"—

content such as video games, social media, images, music, movies, and television shows. Some students responded with elaborate countermeasures to give themselves and their friends access to this highly sought after content. These cat-and-mouse games continued throughout the two years of my study. The school administration, acting through Ms. Quezada and the STLs, proceeded primarily by removing functionality that had been deemed non-educational from tablets, including blocking all Internet sites except for a list of pre-approved URLs, turning off parts of the devices, such as the camera, and increasing the frequency of physical inspection of devices. These activities were all punctuated with various kinds of displays that aimed to communicate to students that the school's means of electronic surveillance was omniscient and omnipotent.

Roughly three months into the tablet program, Ms. Quezada, in response to my questions about surveillance, demonstrated the use of iOS Profiles, a powerful feature accessible by her and her STLs alone. Student iPads were set up and administered via iOS Profiles, XML-based files that contained configuration information. While her primary means of monitoring and controlling the configurations of student tablets was the Profiles feature, she said there might be an interface that provided an overview of student computing, a "God's eye point-of-view," but she didn't know for sure if it existed. This was an admission on her part that there was uncertainty involved in monitoring student computing. Lacking this central "God's eye point-of-view, " school officials, especially Ms. Quezada, pieced together a probabilistic view of what might be on any given tablet. Using the Profiles settings, she showed me that her own iPad reported "8,075 Managed Mobile Devices," a number much greater than the number of iPads in the school (fewer than 600 managed devices). She showed me how she had used this feature to uncheck a variety of options on the student Profile, eliminating capacities of the devices that had become problematic.

Ms. Quezada: Some kids have been messing up. The camera has been a problem. Also FaceTime and GChat. Anything that can distract them will distract them. They were taking pictures of teachers and making fun of them. And of other students. The selfies were… out of control. They were using screen shots to take pictures of tests. We had to cut all of that off. I wanted to show them that I could take it away. But also, I want to let them know that I have control.

This exercise of power shocked students, who discovered that the capacity of their computing devices had been altered only when they attempted to use them in the manner to which they had grown accustomed. This radical reduction in capacities constituted a kind of theatrical intervention, such that many students attempted to report that their devices were broken. The rush of complaints temporarily overwhelmed teachers. Mr. Tustin, another assistant principal, made a hasty announcement over the school's public address system explaining that since the devices had been misused, the cameras had been disabled.

Here, the use of disorientation and shock is effectively yoked to the IT administrator's vision of educational utility. The theatrical unveiling of the change in capacities of computing resources (the elimination of the camera from the set of allowable applications) shows students that their non-educational uses had been noted and school officials had responded accordingly. School authorities framed these non-educational uses in terms of failures of individual students "messing up," that is, purely in terms of the individual actions of certain students.

But this dramatic response immediately suggests to students a number of contradictions that undermine the legitimacy and effectiveness of the surveillance regime as a whole. First, it shows that school administrators have not correctly predicted the uses of tablets. Use of the tablet is mandatory; the camera is an integral part of the device that students may not, according to their contractual obligations, remove or disable. The school has thus forced students to carry a camera with them at all times and only later realized that students might actually use it. Second, it acknowledges that the monitoring and surveillance system might miss all kinds of hacking. That such non-educational use of the cameras could reach "out of control" proportions indicates,

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necessarily, a limit to the control of school administrators: control cannot be reasserted unless it has already been lost. Finally, the dramatic reveal of the camera's fate and the subsequent disruption of class activities shows that the presence of tablets can disrupt the routines of the school, effectively demoting teachers from class leadership as changes in computing policy temporarily overwhelmed class instruction. Episodes like this one revealed fractures in the seemingly impenetrable surface of the category of educational. By allowing security activities to undermine instruction, the legitimacy of a surveillance regime that claims to support education and accountability is ultimately called into question. The surveillance itself became a distraction.

Counterperformances

In the context of the day-to-day life of the school, surveillance became part of the everyday routine, a new kind of work that teachers, students, and administrators had to do and a new way of doing things that had already been enshrined in other routines and accomplished via other artifacts. In particular, the physical inventory of tablets became a prominent ritual that opened and closed a standard school day. Most students behaved as directed by their contracts of behavior, out of fear of the surveillant gaze of the administration, a desire to please teachers and administrators, or perhaps even lack of interest in forbidden content. Still, many students resisted this control, effectively developing counter-performances that signaled superficial obedience but, in the local dynamics of surveillance and counter-surveillance, indicated the possibility of limits to that control.

In January of the second year tablets were in use, I observed a teacher's use of theatricality to effect surveillance. As the students worked on the project and socialized noisily, a student's iPad became a focus of Ms. Quezada's disciplinary attentions. The student, Juan, was showing off photos in his library that included forbidden imagery. Ms. Quezada demanded Juan's iPad and asked him to enter the passcode to unlock it. Juan did so, then Ms. Quezada

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proceeded to delete all the putatively non-educational photos from the library. She did so playfully, commending the student on his clever use of screenshots to collect images as she examined them one by one, casually scrolling trough the photos with a flick of her index finger. The class sniggered at Juan's misfortune, reciting rules about the iPads to one another to punctuate Ms. Quezada's playful but deliberate display of authority over the device and, by extension, the student.

A student at a nearby table chimed in, "She got you, bro. Miss, you should check his history." The class erupted into jeers and catcalls.

Ms. Quezada said, "I should." As she continued her examination of Juan's iPad, he looked over Ms. Quezada's shoulder and rather matter-of-factly informed his classmate that if Ms. Queada should find anything objectionable in the browser history, he was going to beat the other kid's ass. Ignoring the threat (and the profanity), Ms. Quezada continued to clear Juan's tablet of forbidden images and then returned the tablet to him, announcing to the class

> Ms. Quezada: Gosh, you guys. That's not why we give you these computers. These are for school. For school only. If I catch anyone else with all these pictures that aren't for your schoolwork, I'm sending you to Montoya [the principal]. This has gotten out of hand.

In catching Juan red-handed, so to speak, but refusing to punish him, Ms. Quezada defused the tension in the room and refocused students on the activity she had given them. But the issue of Juan's "hacking" went unaddressed. Subsequent interviews showed that this particular issue, the collection of non-educational images, remained unresolved. It bears noting in this incident that any technological means of preventing students from accessing forbidden imagery had failed. Through a clever combination of allowable apps and features, Jaun (like many other students) had collected a gallery of forbidden images — cars, women, shoes, and cartoons, a whole visual encyclopedia of non-educational materials. It was only by physically taking control of the student's device that a teacher was able to determine what kinds of media

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were stored on the device, each image itself evidence of the failure of the school's elaborate monitoring, blocking, and surveillance apparatus.

This incident calls into question the elaborate mechanisms for monitoring student computing. In a sense, Ms. Quezada's resort to physically seizing the tablet is an admission of defeat, an acknowledgement that the ability of students to collect non-educational materials via school computing resources has outpaced the administration's means of prevention. Ironically, Ms. Quezada herself is the designated IT staff responsible for running the school's tablet program, including establishing protocols for monitoring and surveillance. Presumably she should have had the power to prevent any non-educational computing or, at minimum, to manage a system that would alert her in the case of such an event.

BENEVOLENT SURVEILLANCE

"I'm going do whatever I can to make that number go higher."– Ms. Archer, College Counselor

The *school-to-prison pipeline* is a critique of public school discipline policies that ahs persuasively shown how implicit racial bias leads teachers and administrators to over-discipline students of color. These disciplinary over-reactions create a feedback loop that results in more frequent and severe punitive action, ultimately impeding a student's life outcomes (Losen et al., 2015, Raible and Irizarry, 2010). In many cases, students "graduate" to adult correctional facilities. At Number Seven, the disciplinary focus of the school functioned in a different way, with an orientation toward academic performance. I call this approach to student behavior and pedagogy the *school-to-college pipeline*. School administration aimed to create a culture in the school where enrollment in college, university, or a branch of the armed services was the norm. This philosophy presumed a number of facts about the educational situation: that college attendance was the chief means by which their students, all of whom are of color and nearly all of whom come from families living below the poverty level, might improve their life outcomes;

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that students left to their own devices lacked needed skills and knowledge to find and enroll at a college or university; that the percentage of graduating students enrolled at a college or university was the primary metric by which the value of a school could be measured; and that school administrators could create a culture within the school through edicts, rules, and policies enforced on both teachers and students. To create this culture, they adopted a number of measures such as asking teachers to decorate their classrooms with pictures of their alma maters, inviting recruiters from various universities to speak at the school, and holding special events with college themes. On College Day, students were allowed to come to school out of uniform, provided that they wore an article of clothing with a college logo on it. While these measures may seem rather benign, other aspects of this attempt to shape school culture and maintain the school's key performance statistics borrowed school-to-prison pipeline tools of punishment more heavy-handedly. Teachers were discouraged form recommending post-high school plans for students that did not involve some form of college, even for low-performing students who might clearly benefit from vocational school or for students whose documentation status made attending the institution of their choice impossible. The pressure on graduating seniors to report that they had been admitted to college was intense. In the weeks leading up to graduation, a single holdout was identified. Because the school was small and the graduating class consisted of 153 students for much of the second year of my study, administrators put a lot of pressure on the one student keeping them from a perfect 100% matriculation rate. This student did not want to go to college, but was visited by counselors and principals at the school repeatedly until he relented and said he would attend community college. Finally, students whose academic performance made graduation unlikely were transferred out. When I referred to this process as expulsion, the teacher I was interviewing looked around nervously and said emphatically, "We don't use that word. Transferred out…that's what's it called."

In contrast to active daily rituals and counter-rituals that proliferated in instruction, tablet computers contributed to other kinds of passive surveillance— i.e., passive from the point of view of student tablet users— particularly in the area of college advising. Tablet computers came to be central in the administration of college applications by the schools counseling staff, composed of two full-time advisors and a paraprofessional secretary who also worked part of the day in the front office. Teachers occasionally contributed, primarily by releasing students from class to go to the counseling center, which also doubled as the school's media lab. Here, I want to focus on counselors' and teachers' descriptions of their work and how counselors came to incorporate tablets in their primary job duty, overseeing mandatory college applications.

Tablet computers were immediately enrolled in the production of the college matriculation statistic. Ms. Archer, the senior counselor, explained the use of tablets in the school. Every graduating senior in the school was required to apply to at least four colleges as a condition of studying at the school, four being the number of application fee waivers automatically granted to California state residents who qualify based on low family income. This requirement was as binding to all students as was the requirement that students wear uniforms. A violation of this policy could result in a student being "transferred out" of the school, or, in less nuanced terms, expelled.

> Ms. Archer: They [the school administration] just put all these things in place that make it really hard for you to not make it. And then those kids that aren't going to make it kind of weed themselves out, because the culture that we've established here is, you're coming here because you want to go to college. You live in this neighborhood, and there's not a lot of resources, and this is one of the better schools around here. If you want to make it here, and in life, you're going to do what it is that we have laid out, and if not, then you're free to go anywhere you want. And so there's the... Yeah. There's not really talk about, "You're not going to graduate," it's more, just, "Are you going to get into a college you want to?"

Ms. Archer went on to explain that this number figured into the pay structure and administrative evaluation of the principals themselves:

> Ms. Archer: To be deemed "Effective," I guess, and maybe, I don't know, it has to do with their bonuses, but to be an effective principal, I guess they get judged or graded on how many resources they've given the kids, how many... What they've done to make sure the kids don't fail…

Likewise, the rate of students admitted to four-year colleges also affected counselors' compensation:

> It's connected to our bonuses. Obviously, to appease my principal, 'cause he would love 100%, hopefully, but I think we learn from each year what didn't work, and what we wanted for our own... I guess maybe it is narcissistic, but it makes you feel good. Like, "Cool, I was able to help the kids get into their school," so I'm going to do whatever I can to make that number go higher. Yes, it reflects well on our count, cause right now we're at 97% acceptance, and there are five kids who haven't gotten in to a four-year this year, and I heard that's never happened… Academy is all about numbers. It's all about numbers.

In this same interview, she points to the use of tablets as an unmitigated success, a description of the program at odds with descriptions given by teaching staff. First, access to tablets has enabled counselors to better monitor and mediate the college application process; second, the greater number of students successfully enrolling in some kind of college serves the central, legitimating metric (greater rate of college matriculation) of the school and, critically, its parent organization. In each framing, the tablet's "success" is in its contribution to a surveillance assemblage, that of the school's counseling staff and that of the charter management organization. Monitoring of completion of college applications happened in a very different mode than monitoring of tablet use during class:

> Ms. Archer: [I] Love it [the one-to-one program]. So last year they didn't have tablets, so we had... I don't know there's ten desktops out here, for 150 seniors…So, we had to have kids print out SAT tickets... Or not even printing out, just looking at their admission tickets to see if they got in, looking at their portals, we'd have to call them in ten at a time. And if they weren't all working, however many at a time they work, they'd get on their portals, and then they're looking at things. "Okay, this and this, et cetera. I have to go do this." With these transformers [tablets], it's amazing because they can be looking at stuff while they're in class and they can just come down and say, "I need to do this." As opposed to that's their first time seeing it, "Oh, I have to get this, this, and this together." Now it's kind of like it's... It helps organize them and organize their... They're a little more efficient with their time, even though they don't really realize it. And it's kind of teaching them to make lists, and to... They're communicating, I always tell them.
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> From a counseling perspective, I'm able to teach my kids what I know is important for them to learn, how to draft an email. And I like it that they're here and they have their device and I can show them real-time how to do this. Yeah, so I think that as far as my work is concerned, I think [the one-to-one program is] accomplishing its goal. Because drafting email is just as important as writing a paper.

In contrast to the means of surveillance that sought to allow teachers to "see" what students are doing with their tablets in the classroom, Ms. Archer had greater access to student-level data for college applications via a commercial application called Naviance:

> Ms. Archer: It's... It's [Naviance is] not as great as Home Office makes it seem. It's a useful tool and I could see how it would be if it worked efficiently, but it doesn't all the time. It keeps everything in one place, but then we're still forced to create our own spreadsheets just to double-check. So we're now realizing that sometimes the kids' information is in there, we know we put it in there, and then we come to find out the kid is able to access it and they've taken off that information. And we're like, "There's gotta be a lock, something, so we know." So now we've had to create a spreadsheet.

Student performances here are summarized via a number of interfaces. That is, Ms. Archer need not directly interact with each of the seniors whose college applications she must supervise, she need only refer to a summarized report of incomplete applications. Just as the theatrical mode of surveillance in the classroom prompted reciprocal performances of acquiescence and obedience, so too does Ms. Archer's work in the counseling center, although in this case, this work is mediated by a series of computer interfaces. And just as a student's performance of obedience rituals in the classroom can mask actual resistance to the administration's control, Ms. Archer's college applicants found ways to appear to comply while deviating from the script. Again, most students complied and achieved the desired outcome (applying to four colleges), but resistance to the program was sufficiently widespread that countermeasures became necessary.

> Ms. Archer: They've changed accept or denied. And so we... There's an option for conditionally accepted, which is you've been accepted but we can take back that acceptance if you do not pass your English or Math class at the end of the... Or if you don't maintain the same GPA, they can take back their acceptance, the school can. Now there's an option for accept, decline, or conditionally accepted, so, E just the other day had gone through all the conditionally accepted. And she went in and looked and she was like, "Wait. I know I just did hers conditionally." So a kid... 'Cause the kids have access to their own Naviance. Our Naviance screen looks different than theirs, but whatever they change, it changes on our screen too. So we look at it and we're like... And there's no way to look at when they changed it, or what it was prior to them changing it, you know? So luckily she just happened to look at it, but that made her be like, "Now I really have to update my spreadsheet." So it's become a little more work than it had intended to.

She refers here to a clever workaround by students, who could alter the decision status of some of their college applications. A second workaround for students who wished to evade punitive measures related to college applications emerged as well: students discovered that they could appear to meet their quota of completed college applications by creating and uploading documents filled with gibberish. From the administrative interface, a college application would appear complete, but without accessing and reading a word processing document that represents an admission essay, for example, the counselors cannot determine that a student has disobeyed and therefore, cannot refer them to the principal for disciplinary action.

Here, supplying needed information is reduced to a counter-ritual (typing and uploading) that appears to signal compliance, but, in fact, achieves (at least temporarily) the opposite. While this behavior was not widespread and often employed as a delaying tactic by students who were struggling to meet specific deadlines, it troubled Ms. Archer's description of the tablet program's unequivocal success.

For Ms. Archer (and for some students), the surveillance enabled by tablets highlighted a problem with the mandatory applications. Poor students, first-generation college students, and students of color face a number of hurdles in completing college degrees (Harmon, 2012). A longitudinal study of high school graduates found that after a decade, only 14% of students of low socioeconomic status had completed a bachelor's degree as compared to 60% of those of high socioeconomic status, despite a measured similarity in intention to do so at the outset of the study (National Center for Education Statistics, 2015). These statistics are well known to college access advocates and, more importantly, to Number Seven's staff and faculty. The school's reliance on requiring students to enroll in college struck Ms. Archer as possibly misguided. As she described the importance of matriculation statistics, she reflected on deeper motivations for her work:

Ms. Archer: We're in a extremely low income neighborhood. A lot of our kids' family income for like the year, maybe $10,000, maybe 15 max, for a family of like four or five. These kids are really, really poor, and this school... Our waiting list... People, they come almost daily throughout the year. Like, "Can I put my kid on the waiting list, do you guys have room?" Because their alternative is Manual Arts, is Jefferson, is Locke. Locke is a little farther down, but it's just not... There's nothing else around here that is a light of hope, and so this school is, for a lot of these kids.

That's all they wanted. Any kid wants somebody to listen to them. You know? Just to hear them out and they're fine. And so just making connections with these kids and just seeing how they're excited for me to come every day and they would remember things I said and I was just like, "Wow, they're really listening to me." And that was it. And from there, my purpose was okay; I wanted to be a counselor. And I'd only worked in the inner city my entire career.

Like some of the dissenting students, Ms. Kline, a resource teacher who works exclusively with low-performing students, developed ways of complying with surveillance. She encouraged pro forma compliance, while questioning the validity of the metrological regime as a whole.

Ms. Kline: I have to make sure that number one they pass all their classes so nobody fails anything. Make sure they sign up for their SATs, ACTs, like all of the college entry stuff. The counselors do that part but I help support them because they forget, they lose things. We have to explore realistic options because the school will push them for four-year colleges and all of them have to apply. They don't have a choice, they all have to apply to four-year colleges, and then of course my kids will get denied.... What I work with them on are realistic goals, looking at vocational schools, looking at community colleges, looking at Department of Rehab if they're eligible, these other options that the school doesn't advertise…But I know for a fact that only one of my seniors is going to a four-year, and even at that it's not highly-recommended that she do so. But there is a lot of pressure on them.

I know [the rate of students going to a four-year college] is a point of pride. I don't know its validity, or how they dole this number out and these statistics and 99% are going to four-year colleges or 98% whatever we're at. But I'm not quite sure who came up with that number. How they arrived at that number, and how... I know that my kids are factored in I just don't know how they're factored in and why the need to publish them so much.

As in the case of surveillance applied to classroom instruction, the success of the surveillance regime was tested both in terms of sporadic counter-surveillance, but in some sense, buy its own success. Clearly, some students developed ways of resisting electronic surveillance (uploading gibberish documents or editing data), but for the most part, surveillance of tablet computing accomplished the administration's goals. The relative ease of effecting surveillance over student college applications led the very workers tasked with effecting this control to wonder about the importance of the metric they were policing. Ms. Kline's comments point to ways that she tacitly

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accepts an undermining of the whole metrological regime, in effect providing non-compliant students with the cover they need to explore non-collegiate futures without punishment.

NOVEL METRICS

In this third look at the routines and rituals of surveillance, I turn to testing. As in previous instances, I use observation and interviews to contrast descriptions (and legitimations) of surveillance activity with their actual implementations. Here, I show how school administrators explained their extensive use of test scores in terms of accountability and the self-evidence of data, but in fact stopped short using the data they had collected in the manner they had detailed to staff and the public. Access by most students to a tablet contributed to other metrological regimes inside and outside the school. One such regime, instituted in the second year of the tablet program, concerns the collection and analysis of standardized test scores.

Here, Mr. Tustin, one of three assistant principals and also head of the Language Arts department, explains how the one-to-one program enabled the school administration to expand its control of the testing situation by contrasting between two kinds of online resources: web-based and app-based.

> Mr. Tustin: Achieve 3000 that we use for Lexile scores or the Pinnacle Gradebook, those are all actual websites. So, I can access those from any device, any place where there's Internet. So, if I'm in Chicago visiting for the holidays and my computer dies on me, I can grab my mom's tablet and log on to one of those websites because it's all just my own user name and password, versus Pearson is an app-based program that can only be used if you have the app, so you can only use it on a, let's say, tablet or phone. There is no Pearson program on a laptop.
>
> There are some apps that are used for testing now. So the Smarter Balanced tests, which is now called CASP, that's an actual app that we installed on all of the devices in the building. They're secured so that when students log in to those apps, it locks everything else on the computer so that they can't go and say, search definitions on Google or look up formulas and things like that. It's actually one of the nice things about the testing coming on an actual app, because if the testing goes on an actual website where students are logging in to something, it's much easier for them to be able to log in somewhere else and cheat if they're not being watched over carefully. 'Cause not all sites will securely lock everything down, but the apps will, which is really cool.
>
> Now, that's out of our control, obviously. If we're running a certain test or whatever, if it comes web-based, then it comes web-based. And if it comes app-based, then it comes app-based. It's not

like we get to call somebody and go, "Hey, we would much rather have that as an app than a website," you know what I mean?

Here, data produced by tablet computers serves several regimes of surveillance simultaneously. First, the scores of the standardized tests themselves stand in for educational quality. Standards-based education is controlled by economic and cultural elites who "legitimize what counts as both knowledge and appropriate behavior" (Vinson and Ross, 2001). As Gilliom (2010) writes, standardized testing is the single greatest type of surveillance in public schools. Indeed, during the month of May in 2015, regular instruction effectively ceased as students undertook a variety of standardized tests, a regimen so complex and dynamic that the school's assistant principal published a calendar, updated daily, to help teachers know which tests they should be administering on a given day. Standardized testing is a central tenant of outcomes-based education, and a primary mechanism in the determination of failure that primes public schools for replacement by charter schools and other measures favored by the education reform movement.

Still, despite his invocation of the "data-driven" ethos of the CMO and the larger school reform movement, Mr. Tustin acknowledges that the tablet computer program itself has no justification in empirically observed research. According to a data-driven approach, every educational intervention in the school should be supported by evidence of its efficacy, by data that are presumed to be, in the epistemological mode of the natural sciences, objective, self-evident, and observer-independent (Drucker, 2011). Yet in justifying the use of tablet computers themselves, he allowed that there was no data to support the idea that tablet computers produced better education than did schools without tablet computers. Again, there might be any number of reasons to support the use of tablets in the school, but it is the administration itself, in service of the CMO from which it derives its authority and on behalf of which it acts, that requires a legitimation of activities within the school by appeal to quantifiable outcomes. Ironically, being

'data driven' and accountable is a standard to which only subordinates, especially teachers, must adhere.

Tablet computers enabled a proliferation of standardized testing: more tests could be given to more students. Data generated by these tests could be accessed by administrators, who used the data not just as a proxy for individual student learning, but for a measure of teacher quality. Indeed, in the second year of the program, a new metric of teacher quality, directly linked to the greater availability of screens for computerized, standardized testing formed one of three central components used to determine teacher's annual raises.

> Mr. Tustin: [T]hat's what I think we use [tablets] mostly for, is we do all of these other things and we're looking at data from all of these different programs. And, like I said, I think it all ultimately comes down to that without tablets, our students would still be getting help in those areas, but we would be doing it in a completely different way and we would have to get our data in a completely different way. This is... Being able to use tablets and being able to use technology helps us gather the data faster and easier. So with Lexile scores, if I just stick with that, especially 'cause that's what I've been working on for two days, I can take all of their scores, I can generate a spread sheet with all of their scores, I can plug in functions that tell me how much each student has grown. In the past, to do something like that you're doing it all paper and pencil and you're doing all the math yourself and everything. But, with the use of the technology, we're able to plug numbers in and plug functions in and have it generated immediately for us.

This spread of testing regimes functions in marked contrast to the surveillance theatre of normal, daily instruction. Firstly, surveillance in the administrative sense here is reduced to the creation of number, to a metrological function. While many standardized tests are aggressively proctored in the theatrical mode discussed in the preceding section, test results are easily reified, separated from the things they are taken to represent (e.g., learning, cognition, competence, mastery). Once created, the number may then freely circulate in other circuits of institutional power, in this case the bureaucratic functions that the charter school undertakes annually to reward, discipline, or terminate its non-union employees.

> Mr. Tustin: As the administrator, I'm looking at the scores school-wide, I literally work with, I have all the freshmen on one spreadsheet, all the sophomores on another spreadsheet. But then from the teacher's standpoint, I give them that full spreadsheet and they can see how every student in the school did on exam 1, exam 2, exam 3, and what the overall growth is. So as a teacher, I can then take that and look for my individual students, and I can identify the students who are lower than where they should be, and that would then in turn help me decide what that student needs.

With this spreadsheet, once I put it together, I color-code everything for them and everything so that everything stands out. And that way they are able to do that. Now, from an administrative standpoint, I'm looking at the big picture of all my 9th graders, and it tells me I can look for a particular color and identify how many students need a certain service, like tutoring, for example. And I can go, "Well, everybody who's in red because they fell at this number or below, should all be in tutoring because they are way lower than where they should be." And so I can target that, I can target exactly where they are, and then I can figure out what needs to be done to get them to move up.

Just as the imputation of success or failure via metrics functions as an exercise of power in the public education system at the state, the national, and (increasingly) the international level, here the creation of numbers via what appear to be neutral and objective instruments legitimates specific decisions about the apportionment of resources. Students, represented via color-coded entries in spreadsheets, are subject to remediation, often in the form of mandatory afterschool "bootcamps" aimed at improving performance on particular tests (e.g., English proficiency, SAT, CAHSEE, AP). Likewise, these numeric indicators of success or failure link directly to teacher performance pay. Good performance on the test is presumed to be a function of successful teaching; likewise, poor performance on the test was seen as indicative of a failure of teaching. Rewards and punishments indexed to these metrics presumed and enacted a logic of individual agency and responsibility. This philosophy, proudly promoted by the school's governing CMO, contextualized teaching and learning in the school toward accountability, toward the spurious individualization of particular outcomes that stood as proxies to more complex realities with multiple causes. Teachers were well aware of the functioning of this regime and in many cases, hesitant to discuss how it affected their work.

Mr. Tyler: This month has been completely crazy. For a person like me, it's really a struggle to deal with all these schedule changes and all these numbers. I can't even keep up with what all these tests are supposed to be testing. The kids have had it. I have had it. I know I'm not supposed to say this, but at a certain point someone has to say all this testing is not helping us. You're just killing us with these tests and we need time to breathe and just learn.

As in the previous instances, however, the measures taken to enact this mode of surveillance contained within them elements of contradiction. A number of scholars and advocates have addressed intellectual, practical, and ethical problems with the overreliance of policy makers and administrators on test scores. In some school districts, parents and other stakeholders have used the desire to "opt out" of certain tests and accountability regimes to gain political traction to resist education reform (Strauss, 2016). Students at Number Five, it should be noted, had limited ability to resist the new testing regime: failure to take certain curricular or extra-curricular tests would be grounds for discipline and, potentially, expulsion. Parents at the school, largely employed and Spanish-speaking, never disputed any aspect of the school's curriculum: to the contrary, they had all opted-in through a rigorous application process. At a monthly meeting for parents that I attended, when parents were given the floor to ask questions, each of the questioners asked for permission for their children or other relations to attend or continue attending the school. What was meant to be a performance of deference to parent concerns became instead a deferral to the school's authority. In fact, the school had an extensive waiting list. As Principal Montoya was fond of telling students, many other local kids would be glad to have their spot.

The frequency of testing and the unpredictability of test formats taxed administrators, teachers, and students. The affordances (or lack of particular affordances) of the tablets caught many teachers by surprise. In March of the first year of the tablet program, and English teacher, Ms. Towle, described her initial experiences with standardized tests delivered via tablets: she had recently administered a benchmarks test using the iPad, which had been problematic. Students had been "hammered" to highlight and annotate texts for comprehension, but suddenly found themselves unable to do so as the test had been delivered in a digital format. Preliminary results of the test showed that none of her students had scored at the advanced level (as opposed to the 6

to 8 students who might do so in previous years). Likewise, no student had scored "Far Below Basic," a grade typically received by the same half-dozen or so test takers. She described these results as "confounding."

Home Office decides on test formats. A test will typically be delivered to the teacher the week before the exam; decisions about format might not be known by a teacher until she distributes the exam to the class. Ms. Towle described problems that result from this status quo: students might type responses to an exam on their iPads, then email the essay to the teacher since the iPads cannot print. At this point, the teacher might have to export the text to a word processor or some other program in order to grade it and report the grade. She described a test, the Achieve 3000, test that had been delivered in paper form one year and digital the next, then some hybrid of digital and analog the following year. Students, who had never seen the exact format of the test, had problems answering the questions because the radio buttons in front of the multiple choices were too small

> Ms. Towle: They fat-fingered it. It's confusing for students who supposedly have so much ability with technology. I see them tense up when they are confronted by a new interface. Education is not responsive; it is reactive. Education is like fashion: wait long enough, and everything comes around again.

Ms. Towle expressed frustration at the constant changes in format and the inattention of Home Office to these disruptions. In her view, much of the rush to the digital formats needed for the iPads had to do with the convenience of higher ups in buying, distributing, and scoring tests and other curricular content. Ms. Towle included the push to adopt the Common Core as part of this push toward quantification and administrative convenience. For essays, students still wrote their responses by hand. Ms. Towle described students' typing abilities as "horrible." She could relate to this difficulty as she herself types poorly. In the course of one of her teacher certifications, she was forced into a digital format. She'd had so much difficulty using an online component of her certification that she'd decided to ask for paper materials. Since the exam had

been "turned over" to Pearson, they refused to issue paper materials and instead suggested she register her poor typing as a form of disability. Ms. Towle also expressed concerns about the high number of English Language Learners in class. As she told it, they were particularly vulnerable to diminished test scores as a result.

Performance of testing relied on conventions of test proctoring. For state-mandated tests, school staff (including myself) signed confidentiality agreements, affirming that we would not copy or share the contents of tests. Students, released from the normal procession of class periods, spent entire days taking tests, sometimes on their tablets, sometimes on paper, sometimes both in rapid succession.

Proctoring of tests, conducted by teachers, announced typical routines and concerned allowable activities, spatial arrangements, and allowable uses of tablets. Teachers read test instructions aloud, announcing the time the text would take, occasionally breaking character to remind students of particular points of preparation. Teachers also issued instructions ("Take everything off your desks.") and walked thought their rooms to inspect the placement of books, bags, and bodies. Jittery students blurted out last minute questions about the content of the test or the length of time they would be given to work. While students mostly behaved as directed by the proctoring performances of teachers, as is the case in all schools, cheating was not uncommon. Although I more frequently observed traditional modes of cheating (passing notes, waiting for the teacher to leave the room and then asking aloud for answers, observing other students' answers), Academy students had certainly updated their techniques. Most commonly, students would surreptitiously access their phones to retrieve information or answers from the Internet, look at digital cheat sheets, stored materials they had prepared specifically for reference, or communicate with others via text. By May, Ms. Quezada had disabled most of the cameras on the tablets, but students still used them to circulate images of screens they had captured using

their phones. By taking a photo of a tablet's screen, a student could create images that would forewarn other students about the contents of tests.

In this case, though, school administrators balked at fully acting on the data they had gleaned through the surveillance regime they had built. Teachers had no choice but to give the tests and students had no choice but to take them. For students, the results of standardized tests could have many consequences. Standardized test scores were incorporated into student grades, to the help or detriment of a student's overall grade point average. Poor academic performance led to disciplinary measures and possibly remedial obligations. But the testing was merely the data collection phase of a larger, broader surveillance effort, one that ruled both students and teachers, and to some extent, school administrators. Standardized test scores were incorporated into teachers' yearly performance evaluation and formed part of a scale that was used to determine compensation. But the use of the metric in teacher pay, although ostensibly linked to salary increases via the CMO's commitment to merit-based pay, did not necessarily follow. The use of measures of teacher performance as measured by test scores is part of a broader push for 'accountability' in education reform, the idea being that teachers should be evaluated based on how well they teach (performance-based pay) rather than how experienced they are (tenure).

> Ms. Quezada: They give you thirds, basically. One-third is based on [student] test scores, one-third on parent input, and one-third on your peer evaluation. The community input is fine. Everybody got all the points because the parents didn't really have anything to say. The testing is whatever it is. Then the peer-evaluation is really the most important. It's supposed to be weighted the same, but really it's the most important one. That's how they [school administrators] treat it.

A few weeks after the May tests, before the end of the school year, Mr. Tustin was tasked with telling each teacher what his or her merit-based pay increase would be. While the promise of teacher-based bay in its brute form would mean that teachers whose students did well on tests would be paid more, the actual implementation of the metrics did not accomplish such action. As

Ms. Quezada put it, "If they can see you are trying and they like you, you get the maximum raise. I think everyone got the maximum."

Surveillance, in its guise as accountability, would hold that the data captured about individual student performance or aggregated in an analytic schema would dictate professional reward or punishment. The school administration balked at such action though, effectively prioritizing more subjective measures ("one-third on parent input, and one-third on your peer evaluation"). This is particularly important, since, as Ms. Quezada pointed out, parents were not in a position to critique any aspect of the school's authority ('[T]he parents didn't really have anything to say."). Effectively, this creates a placeholder in the scale, a blank signifier that can be used to blunt, counter, or emphasize whatever number is generated by student performance. While the use of student's test scores appears to be a sophisticated use of surveillance, the actual implementation relies more on the holistic, subjective judgments of teachers and school staff than on anything else.

At the time of the performance reviews, Academy schools became involved in a public controversy not directly related to the one-to-one tablet program. Teachers at a sister school filed a lawsuit alleging anti-union practices at all Academy schools. The Los Angeles Times quoted teachers from Number Seven describing their opposition to forming a union: Principal Montoya had specifically offered any teachers who wished to attend an anti-union rally time off from school. While the push within the Academy's 22 schools for the union occurred for a variety of reasons, a number of teachers came to resent the significantly lower rate of pay they received as compared to comparably qualified public school teachers at LAUSD. Although they had just recently instituted merit-based pay, most teachers received significant raises (in one case, a nearly 30% raise in annual compensation) that brought their pay closer to that of their union counterparts. While I do not wish to insinuate that the results of student tests scores were

ignored, I wish to point out that between the collection of data and the implementation of annual raises, a number of negotiations of various kinds took place, including dynamics that took place totally outside the school itself. Administrators who had so keenly boasted of the efficiency and impartiality of their metrics pursued more holistic and subjective evaluations, in effect drawing into question the legitimacy of the "accountability" regime in the first place. Again, the post hoc justification for the tablet program in the case of testing from the point of school leadership is that it allows "new kinds of assessments we can give that we couldn't give before." But that explanation, that expansive new surveillance powers would enable new modes of teacher evaluation and promote accountability (and ultimately, quality) is at odds with the actual use of those metrics. In fact, what mattered most in determining how to reward or punish based on test scores was "If they can see you are trying and they like you."

Teachers and administrators then were attuned to the limits of measurement captured via standardized tests, even as they participated in public performances (including, for two teachers, media interviews with national outlets) that explicitly upheld the rhetoric of accountability via surveillance and interpretation of objective, quantitative data. Viewed from up close, as teachers lined up in the halls outside Mr. Tustin's office to get the news or gossiped with each other in their classrooms, surveillance showed a different face, one that worked not through electronic eavesdropping or data aggregation, but through reputation and personal experience. In this sense, surveillance activities tied to the ethos of accountability, at least in the area of teacher pay, were perfunctory in the sense that whatever the data indicated about the performance of students on standardized tests, the administration took efforts to shield teachers from the sanctions that distinguish charter schools form other forms of public education. The use of data then become rhetorical more than computational, yet another way for the CMO to define itself in opposition to the failure that it imputes to other public schools.

SURVEILLANCE(S) AT SCALE

What can this examination of the practices of surveillance at the scale of the school reveal about the panoptic principle and about the very real macro-level, political economic and fictional surveillance dynamics that began this article (and to which surveillance studies and related fields address themselves)? Despite the uneven and incomplete surveillance effected by school administrators at the field site, other forms of surveillance and data capture were at work, many of which functioned outside the school itself. In the context of national security apparatuses within the United States (and, to be fair, internationally) any transmission of electronic data via the Internet could be said to subject a user to surveillance regimes by the state, by corporations, or by third parties that exist solely to facilitate communication between the previous two in service of monitoring communications. Whether or not the United States has become, as many scholars suggest, a *surveillance society*, how might we move our focus between different scales of surveillance and how might doing so help us understand surveillance?

So far, this chapter has focused on observations of different forms of surveillance that emerged as teachers and administrators integrated tablet computers into the daily life of the school. Ethnographic methods, aligned as they are to questions of culture, meaning, and interpretation, place observed behavior within a rich theoretical and conceptual framework, within a story about how the world is, or, at least, how participants talk about the way the world is. Still, a great deal of scholarship on surveillance concerns itself with questions of political economy and the world system. While the ethnographic method employed in this chapter gives the researcher considerable access to the everyday activities that constitute surveillance, a number of other forms of surveillance are harder to "see" in the ethnographic sense. How can we analyze the micro theatre of everyday life in one Southern California school to probe the

contours of global corporate surveillance without overplaying the evidentiary value and specificity of this single case?

As science and technology studies has insisted for decades and scholars in informatics have reminded readers, the design of digital artifacts embeds values in technological systems (Shilton, 2012). What kinds of subjects are formed by a society run through with all manner of digital devices, a society that is intimately and electronically monitored with great granularity, a society that produces apps for the self-report of its meals, its nightly rests, its ovulations? In this way, I want to speculate on what kind of public a one-to-one tablet program addressees and what kind it calls into existence.

To the faculty and staff who administered the program, the term "data" meant disk space used, the amount of stored stuff on each individual tablet. No administrator or teacher I spoke to at any point was aware that data created by students could be synched via the app to some other database or storage scheme. Teachers did not understand their work to include decisions about privacy or data creation. Decisions about what apps should be used were often made from above (by district personnel) or on the fly, based on an activity that teachers wanted to do. Rarely, students themselves would ask for a specific app they needed in order to do school work, for example access to a web browser or Google Docs. The point is that apps were not screened according to the data policies of software providers. To the extent administrators vetted apps at all, consideration was given to technical requirements (e.g., Is this app available for the operating system currently installed on the tablets?), educational value (e.g., Is this app used for school?), and age-appropriate content (e.g., Is there nudity or profanity? Can this app be used to access content with nudity or profanity?). School staff did not concern themselves with data access or retention policies.

Figure 4.2. A view from "inside" a tablet. This screenshot shows apps had been pushed to student iPads during the spring of 2015. Each app corresponds to a portion of the total data stored on the device. Each individual app stores and synchronizes data according to its own design and terms of service.

These policies did draw the attention of lawmakers, however. Based partly on the

implementation of one-to-one tablet computer programs in other public schools in California,

privacy advocates and state legislators authored and passed a new state law concerning student

data, the Student Online Personal Information Protection Act. This California law, predicated on

the premise that federal protections such as The Family Educational Rights and Privacy Act

(FERPA) have become antiquated and inadequately protect vulnerable student populations, aims

to curb use of student data by third-parties for non-educational purposes. This is a rare instance

where state lawmakers have acknowledged (however provisionally) limits to corporate

surveillance. The law also serves as the basis for a non-binding industry pledge that contains

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nearly identical provisions and has been signed by many companies that operate outside the jurisdiction of California's new law[11].

The main action of the law is that it requires operators that sell services to California schools to protect personal information of student users. Specifically, the law prohibits several things. It forbids companies from selling data associated with student users and bans the assembling of profiles based on persistent identifiers. It also requires certain kinds of notifications and security measures to avert or limit the damage from data breaches. Critically, many provisions of the law will not apply to anonymized or aggregated data.

This law, held up as a blueprint for a national model, is certainly a needed first step for reducing surveillance abuse, but sets out a loophole for nearly any kind of data collection and explicitly recognizes student users as the subject of data rather than creators of data. At number Seven, data created by teachers, students, and administrators were only rarely and partially accessible through educational activity within the school, but completely accessible for analytics, aggregation, resale and market research outside the school. From this perspective, the makers of apps and other educational technology, described by state law as "third parties" to student data capture, are the owners of data, who partially share what they have captured with schools (or the state). Processing, aggregation, and storage took place largely offsite, accomplished by private companies operating remotely on data collected via mandated public education. In this sense, it is the school that is a third party to such collection.

The important thing to note is that each student user potentially creates data via all of the apps available for student computing, data that synchs with remote servers in different ways. The

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[11] The text of the pledge and an updated list of signatories can be viewed at https://studentprivacypledge.org.

details of what exactly each app collects are not available to student tablet users or school staff. Likewise, each app collects data according to its own policies, so an individual student user who used a school tablet last June might be subject to as many as 37 different regimes of synchronization.

In concluding then, I want to point out that the presence of these apps and their opaque and idiosyncratic data polices represents a real challenge for surveillance studies and scholars working in related disciplines. There is, potentially, a richness and diversity of practices and practical effects here that cannot be described by appeal to a surveillance imaginary. Truth is, after all, stranger than fiction. In that each app potentially links every student user to a different surveillance apparatus, we can make few conclusions about the character of the various regimes involved without greater study of each system. This approach could take many forms. The most glaringly obvious void in the research literature is a forensic approach: we need to know how much data students produce and what parties may access such data. We also need to know how these data are combined, transformed, and aggregated to determine what kind of correspondence exists between public school education data and the students and families they are supposed to represent. Finally, we should inquire as to access policies that might place such data in places where it can be acted upon by community and education advocates. Educational data of other kinds have been used successfully by advocates to initiate legal action to address race-based educational disparities and segregation, such as American Civil Liberties Union's lawsuits challenging charter school segregation.

The panoptic principle trains our focus on visible modes of surveillance. The first aspect of this imaginary I want to problematize is that visible surveillance does not always indicate an internalization of discipline. As the preceding empirical description of surveillance has shown, subjects learn ways to appear complaint when they are not, successful surveillance regimes draw

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the goals of the regime into question, and those who control the apparatus of surveillance might not act on what they have learned. The second problem I want to raise is that surveillance happens at multiple scales, many of which are effectively invisible to the subject of surveillance.

Finally, there can be no surveillance without, however far in the past, however tangentially, however tenuously, human resistance. Even relatively autonomous systems, such as algorithmic security programs that identify suspicious faces or predict patterns, can be tricked, chaeated, or hacked. What I have tried to show in this chapter is that scholars must attend to the specific details of a surveillance assemblage in order to understand it, of course, but also as a necessary precondition for subverting or resisting it. The panoptic principle is a mystique that diffuses the ability of the subjects of surveillance to act and increases the ability of the ignoble or incompetent to do harm. Ethnography at various scale applied to broadly construed field sites can help make the cultural and historical phenomenon of surveillance understandable and, when appropriate, tractable to change or resistance.

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CHAPTER FIVE: CONCLUSION

SUMMARY OF FINDINGS

I began this project with three open-ended questions about data, devices, and discourse. Briefly, tablets were used for surveillance, for counseling, and for administration, but rarely for instruction. Teachers turned to available software and systems to produce tablet-ready curriculum, frequently in the form of PDF documents. The production and management of documents mandated elaborate routines, professional practices that teachers learned from one another. Individualized, interactive curriculum that responded to a student's needs or even to his or her previous answers remained elusive, a powerful and influential fantasy.

In "What It Takes to Do Tablets," I looked at how infrastructure shaped and reshaped instruction. I showed how the insertion of tablet computers into the already technology-rich processes of instruction created the expectation that tablets would be used in particular ways, a norm that spread through the school via the informal collaboration and skills-sharing of teachers. "Doing" tablets involved a whole constellation of strategies and technologies to make tablet-ready curriculum, "content," as it were. Absent usable software, the provision of this content fell to teachers. Many teachers simply ignored tablets or used them minimally. Still, even this limited use produced new demands on teachers, primarily in the areas of desktop publishing. In the pattern of use that emerged at Number Seven, the work of teaching came to take on aspects of document management. I used this dynamic to question the digital divide narrative in two ways: digital divide framing overlooks many kinds of technology already present in poorer communities and ignores the costs associated with implementing new computing regimes. Any digital divide narrative that discounts or ignores the numerous demands of infrastructure ends up creating an invisible burden on the communities that technology is supposed to benefit.

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In the next chapter, "The Value of Youth," I considered the labor of Student Technology Leaders from the vantage of two research perspectives: digital youth and digital labor. In that chapter, I juxtaposed laudatory and pessimistic accounts of youth media usage into a single perspective, one informed by studies of affect. It's my position here that just as the home is a charged and deeply symbolic site for the exchange of different kinds of value in contemporary capitalism, so too is the computer interface. As opposed to Marxist scholars who generally hold that the asymmetrical capture of value by media corporations constitutes alienation and exploitation (Peters and Bulut, 2011), I posit that users themselves are well aware of the value they derive from such use and that it constitutes an important source of cognitive and social capital. Still, the use of media and information technologies position users in multiple kinds of markets simultaneously and information studies scholarship to this point has largely underanalyzed the role of markets, however construed. Users trade affective or cognitive value from engaging with technology and creating data, but the media and technology companies that produce and operate the various commercial platforms on which much of contemporary communication depends are the primary — and frequently, exclusive — recipient of monetary value. The spread of ed-tech extends this dynamic into public education. This is a very different financial relationship with publishers than has been the case in normal school education in the last century. What kinds of economic relationships are possible between users, schools, communities, and the corporations that produce ed-tech? At present, the relationship borrows the metaphors and interfaces that structure individual, commercial use of platforms, a mapping all-together at odds with the traditional civic and democratic virtues associated with public education.

"Small Defiances," looked at a paradox in surveillance: although surveillance at Number Seven was touted as ubiquitous, students (and some teachers) became familiar with various

aspects of the surveillance apparatus and found ways to ignore or circumvent this regime. This turned surveillance from a coercive vector of power into a kind of bureaucratic joust. In terms of day-to-day class discipline, if students were already in trouble, surveillance would retroactively produce evidence of wrongdoing to justify punishments that had already been meted out. For the most part, teachers did not have an effective means of monitoring student tablet use beyond physical surveillance. I argued that omniscient surveillance is a fiction and that actual surveillance regimes always have flaws or exploitable weaknesses. Familiarity with surveillance regimes can provide means of escaping administrative control. In contrast to the frequently evoked trope of panopticism, the more familiar an observed subject is with the means of surveillance, the greater the chance she will learn ways to trick or frustrate the regime.

In the closing sections of this chapter, I want to address two general themes that emerged from the more focused explorations that constitute the body of this dissertation. The first concerns a potential methodological contribution, one that extends science and technology studies approaches to technology into the domain of education. The final section concerns the cultural significance of computers, how computers themselves can alter and shape social relations. I argue for further scholarly attention to the motivating significance of the *idea* of computers separate and apart from any particular *use* of computers, a distinction latent in the preceding study.

DIALECTIC OF SUCCESS AND FAILURE

> We are moving forward with the integration of technology into the learning environment, ensuring that supporting instruction is at the forefront of every conversation. To that end, we are continuing regular meetings of the Instructional Technology Initiative task force — a collaborative of teachers, parents, administrators, and technology resource experts — to guide us in developing a comprehensive plan for incorporating classroom technology over the next five years.
>
> —Michelle King, Los Angeles Unified School District Superintendent, 2016

Writing in 1995, Alfred Bork, Professor of Information and Computer Science at the University of California, Irvine and founder of the Educational Technology Center, a research unit focused on the use of computers in learning, said

> Although computers have been used in education now for over 30 years, there is little sign that the major problems of education are getting any better. It is in terms of the overall quality of education nationally and internationally that we must judge whether the computer had made a positive or negative contribution. On this basis the computer is clearly a failure (Bork, 1995, p. 97).

He went on to argue that this failure is not intrinsic to computers themselves, not a fault of the machine or its design, but owed completely to how they had been incorporated in learning, how they had been used by humans. He listed several reasons for this failure of the computer to improve education, including an emphasis on hardware rather than on learning or students; "elitist" software that functions only for expert users; the tendency of policy makers to grasp onto new solutions rather than continue long-term plans; lack of individualization of educational software; and the confusion of access to information for learning (p. 98-101). "We could have rebuilt education with technology many years ago," he lamented (p. 100). While the particulars of Bork's editorial continue to be relevant, the eerie similarity of his framing to contemporary editorials that appeared in Los Angeles media between 2013 and 2016 shows that the general contours of success and failure adhere to long-established patterns. What I want to argue here is that the construction of a public consensus about success or failure in the application of computers to an educational situation rests as much on normative grounds and imagination as it does on an empirical description of reality. What can be (or must be) a failure defines a status, and in doing so, defines a logical opposite, a reciprocal status of success. This dissertation uses a specific success, one that is partially constituted by a larger failure, as both a setting and as a demonstration of this dialectical action, what Lefebvre calls "contradictions within a unity"

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(2008, p. 91). Education and information studies research could usefully profit form such attention to failure.

Much of what occurred at Number Seven with regards to tablet computers was inspired by the larger, more famous program at LAUSD. Policy documents related to the one-to-one program situated the program within efforts to increase access to information for the purposes of increasing social justice, to "bridge the Digital Divide and teach 21st century skills" by bringing new forms of computer technology to public schools in Los Angeles (LAUSD, 2013). This document makes computer use into a site of freedom and agency, of economic mobility. Indeed, postmortems of the "failure" at LAUSD often uphold this social justice framing and suggest that the LAUSD program only suffered because of how it was handled. It was only the details of the program that were misguided, not its fundamental orientation toward social justice. In this respect, failure serves to insulate a particular approach toward social justice and to preserve a particular definition of access, that is to say that access to technology by underserved students is automatically good and inherently serves social justice.

I asked every teacher and administrator I interviewed at Number Seven what the one-to-one program was for, what it meant to accomplish, but I never got the same answer twice. By contrast, many teachers alluded to or mentioned concerns with social justice as motivating their teaching careers. Much of what I observed at Number Seven concerns a perceived competition between Academy Schools and the larger public school system of which it is a part. Indeed, at the start of my study, one administrator (Mr. Michaels) explicitly stated that the reason that Number Seven wished to start a one-to-one program was because LAUSD had one and so such an effort was necessary. During this same period, Ms. Quezada, the math teacher cum IT specialist, stated that it might confuse students who came to Number Seven from LAUSD if there were no tablets or if a different kind of device were in use. This competition between

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charter schools as stand-ins for the larger school reform movement and Los Angeles Unified

School District turned on a specific description of another kind of failure, the failure of urban

schools, a theme that showed up often in my interviews and observations.

Stalder (2002), in discussing the demise of electronic cash in Canada, says that public

failures render visible relations between science, technology and society, making these available

for analysis. He writes,

> Short-term failures can contribute significantly to long-term development, although not necessarily in the way originally intended. By moving away from simplistic dichotomies of success versus failure and by concentrating on the complex and often uneven process of transformation, we can develop a more realistic understanding of large-scale socio-technical change (p. 210).

To apply this point to the current project, I am interested in a series of interlocking public

controversies that involve technology, education reform, and social justice. While some of these

issues have receded from the news and others have not, my strategy has been to use the dialectic

of success and failure as a point of departure rather than as a test of quality of a particular use of

computers. LAUSD's iPad debacle is a public failure, one that makes possible and even

necessary the success of Number Seven's one-to-one program. This logic of success and failure

places blame on LAUSD for failing to use tablets in ways that meet public expectations. In

contrast, Academy Schools have successfully incorporated tablets. But what are the assumptions

upon which these assessments rest? In the case of LAUSD, it is people who are presumed to

have failed to behave as needed, incompetent humans who have come between educational

technology and the intended recipients of its benefits. In the case of Academy Schools, humans

have behaved as directed and so the intended educational benefits are presumed to have arrived

at their destination. Echoing work in the sociology of science and subsequent approaches in STS,

I argue for a symmetrical approach, one that takes public successes and failures as constructed

based on a variety of interests rather than derived directly from the gradual revealing of natural knowledge to humankind (Sismondo, 2007).

In stretching this tenet of epistemology, I mean to point out that education is not the product of objective, observer-independent truth. Particularly in the case of public education, education is a site defined by competing interests, struggle, and politics (Apple, 1995; Zamudio et al., 2011, p. 96; p. Monahan, 2005, p. 178-9). But both success and failure in this case share a sense of computers being inherently educational, used to deliver individualized curriculum instantly to every students, tailored to her specific needs. This is a powerful and persistent vision. In this sense, what this dissertation is about is the perpetual desire to technologize education, a recurring impulse over time to solve the political problems of public education through the application of technology. Given this observation, we cannot help but conclude that the use of computers in education is overdetermined: the power of computers to accomplish the transformation Professor Bork referred to at the top of this section is inflated. Somehow computers applied to public education never quite manage to change school into something other than school. Controversies over technology programs (or the successes that do not produce headlines or lawsuits) presume an incorporation of computers and computer-like devices in ways that have little to do with day-to-day routines of school life. This powerful push to incorporate computers remains immune to evidence or controversy and is itself worthy of further study.

FOR EVERY USER A COMPUTER, A COMPUTER FOR EVERY USER

This dissertation take place between two moments: the dramatic, showy arrival of the new devices and their eventual domestication, when tablets became routine, banal, unnoticeable, just one more thing to be schlepped around by overburdened and tired students. In the case of the former, the pomp and ceremony of the tablets' first day in use can easily provide a sense of moment, of the relations that existed at that time. Almost all of the things that would play out in

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the two years of my study were there, readily observable from that day (the scene I started this dissertation with): the neediness of tablets, the industry of students, the disregard for the expertise of teachers. To end this dissertation, I will depict another moment, one where the relationship of the parents of Number Seven came into play, how technology that was old hat managed to make itself new again. I will end this story about technological innovation with a look at how some of the adults in the community figured as learners and users of computers.

With all the technological changes afoot at the school, Principal Montoya and Mr. Michaels got the idea to do something for parents, to help them with their own literacy issues. Their interest was both altruistic and pragmatic: parents who undertook some kind of education would likely be better involved in their children's schooling and any benefits to the skills of parents would help the whole family. In February of 2015, parents of Alliance students were invited to join free classes to be held after school at Number Seven. Co-sponsored by the City College of Los Angeles and the local branch of the Los Angeles Public Library, the classes were meant to address the most pressing needs of parents: English language and computer literacy. The computer class turned out to be the more popular option. At the inaugural computer literacy class, roughly half a dozen adults attended, almost exclusively women, several of them with small children it tow, the younger brothers and sisters of Number Seven students. They met in Ms. Quezada's classroom at Number Seven where they were greeted by a bilingual instructor and volunteer librarians. The small turnout disappointed Mr. Michaels, who explained to parents that if the class could not attract at least six regular students, it would be canceled. "No va," he said several times for emphasis, inviting one of the librarians to translate for him to make sure he got his point across. The English class fizzled all together and was canceled immediately.

The teacher waited to give more parents time to materialize, but, after about twenty minutes, decided to get started with the few parents she had present. She jumped right in, getting

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her students started on laptops that a few STLs had set up earlier in the day. The class covered

basic skills such as turning on the computer, opening a web browser, and using the search bar.

After a series of directions and a round of vigorous troubleshooting and handholding, the

instructor guided each parent present to conduct a web search, after which she exclaimed,

"Congratulations, you have just performed your first Google search!" The parents applauded and

laughed, a welcome break from their obvious discomfort.
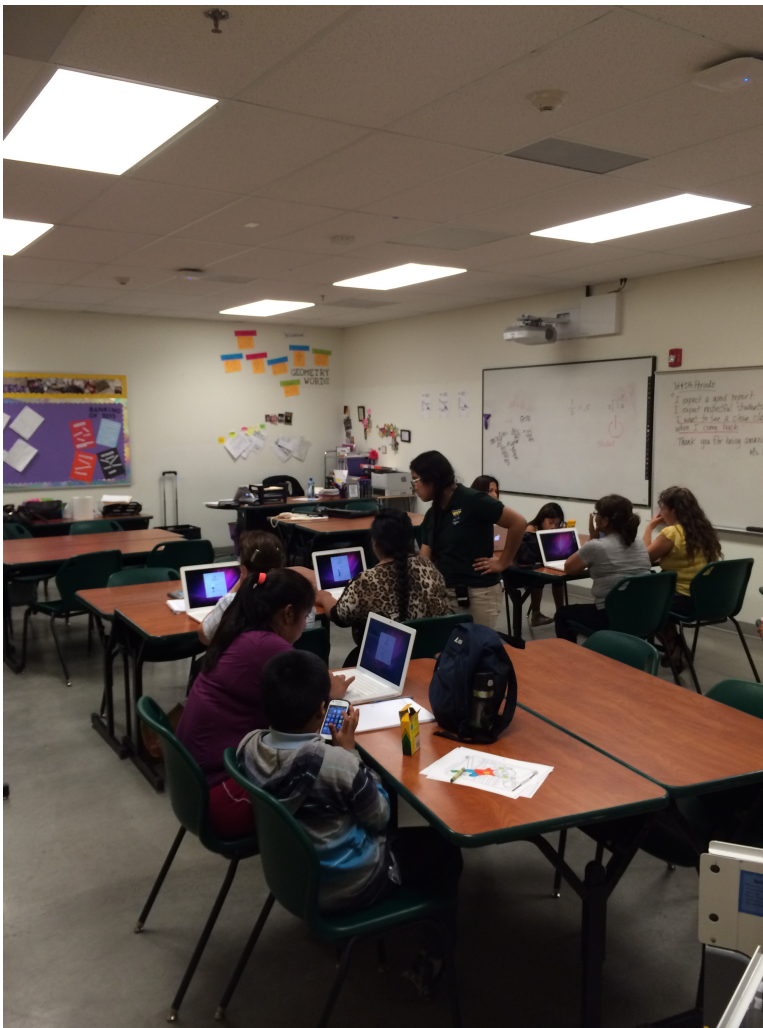

Figure 5.1. An adult education class meets. The woman in the foreground has just completed her first Google search. Her young son, seated to her left, plays with a smartphone. A volunteer from the local public library troubleshoots.

Just as the class completed their first search, I noticed the child one of the adult students,

open up a videogame on a smartphone. Mr. Michaels, noticing the same thing, pointed to the kid

and said, "Isn't that incredible? That's what you're studying, isn't it? These kids are incredible."

It was hard not to be swayed by Mr. Michael's genuine admiration for the intelligence of children, the boy in front of us seeming to demonstrate all the quick-wittedness and adaptability of Number Seven's students. In pointing out the young son, already technologically savvy, deeply engaged in a smartphone while his mother learned to use a search engine for the first time. The boy seemed competent at using technology, even as his mother struggled to perform the most basic of operations. For Mr. Michaels, this was strong evidence, evidence that confirmed what he already took for granted. Mr. Michael's referred to something he had told me the first time we meet, over a year earlier, when he said of Number Seven's students, "These kids are digital natives. They know computers better than me. They grew up using computers. It just comes more natural to them because they're younger." The son did seem to be having a genuinely different experience with computers and computer-like devices than his mother. This difference tempted me to think in generational terms. I nodded to Mr. Michaels and took a picture, but as I thought it over, I see now that what I saw did not confirm Mr. Michaels's assessment. As I look back at the picture, I see a vastly more ambiguous situation, one that troubles the concept of literacy. I see an incredibly complex social terrain, one marked by familial relations, immigration, age, and gender. I also see particular cases of use, in one case performing a web search on a public computer and, in the case of the son, a child pressing the buttons that will call up a videogame. In short, the picture does not affirm a pat narrative about who knows how to use computers. Instead, it reminds me of the diversity of human experience and the complexity of life.

This complexity is rejected by digital divide narratives, which have proved incredibly durable and are frequently invoked in social science and education research uncritically. If we accept that technology and society are mutually constituted, the digital divide narrative cannot

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stand. This manifests in a slipperiness in digital divide narratives, a collapse of cause and effect. Do poorer communities have less access to desirable technologies because they are poor or are they poor because they lack access to technology? Divide narratives answer in the affirmative for both questions. My objection is that the forms of use that are valorized in digital divide narratives correspond highly to values and biases ambient in society. For example, video games have often been derided in popular media as an unproductive use of computers and digital technology, but have recently been reappraised in scholarly literature (Gee, 2003; Squire, 2011). Use of computer technology in education occurs amid all kinds of other social situations; in my study, this means that teaching and learning took place in a segregated charter school in South Los Angels, with all the attendant complexities such a situation must involve. Computers are seen as somehow outside this situation, as an external force that can change the life conditions of students via educational activity. But there is no such evidence that this is that case, nor can there be for such a broad and causally complex claim. Use of computers has not ever nor (could it possibly) alleviate inequity in society. This is, to be blunt, what Eubanks (2011) calls the "magical thinking" that equity of access means social progress:

> Most technology policy, firmly planted in the tradition of universal access, ignores nondistributional issues and misrepresents the empirical realities of living in the information age, offering individualized and market solutions to broadly structural problems. The overreliance on the distributive paradigm in digital divide policy and programming is at the heart of our inability to recognize and address some of the most pressing social justice issues of the information age (p. 37).

Ironically, neither use of computers in the photo here would be considered suitable by administrators at Number Seven, neither the mother's way of looking for information or the son's expertise in mobile gaming. The reality of life in the community is that computers have little to do with the problems people are facing and habits of use are incredibly varied. The importance of some form of digital literacy has been exaggerated in the popular imagination. While access is a central value of the LIS profession, access to information cannot substitute for

equitable access to resources, nor can a bibliocentric vision of access justify access to any and every kind of consumer technology. As the chapters on infrastructure and labor have shown, access carries hidden costs. Offering up potential consumers who have no ability to reflect on their own value to commercially mediated systems and artifacts does a disservice to the community, one legitimated by parochial views of what computers are for and how they should be used.

THE MEANING OF COMPUTERS

Throughout my interviews with teachers, a palpable sensation of anxiety hung over our talks. Some of that anxiety might be due to the hectic nature of high school teaching, the way that bodies are always in motion. Up close, public school teaching is amazingly choreographed. At any moment, a bell rings and the halls fill to overflowing with bodies, then a moment later, the bell rings again and they disappear. When school lets out, the streets for blocks around come alive with vendors, busses, cars, bikes, skateboards, and many other urban florescences. There's a lot of life there to be managed and for the most part, teachers feel that they were just holding on, trying to ride the waves. Still, despite this realist take on what public education looks like, there's something about computers and schools that does not fit correctly, a sense of insufficiency among teachers, a feeling of fraud at making it all up on the fly. Ms. Tasha, the math teacher who ended up using the tablets and the Pearson app as originally planned pointed out her own lack of knowledge of computers. When I told her that of all the teachers I had observed, she alone had managed to incorporate the Pearson app into her teaching, she seemed surprised:

> Ms. Tasha: The reason I don't feel that I'm good at [using tablets] is because I have a very limited repertoire. There are certain things that I know how to do, and I'm fine. I'm able to replicate that. But in terms of venturing out and doing beyond those norms and those set usages, I'm not that good. There's... I guess I'm basing where I am compared to where I would think others are in terms of the technology.

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Clearly, something in Ms. Tashas's self-assessment does not match her demonstrated skills in using tablets in instruction. I am less interested in her personal and professional views on her own work, though, than in what I see as a prevalent problem in studying computer use. Part of the difficulty in developing a meaningful analysis of digital technology applied to public education lies not just in the ubiquity of various kinds of computers and their taken for granted status, but in the cultural prominence of computers, in the public understanding of what computers mean, what Ms. Tasha called "the terms of the technology." Computers make a number of complex processes happen, but in and of themselves, absent any particular application, they exert a powerful mystique, what Golumbia (2009) calls computationalism and what Drucker (2009) refers to as "the powerful cultural authority exerted by computational media, grounded in claims to objectivity premised on formal logic" (xiv). Computers have been imbued with their powerful aura by their genealogy, their birth in think tanks and academia, but also by scholars. In a work of media studies that seeks to sketch out the history of the computer as it exists in the contemporary world, Lunenfeld (2011) argues that the combination of media production and consumption enabled by personal computers and mobile devices makes them the most important human technology:

> The computer is a dream device, the first media machine that serves as the mode of production, means of distribution, and site of reception. It is the twenty-first century's culture machine (p. xiv)

These theorists rightly point out that the computer itself exerts cultural force beyond whatever ends a particular application accomplishes, that the idea of computers shapes what can be imagined. Computers form part of what might be called an imaginary of computers. In administering various aspect of our lives through smartphones and apps, we bring computers into our daily lives, but we also bring our lives to computers, changing our habits and understandings to suit computational metaphors (Auerbach, 2011)

	Traditional (instruction)	Extended (knowledge construction)
Activity	Teacher-centered and didactic	Learner-centered and interactive
Teacher role	Fact teller and expert	Collaborator and sometimes learner
Student role	Listener and learner	Collaborator and sometimes expert
Learning emphasis	Facts and replication	Relationships and inquiry
Concept of knowledge	Accumulation	Transformation
Demonstration of success	Quantity	Quality
Assessment	Norm-referenced and multiple guess	Criterion-referenced and performance portfolios
Technology use	Seat work	Communication, collaboration, information access, and expression

The chart above shows the shift that occurred in classrooms as the ACOT teachers extended their traditional views of teaching and learning—from instruction to knowledge construction.

Figure 5.2. A record from the Apple Archives. The shifts it describes when computers are brought into classrooms look disturbingly familiar.

The page above comes from the Apple Computer Archives at Stanford University (Apple Computer, 1995). I reviewed a number of promotional materials, informational brochures directed at educators. Early brochures, those that date from the early 1980s, explain how to get computers and offer basic definitions of computer terminology. These early promotional broachers are essentially reference materials. What emerges quickly is a very familiar story about what computers can do in school. The image above comes from a brochure called, "Changing the Conversation about Teaching and Learning" from 1995. The brochure features a table that describes many instructional processes, then describes how these processes will be reconfigured in a classroom that has a computer in it. Notably, the teacher's role shifts from being a "Fact teller and expert" to being a "Collaborator and sometimes learner." A number of other

transformations of class roles are said to ensue from the addition of a computer to classroom, transformations that are still promised by contemporary ed-tech concerns. Again, what is most striking about these records is that they show a fairly consistent set of understandings about computers, understandings still at work in both the marketing of ed-tech and in scholarly studies of technology. Computers here are transformative and liberatory, intimately tied to what we should want education to be.

In this way, the meaning of computers is powerfully shaped by markets and brands. This meaning has also been established by computer manufacturers and vendors themselves, in particular Apple Computer, which has for several decades maintained a concerted effort to associate its products with education. While I resist a purely mechanistic view of marketing and advertising practices as the direct manipulation of individual consciousness (in the mode of the anti-consumerism of *AdBusters*), I agree with current work in sociology of consumerism (much of it derived from Bordieu) that depicts marketing and advertising as doubly-articulated cultural intermediation work, as an important sector of the economy and as the collection of practices and activities that function to attach meanings to the circulation of goods and services (Ariztia, 2015; Cochoy, 1998; Cronin A, 2004; Nixon and Du Gay, 2002). The broader meaning attached to media and information technologies is also constructed by its domestication, its use in the home, within social groups, or, in the case of mobile technologies, in other social sites (Haddon, 2006; Hartman, 2013).

The intervention I want to make here for future studies is to focus attention on studies of consumption. Daily life is increasingly mediated by digital technology, but critical scholarship thus far has mostly focused on the technological features of computers applied to some function or other (Introna and Hayes, 2011). It means something to insert a computer between a teacher and a student, but it means something else entirely to insert an Apple computer (or a Microsoft

application or a Google Doc) into the situation. In short, culture that is mediated by a computer or a computer-like device is also transformed into a specific kind of consumer arrangement, into a capital intensive exchange. If much of what we feel we are supposed to be doing with computers is in fact influenced by commercial agendas, attuning scholarship to the role of commercial mediation might provide an alternative to anxiety, a way for us to re-script our uses of technology.

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APPENDIX

App title (in Settings)	Publisher
PSoC	Pearson
iMovie	Apple
Keynote	Apple
Pages	Apple
Numbers	Apple
Prezi Lite Editor	Prezi Inc.
Comic Maker	EDSS Global Company Limited
AIR Secure Test	American instates of Research
Dictionary	Merriam-Webster, Inc.
Sheets	Google
Lumosity	Lumos Labs, Inc.
Chrome	Google
Khan Academy	Khan Academy
Dropbox	Dropbox
Subtext	Renaissance Learning
Docs	Google
Drive	Google
Photos and Camera	Apple
YouTube	Google
GeoGebra	International GeoGebra Institute
iTunes U	Apple
Puffin Free	CloudMosa, Inc.
Duolingo	Duolingo
TED	TED Conferences
Adobe Reader	Adobe
Gmail	Google
Quizlet	Quizlet LLC
Free GraCalc	William Jokusch
BrainPOP	BrainPOP®
Safari	Apple
studyNow!	Ck-12 Foundation
iBooks	Apple
Desmos Graphing Calculator	Desmos
Mail	Apple
Calenadar and Reminders	Apple
Podcasts	Apple

Figure A.1. Apps in in student tablets as of May 2015, as listed in an individual tablet.

Figure A.2. This detail of a billboard from February 2014 reminds students of the rules that accompany the "privilege" of having an iPad.
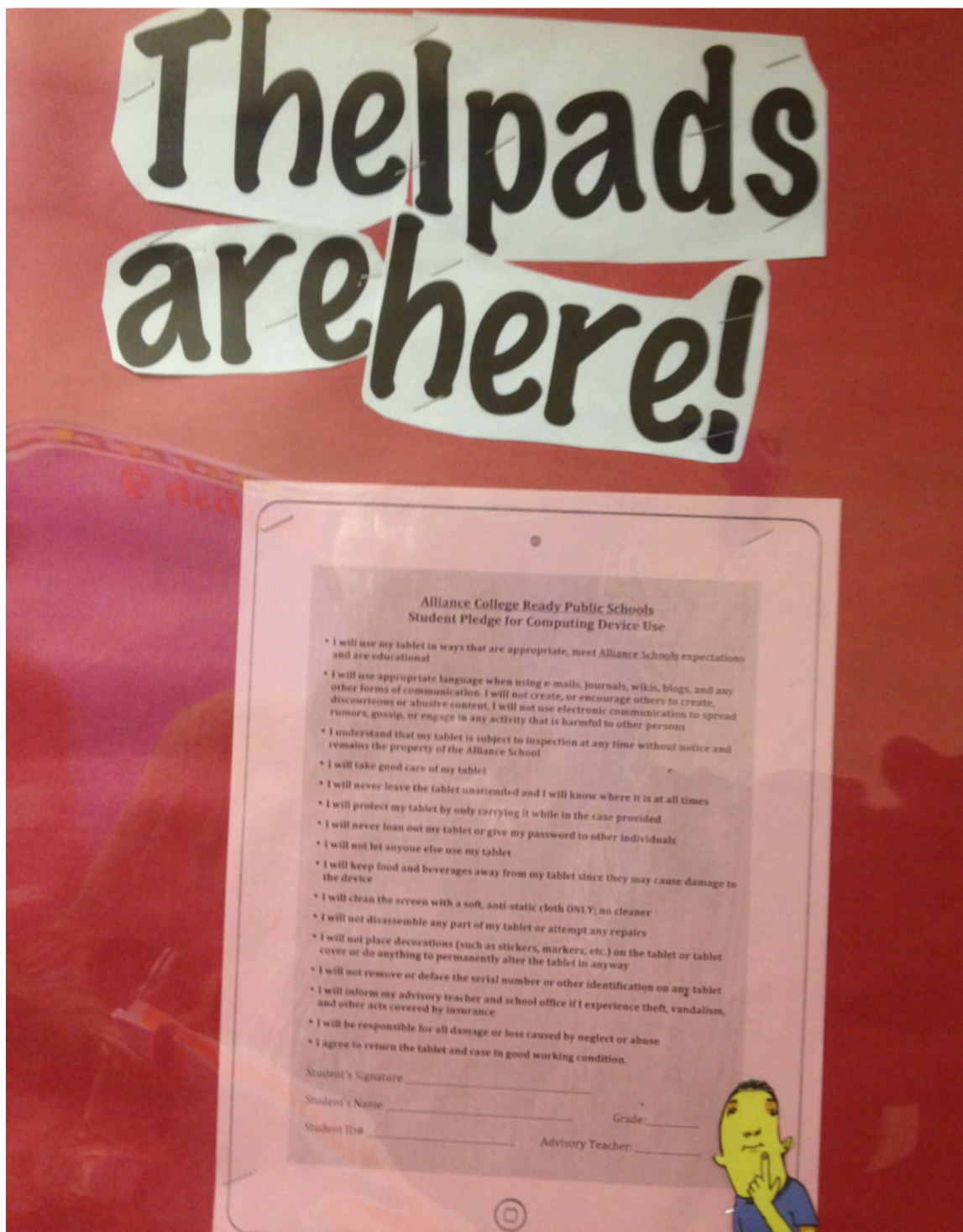
Figure A.3. This bulletin board from February 2014 includes a summary of the "Student Pledge for Computing Device Use" students must sign in order to use tablets.

- I will use my tablet in ways that are appropriate, meet Academy School's expectations and are educational
- I will use appropriate language when using e-mails, journals, wikis, blogs, and any other form of communication. I will not create, or encourage others to create, discourteous or abusive content, I will not use electronic communications to spread rumors, gossip, or engage in any activity that is harmful to other persons
- I understand that my tablet is subject to inspection at any time and without notice and remains the property of the Academy School
- I will take good care of my tablet
- I will never leave the tablet unattended and I will know where it is at all times
- I will protect my tablet by only carrying it while in the case provided
- I will never loan out my tablet or give my password to any other individuals
- I will not let anyone else use my tablet
- I will keep food and beverages away form my tablet since they may cause damage to the device
- I will clean the screen with a soft, anti-static cloth ONLY; no cleaner
- I will not disassemble any part of my tablet or attempt any repairs
- I will not place decorations (such as stickers, markers, etc.) on the tablet or tablet cover or do anything to permanently alter the tablet in anyway [sic]
- I will not remove or deface the serial number or other identification on any tablet
- I will inform my advisory teacher and school office if I experience theft, vandalism, and any other acts covered by insurance
- I will be responsible for all damages or loss caused by neglect or abuse
- I agree to return the tablet and case in good working condition

Figure A.4. Text of the student pledge.

Chronology of Key Events in One-to-one Tablet Programs

in Los Angeles, 2013 - 2015

February 12, 2013   Led by Superintendent John Deasy, the Los Angeles Unified School

District (LAUSD) School Board approves a proposal to outfit every

student in all of its K- 12 public schools with an iPad and a set of apps,

including one produced by Pearson. This program in part of the Common

Core Technology Initiative, a program whose constitutive documents

include specific language about "21st century learning" and addressing the

"digital divide." Local and national media report this program widely.

June 19, 2013   LAUSD awards Apple $30 million in contracts to Apple to supply iPads

and software to schools. Los Angeles Academy Schools decides to invest

some of its technology budget in iPads as well. The not-for-profit charter

management organization (CMO) orders schools to implement one-to-one

programs, beginning with a pilot programs at College Prep # 7 and two

other schools

October 10, 2013   During this initial visit, I meet with the school principal, Dan Montoya;

Assistant Principal Balboa; and a math teacher who also served as the

school's technology coordinator, Sonia Quezada.

Ms. Quezada explains the decision to give students iPads as a consequence

of the introduction of the Common Core State Standards for math and

English education: an app produced by education publisher Pearson is the

only Common Core-aligned curriculum available. Seniors will not be

included in the one-to-one tablet program. Ms. Quezada also explains that

the students will receive iPads (as opposed to any other device) because

Los Angeles Unified School District had given its students iPads.

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December 5, 2013	iPads issued to Number Seven's students for the first time (this event is depicted in Chapter One). First incident of hacking. Major IT work assigned to Student Technology Leaders (STLs).
January 17, 2014	Mr. Tyler's class observation: problems with interoperability and the management of multiple sets of permissions become apparent (as depicted in Chapter Two).
January 24, 2014	A system of using colored semaphores to indicate the successful completion of afternoon check-in procedures is instituted. I observe a pair of incidents related to lost or stolen tablets and the intense security routines developed for inventory control, all effected by STLs (see Chapter Five).
February 4, 2014	Mr. Patron's class observation: Mr. Patron's way of "doing tablets" spreads to other teachers, who by and large have received no training or professional development in using tablets in instruction. This mode of delivering instruction relies heavily on free-to-use platforms and formats, such as the Google Product suite, Weebly.com, and the PDF format. Ms. Quezada reports several problems: her math classes and advisory have fallen behind in their work due to her technology-related duties. Several of her STLs have reported drops in grade point average. Ms. Quezada coins the term "mass user-unfriendliness."
March 26, 2014	Tablets are incorporated in school-wide standardized testing, resulting in numerous difficulties around permissions and test formats.
June 5, 2014	Principal Montoya and Home Office decide to add tablets for seniors. The stated reason is that juniors have already been using tablets and would find their absence disruptive in senior year: no mention is made of Common Core or the Pearson app. Principal Montoya, Ms. Quezada, and some of

the STLs attend a meeting with a saleswoman from a technology retailer. The students select a tablet produced by Asus, one that has a swiveling keyboard, nicknamed a transformer. This meeting and subsequent purchase represent a significant expansion of the one-to-one program and a departure form its original purposes.

July 31, 2014   Ms. Quezada works over the summer, using the absence of students to catch up on her technology coordinator duties. Several STLs come in to work with her. Much of this work consists of inventory and setting up tablets for new users by removing stored data and apps. STLs also coordinate the indexing and preparation of removable keyboards for iPads. The STL program is reorganized: instead of meeting in Ms. Quezada's room daily at the start and end of each day, STLs are to attend another teacher's advisory and take responsibility for all of that teacher's technology-related issues as well as the daily check-in and check-out procedures. For STLs, the new organization means that they became special members of an advisory class rather than an advisory all to their own. They do not meet collectively daily and instead rely on documents and routines to organize their work, rather than the orders of Ms. Quezada.

August 25, 2014   LAUSD cancels its iPad contracts after media reports inappropriate contact between Superintendent Deasy and Apple executives.

October 16, 2014   LAUSD Superintendent Deasy resigns due in large part to negative publicity and legal investigations related to the one-to-one program.

October 21, 2014   Ms. Quezada returns from two months of sick leave due to stress-related health issues. This results in greater autonomy for the STLs, who have already developed routines and procedures to manage their duties.

December 5, 2014   The school is renamed in a ceremony that celebrates donors (depicted in

Chapter Four).

February 6, 2015   Adult education classes are offered for parents in computer literacy or

English (as depicted in Chapter Five).

February 20, 2015 Ms. Tasha's class observation: the only teacher in the school routinely

using the Pearson app is Ms. Tasha. School administrators issue a rule that

teachers must use tablets at least once per week, but do not enforce the

rule.

April 16, 2015   LAUSD abandons the Pearson app and demand a refund for the incomplete

software. The Securities and Exchange Commission announces that it is

opening an investigation into the use of bonds to pay for LAUSD's one-to-

one program.

March 20, 2015   Ms. Archer describes the school's one-to-one program as a success in the

area of college advising (an interview discussed at length in Chapter Five).

May 5, 2015   STLs gather in the courtyard for a group interview about their work with

tablets (described in Chapter Three).

June 18, 2015   Mr. Tustin, an assistant principal, discusses various forms of data

collection related to tablets (described in Chapter Four).

Figure A.5. Chronology of key events in one-to-one tablet programs in Los Angeles, 2013 – 2015.