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## **The Digital Divide in Classroom Technology Use: A Comparison of Three Schools**

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# **The Digital Divide in Classroom Technology Use: A Comparison of Three Schools**

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## **Abstract**

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While concerns about the “digital divide,” or access to technology, remain relevant for many schools, we do not yet fully know how often-expensive education technologies are employed across school contexts. In particular, few studies exist that evaluate how teacher beliefs about student social class and race-ethnicity, as well as institutional perceptions of the value of new technologies, inform everyday teacher practices with such technologies. Classroom observation and interviews were conducted with 5 teachers across three elementary schools that vary by race and class. Results indicated that teachers at middle/upper class schools encouraged dynamic uses of interactive whiteboards, while in the low-income school they functioned like traditional blackboards. Findings suggest that teacher beliefs and institutional perceptions inform how technologies are used in the classroom. In particular, beliefs about the meaning of student race and social class, as well as institutional goals for implementing new technologies, inform the extent to which students are granted agency to learn with new technologies.

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**Keywords:** education, technology, new media, digital divide, teachers, race, class, culture

# La Brecha Digital en el uso de la Tecnología en el Aula: Una Comparación de tres Escuelas

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## Resumen

Mientras que las preocupaciones sobre la "brecha digital", o el acceso a la tecnología, siguen siendo relevantes para muchas escuelas, todavía desconocemos completamente cómo la, a menudo costosa, educación en nuevas tecnologías se emplea en los contextos escolares. Existen pocos estudios que evalúen cómo las opiniones del profesorado respecto la clase social y la etnia de los estudiantes, o la percepción institucional del valor de las nuevas tecnologías, influyen en las prácticas docentes diarias con estas tecnologías. Se realizaron entrevistas y observaciones de aula con cinco profesores en tres escuelas primarias que varían en raza y clase. Los resultados indicaron que los maestros en las escuelas de clase media/alta alentaron el uso dinámico de pizarras interactivas, mientras que en la escuela de bajos ingresos funcionaron con pizarras tradicionales. Los resultados sugieren que las creencias del profesorado creencias y las percepciones institucionales influyen en cómo se utilizan las tecnologías en el aula. En particular, las creencias acerca del significado de la raza y clase social del estudiante, así como los objetivos institucionales para la implementación de nuevas tecnologías, influyen en a la medida en la que se conceden ayudas para que los estudiantes aprendan con nuevas tecnologías.

**Palabras clave:** educación, tecnología, nuevos medios, brecha digital, profesores, raza, clase, cultura



Researchers who study the reproduction of social inequalities in schools have not to date well considered the relationship between culture and educational technology in the persistence of inequality. Although concerns about the “digital divide,” or access to technology, still remain major problems for many schools and communities, educators and researchers are becoming wary of gaps in how technologies are used as they become more available (DiMaggio and Hargittai, 2004; Warschauer, 2004). This study explores how the same educational technology – the interactive whiteboard – is used across elementary schools that vary by social class. Different from other studies of classroom technology use, I examine how culture, in the form of teacher beliefs and institutional perceptions about technology reform, might structure instructional use of interactive whiteboards. Observing the differentiated use of technology across class contexts provides insights into how opportunities to acquire valuable technological competencies favor some students over others.

Using data collected from interviews and observation in classrooms at three suburban elementary schools that vary by social class and race-ethnicity, I compare teachers’ classroom practices and use of instructional technology. Through classroom observation, I focus specifically on teachers’ use of the interactive whiteboard in their everyday lessons. I tabulate counts of use of the technology to examine how often it is used in each classroom. Teachers in the middle and upper class schools exhibited greater freedom in their use of the interactive whiteboard, utilizing advanced features of the technology and allowing students to frequently interact with the board. At the lower class school, student interaction with the interactive whiteboard was limited, and the technology was only used as if it a traditional blackboard.

Students of Bourdieu may not be surprised to find that teachers at working class schools, as opposed to middle and upper class schools, are less likely to impart competencies that are valued by the dominant class. However, few cases studied allow the researcher to examine what happens when schools’ set of idealized skills and competencies undergo dramatic change. Large-scale technological changes in the broader environment are beginning to shape schools in ways that could potentially rearrange valued skills and competencies for students. I argue that changes to the existing

Bourdieuian social field of education could potentially create new opportunities for technologically skilled teachers to empower disadvantaged youth by teaching them competencies deemed valuable by the dominant class (Bourdieu, 1984). Given that schools are predominantly run by white, middle class teachers and administrators, scholars have argued that these settings represent a field where middle-class skills and competencies are favored, providing cultural capital to students for important advantages (Bourdieu, 1977; Lareau, 2000, 2003).

Elements of the school environment, however, may inform the extent to which changes to the larger field are incorporated in classrooms. For example, McDonough (1997) finds that teacher beliefs and habits shape how they carry out their daily tasks, and in ways that differ for students of different social classes. In this study, I find that cultural beliefs shape the extent to which emergent technological changes to the educational field are either adopted or assimilated into existing classroom practices, with longer-term implications for children at the working class school who do not benefit from lessons that impart competencies with technology.

### **The “New” Digital Divide**

Education research in the 1990s and early 2000s on the “digital divide” relied on a conceptual framework that assumed inequalities would be eliminated once technology became more available to families, schools, and communities (Hargittai 2003; National Telecommunications and Information Administration 1995; 1998; 1999; 2000). Recently, however, scholars have argued that this guiding definition of the divide and the subsequent scope of related research are both too narrow. First, the definition relies too heavily on a binary separation of users and nonusers when there may also be variations in terms of what people do with technology once it is more widely available (DiMaggio et al. 2004; Hargittai 2004; 2010; Warschauer, 2003; Zillien and Hargittai 2009). Second, few studies have examined the relationship between culture, technology use, and school inequality.

Through mixed methods designs that include classroom observation, interviews, and surveys, Warschauer’s research on technology use in schools suggests that culture, social structures, and socioeconomic factors

may interact in ways that produce variation in how technologies are adopted in the classroom. In one study, Warschaeur (2000) compares technology reform at an elite, high SES school and a low SES school in Hawaii. He finds that both schools made significant changes to their curriculum, schedule, and teaching to accommodate new reforms with technology, and that contrary to predictions from the literature, the low-SES school was using their technology in myriad ways instead of invoking an authoritarian “drill and kill” teaching strategy. In another study with quite different results, Warschaeur (2007) compares how ten one-to-one laptop schools in California and Maine use laptops. He finds that high SES schools generally used technology in more dynamic ways than low SES schools, but noted that socioeconomic context, values, and beliefs inform how the tech programs are adopted. Warschaeur’s work adds important nuance to existing research on the digital divide, and suggests that culture might matter in shaping teacher use of technology.

Some research also suggests that teacher’ beliefs about technology and student populations affects the extent to which teachers use technology in the classroom. Mouza (2009) finds teachers who believe their students are unruly or poorly performing are sometimes less likely use new technologies to teach because they have to focus their attention on other classroom management tasks. Interestingly, she also finds that the teachers in her sample uniformly believed that technology was good for teaching. This study adds to the existing literature by exploring how beliefs about students who vary by race and class might shape how technology is used. Additionally, I show how institutional perceptions of the value of technology might vary by school, providing more nuance to our understanding of teacher beliefs and technology.

### **Social and Cultural Structures in Schools**

Scholars of school inequalities often draw on Bourdieu to explain how social and cultural capital aid in the reproduction of inequalities. For Bourdieu (1984), fields represent the settings or contexts where social positions are negotiated. Cultural capital, or “competencies” specific to the field that are acquired primarily through one’s social origin, assist in the attainment of social benefits afforded by the dominant class. For example,

one field could be the field of art, or the field of politics – in each of these fields, different competencies are valued and allotted capital through competition (Emirbayer and Johnson, 2008). Research has shown, for example, that parents have childrearing strategies that differ by class and inform kids' habits, styles, and beliefs, which in turn have later implications for kids' success in schools (Calarco, 2011; Lareau 2000; 2003).

Much research on cultural capital in schools typically assumes teachers' adherence to the same dominant educational ideology across schools (Bourdieu, 1977; Heath, 1983; Lamont and Lareau, 1988; Lareau, 2000; 2003; Lareau and Weininger, 2003). Yet, different elements of school culture, including teachers' beliefs and institutional perceptions, also set the terms for the kinds of lessons and content taught to different student populations and across school contexts. McDonough (1997) finds that schools' social class culture informs how students are instructed. Through a comparison of schools that vary by social class, McDonough finds that students attending higher SES, more selective schools are guided into college choice trajectories deemed ideal by the cultural context of the school. The habitus situated at the school funneled graduates into different types of postgraduate destinations. In extensions of McDonough's work, research has found that school habitus informs teachers' sense of responsibility for student learning (Diamond et al., 2004), and expectations for student performance (Antonio and Horvat, 2002) and post-secondary education (McDonough, 1997), as well as the dispositions of students themselves (Horvat and Antonio, 1999).

Cultural elements of the school, including teachers' beliefs and institutional perceptions of the value of technology, might shape how technology is used and vary by schools that differ by student race and class. Schools may not only reward students who demonstrate proficiencies in middle class cultural styles, but they may also only teach valued styles to middle and upper class students – schools with students of color and from lower SES backgrounds may receive different forms of lessons with technology that are less valued by dominant middle and upper class cultural institutions.



## **Technology and the Field of Education**

Although education researchers have examined how Bourdieu's notion of cultural capital operates in school contexts, few have exploited his concept of fields to explain differences in teaching, evaluation, and student success. In particular, scant work examines what happens when fields change, a possibility Bourdieu discusses though primarily describes as a slow process (Bourdieu, 1984; Bourdieu and Wacquant, 1992; Couldry, 2003; Swartz et al., 1997). In his conception, there are constant struggles over the rules of engagement in fields among actors that compete and modify its terms over a prolonged period of time.

The rapid adoption of digital media and technology in society has begun to shape the education. The tension between existing school practices and the adoption of technology and digital media by schools has been the subject of recent research, news, and even legal debacles (Hoffman, 2011; Miners, 2009; Ortutay, 2011). Given this shift, Bourdieu would offer two possibilities for the use of technology in schools. One scenario would be that teachers who are technologically savvy who utilize the new technology could provide their students with competencies that can be used as cultural capital. At schools with fewer resources that serve students from low-income families, this technological competency could provide skills that disadvantaged students could use to get ahead. The other scenario Bourdieu would offer is that teacher skill with technology may not matter. The field of new technology would become quickly assimilated into existing school practices such that the original teaching philosophy would remain the priority.

What conditions determine whether or not the emergent field of new media technology is either accommodated or rejected in favor of existing practices? In order to assess whether or not teachers use technology differently across social class contexts and if, in fact, its usage provides opportunities for disadvantaged students, I compare instructional use of a computerized blackboard, the interactive whiteboard, in classrooms across three elementary schools. I also observe how teachers manage students in their classroom, and compare how teachers maintain authority in each school. Through interviews, I explore teachers' rationales for using the interactive whiteboard in the way they do, and their beliefs about how their

students learn. In this study I find that cultural elements of the school environment, including teacher beliefs and institutional perceptions about the value of technology, filters new changes to the educational field at the classroom level. Middle and upper class school teaching styles centered on student agency provide advantages through technological opportunities for students, whereas the authoritarian culture at the low-income school restricts flexibility with technology at the lower income school.

## **Method**

### **Interactive Whiteboard Technology**

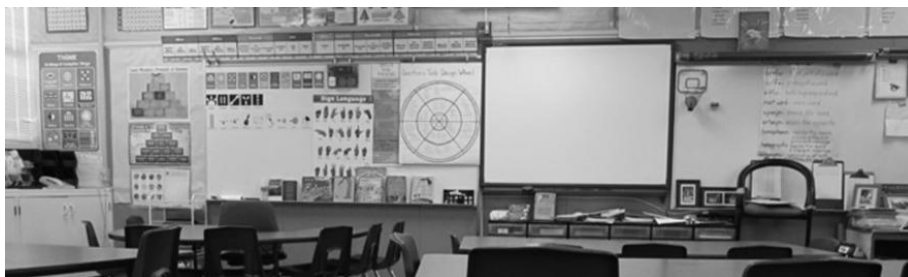
Although many kinds of educational technologies are used in schools across the U.S., I chose to study the interactive whiteboard because of its capacity to function as a traditional school blackboard as well as an advanced computer technology. Moreover, educational institutions are rapidly adopting this technology for their classrooms. Two major developers of interactive whiteboard technology are Smart Technologies and Promethean. Their boards similarly use a projector to display video output from a computer, and respond to users' touch input on the screen as well as a variety of tools, including inkless pens in different colors, that can be used to manipulate the content on the screen.

Interactive whiteboard software and curriculum software can be used for instruction beyond the simple use of writing as if it were a blackboard. Software programs can allow use of virtual math tools, including rulers, compasses, and protractors; video display; Internet and web access; overlay between scanned text documents and user-generated content, such as drawing tools like highlighting or shapes; use of responders so students can answer questions from their desks for games or quizzes; and virtual learning games aimed at teaching math, science, and other subjects.

### **Research Sites**

I strategically selected three research sites at elementary schools with different social classes but with similar school commitments to technology literacy. Brinker Elementary (all names are pseudonyms) serves

predominantly Latino students (96%) from working-class backgrounds. Brinker is a public school in a suburban setting with approximately 600 kindergarten through 6th-grade students. The school grounds are clean and well kept but its hallways and classrooms emphasize function over form. Students' parents often do not speak English, with 73 percent of the students as English language learners. Classroom size varies between 15 and 35 students. Teachers appear dedicated to their work, but the school has also been at risk of being labeled a “failing school” due to low test scores in recent years. The school hosts several outside non-profits, including the Boys and Girls Club. All classrooms are equipped with interactive whiteboard technology, obtained through a federal grant. Three teachers (including the teacher I observed and interview) joined with the principal to order and implement the interactive whiteboards and educate teachers on its proper use. The classroom I observed at Brinker was equipped with an up-to-date interactive whiteboard (see Figure 1). The room was very well organized, and walls were covered with posters that emphasize rules and regulations, hard work, and test score performance (see Figure 2).



*Figure 1.* Image of vantage point in the Brinker Elementary School classroom.



*Figure 2.* Image of the back of the classroom at Brinker Elementary.

Flynn Elementary exists in the same school district as Brinker, however its student body is very different. Flynn serves predominantly Latino (30%) and white (64%) middle-class students, though a significant portion of its students are from working class backgrounds (38%). With approximately 600 3rd through 6th grade students, the school's classes have between 20 and 35 students in each class, and English language learners constitute 14% of the student body. Flynn's grounds are well kept, similarly to Brinker, however its classrooms are comparatively different in terms of look and feel: the walls are often decorated with vibrant colors and posters displaying student work, with decorations suspended from the ceiling in many of the rooms. The local town center regularly schedules sports games for students on campus grounds, and the Boy and Girl Scouts use school facilities for activities that foster community enrichment. Of the three classrooms I observed at Flynn, one had an interactive whiteboard. The school has a computer lab and a number of classrooms have one or more functional computers for student use. Brinker and Flynn are schools within the same district, one in which the board mandates a K-12 curriculum to promote digital literacy across a variety of age groups. Both Brinker and Flynn provide students with lessons on cyber safety, security, digital life, privacy, and digital research. Moreover, each school has a staff technology coordinator who serves as a liaison between the district and the school to assist with technological needs.



*Figure 3.* Image of vantage point in the classroom at Flynn Elementary.

The Foley School is the third and final school site in the study. Foley is a private school with predominately white students from wealthy families. The school has approximately 600 Pre-Kindergarten through 8th-grade students. Classes average 20 students per teacher, with teacher assistants in the majority of classrooms. Yearly tuition is over \$16,000. The grounds at the Foley School are well cared for with lush greenery and flowers strategically placed throughout the campus; the buildings are freshly painted and architecturally appealing. Classrooms are well decorated with posters and student work. The school invests a significant amount of its funds in technology and technology education. The school offers an up-to-date computer lab, and several mobile computer stations, equipped with 20-30 laptops, that are moved from class to class depending on the teachers' needs for lessons. Upper-year students, trained in Adobe software, become familiar with architectural design software as well as photo and video editing programs. Curricula for primary and lower year students – among those whose classroom I observed – expose them to technology developmentally through learning how to use applications, navigating computer document management, and engaging in instruction via the interactive whiteboard in class.



*Figure 4.* Image of vantage point in the Foley School elementary classroom.

**Research Sample**

This project follows three teachers – Rob at Brinker (low SES), Gaby at Flynn (mid SES), and Casey at Foley (high SES) – as they teach routine classes in a room equipped with interactive whiteboard technology. Additionally, I was able to observe and interview other teachers at the three schools, allowing me to assess the school cultures from multiple vantage points, where possible. All teachers in the sample are white and middle-class, and are experienced, credentialed teachers who have taught at one or more schools that vary by social class. Moreover, all teachers describe themselves as comfortable with technology, and all interactive whiteboard users possess extensive training in education technology. Classrooms observed at Brinker and Foley averaged 15 students per class, while classrooms observed at Flynn averaged 30 students per class; although class sizes vary, the class sizes are the same for the lower and upper class schools. These teachers were strategically selected because they all have similar profiles, with demographic characteristics that are by and large representative of teachers in U.S. schools: white and middle-class (Keigher and Cross 2010). Moreover, they offer a unique comparison because they only substantially differ by the school social class context where they teach.

Table 1  
*Sample characteristics of the schools, teachers, and classrooms observed with interactive whiteboards*

*Table 1: Sample characteristics of the schools, teachers, and classrooms observed with interactive whiteboards*

Teacher	School	Teacher Gender	Grade	Avg. Number of Students in Class	Student SES	Student Race-Ethnicity
Rob	Brinker	Male	3	15	Low	Mostly Latino
Gaby	Flynn	Female	4	30	Middle	Mostly White/Latino
Casey	Foley	Female	4	15	High	Mostly White

**Classroom Observation, Interviews, Design Workshops, and Analytic Strategy**

With the aid of another researcher, I conducted classroom observations, and attended faculty meetings as well as school events between March and June

of 2011 for just over 60 hours, with 26.5 of those hours spent observing classrooms equipped with interactive whiteboard. All teachers were interviewed in April and again in July. Teachers also participated in four design workshops for 18 hours during the month of July, where I conducted focus groups on the use of technology in their classes.

Each classroom case study consisted of observation through team-based fieldwork with two researchers, an approach that has been cited as helpful to triangulate findings and observe more interaction when access and time available to observe is limited (Douglas, 1976; Snow and Anderson, 1993; Snow et al., 1986). Although only one researcher observed in a classroom at any given time, observers systematically switched classroom assignments for data collection every two weeks. Classrooms were observed for 1-2 hours in each class at a time, allowing observation of transitions between the 40-minute periods and witness lessons on a variety of subjects. Attention focused on two kinds of interactions in classrooms: teacher use of technology and teacher classroom management. Time-stamped notes were recorded while observing from positions in the back of each classroom, avoiding the line of sight between students and the teacher. Each week the researchers met and discussed themes that emerged during observation, and reviewed and clarified recently completed field notes.

### **Frequency Data: Instructive Use of the Interactive Whiteboard**

Tracking the frequency of interactive whiteboard usage in classes as well as how they were used to teach were major objectives of the research. I maintained detailed, time-stamped accounts of interactive whiteboard use in the fieldnotes as a supplement to other ethnographic data. Fieldnotes were coded using a simple hierarchy: “interactive whiteboard use” was the root code for a moment when the interactive whiteboard was used for a lesson, and “dynamic use” and “traditional use” were child codes that reflected differentiated use. “Traditional use” indicated use of the interactive whiteboard as if it were a traditional blackboard. “Dynamic use” referred to moments when the interactive whiteboard was used for anything except as if it were a traditional blackboard. Dynamic use could include a variety of different uses of the interactive whiteboard, including interactive games, use of toolbars, playing video, remixing content on the screen, switching

between programs, searching the Internet, and presenting work. For example, if a teacher solved a math problem on the board using a marker as if it were a piece of chalk and then switched to show a video lesson, it would be coded as two uses of the interactive whiteboard, the former as traditional and the latter as dynamic. With these counts, I compared the frequency and types of use of the interactive whiteboard in each of the schools.

### **Differential Use of Interactive whiteboard Across Classrooms**

#### **Results from Analysis of Frequency Data**

The results from frequency data indicate stark differences in interactive whiteboard use between middle/upper and lower class schools. Table 2 shows the hours observed and rates of interactive whiteboard use per hour observed, and Figure 5 compares different uses of the interactive whiteboard across schools. Brinker (low SES) and Foley (high SES) use the technology at a rate of 1.7 and 1.8 times per hour observed, respectively, whereas Flynn (mid SES) uses it at a rate of 1.1 times per hour observed. When interactive whiteboard technology was used at Brinker, the lower class school, it was used as if it were a traditional blackboard 100% of the time (1.7 uses/hr), whereas Flynn and Foley used it this way 10% (0.2 uses/hr) and 12.5% (0.1 uses/hr) of the time, respectively. In terms of dynamic use of the interactive whiteboard, Flynn and Foley lead with usage rates, using the board dynamically 90% (.9 uses/hr) and 87.5% (1.6 uses/hr) of the time, respectively. Brinker had no observed instances of dynamic interactive whiteboard use.



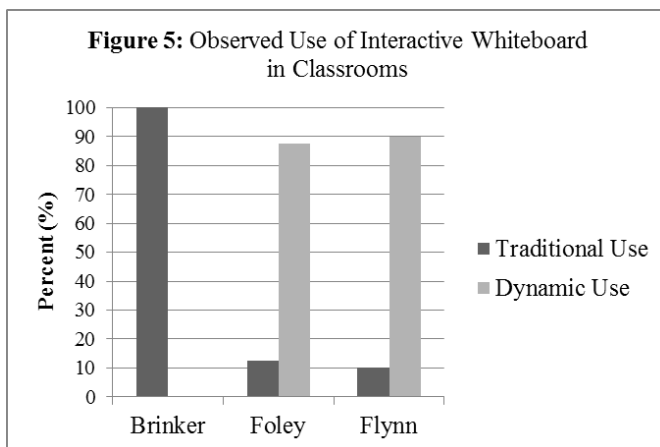
Table 2

*Frequency and type of interactive whiteboard use in classrooms (uses/hours observed)*

**Table 2:** Frequency and Type of Interactive Whiteboard Use in Classrooms (uses/hours observed)

	Classroom Hours	Traditional Use	Dynamic Use	Total Use
	Observed	(uses/hr)	(uses/hr)	(uses/hr)
Brinker	7	1.7 (100%)	0.0 (0%)	1.7
Foley	10	0.2 (12.5%)	1.6 (87.5%)	1.8
Flynn	9.5	0.1 (10%)	0.9 (90%)	1.1

*Note: Percents compare the rates of use per hour observed at each school.*



*Figure 5. Observed use of interactive whiteboard in classrooms*

Note: “Traditional Use” refers to use of interactive whiteboard in ways that are no different from the use of a traditional blackboard. “Dynamic Use” refers to use of interactive whiteboard in any way other than traditional use.

Frequency data show that Foley and Flynn teachers in classrooms equipped with interactive whiteboards use the technology in dynamic ways at rates much higher than the teacher at Brinker; the rate of traditional use was much higher at Brinker than among teachers at Flynn and Foley. At Foley and Flynn, teachers switched between various kinds of media, including websites, video, interactive games, and allowed students to interact with the board and use complex toolbars to add and remix existing content on the screen. At Brinker, the board was only used as a traditional blackboard with students rarely permitted to use the screen.

What accounts for these observed differences in use? All teachers have the same, up-to-date educational technology in their classrooms. All teachers are white, middle-class, and experienced teaching professionals. Classroom sizes for the classrooms observed at Foley and Brinker are the same. All schools have curricula and policy measures designed to integrate technology in the classroom. Moreover, Rob at Brinker has more technological training than do the interactive whiteboard users at Foley and Flynn, and we would expect he would use the technology in more diverse and meaningful ways. So what explains the observed differences in use? A review of the observation- and interview-based data allows us to examine the mechanism behind these differences more precisely.

### **Brinker Elementary (Low SES)**

“Don’t let the students see your passwords,” the principal forcefully instructed faculty. “They will steal them and access all of your e-mail messages!” Teachers at this week’s faculty meeting were wide-eyed, listening intently to the principal’s warning. She had just told a story about a teacher at another district coming under fire for students breaking into a school e-mail account and viewing confidential school information. The message to teachers about technology at Brinker was clear: students are seen a threat to its appropriate use.

Despite a fear among teachers of student e-mail hacking, interactions and interviews with Rob, a teacher and the faculty liaison for the implementation of education technology at Brinker, reveal that he has many ideas for how to use technology in innovative ways that promote critical

thinking. During the workshops, Rob developed interesting project ideas for education technology design and implementation in classrooms. In one example, Rob talked with us about creative lessons he would develop if he had iPads in the classroom:

You know I think that introducing students to the educational aspects of technology is a huge component, it's an important component...I envision them all having their little iPads, on their desk, and you say okay! Today we're learning about the sixth grade book *Where the Red Fern Grows*...let's read chapter two. Right from there I can go to the *Red Fern Grows* movie. I can give them a snippet of that movie already downloaded on the computer, and say, look at how the book developed the chapter and look at how the director saw the movie, because it's never the same. You could give them an argument like that.

In Rob's vision, new technologies are valuable teaching tools to engage students with existing curricular goals like literacy and critical thinking. Although he never used the interactive whiteboard in dynamic ways during classroom observation, he did show both of us, on separate occasions, how the board could be used – but only after his students left the room:

Rob asks if I have a moment so he can show me some cool interactive toy on the interactive whiteboard. I say I do, and he scrolls down on the screen to what look like icons or widgets, and he drags an icon that looks like a pair of dice to the center of the screen. "Look at this," he says, "this is wild." He slaps the screen, and the dice roll. He starts 'teaching' to an empty classroom for me, and announces: "Want to know about probability, kids?" He slaps the dice again and they roll. "One in six, let's get statistical!"

Rob also expressed his firm belief that his students, and students at Brinker, were more than capable of learning the technology:

I think they would be excited [about a new iPad program], but you have to take a couple days, maybe a week, just to get them introduced to it, how to turn it on, how to charge it, how to take care of it, how to pull up applications...giving those basic

components would be the most important just to set a foundation for them. And then, I believe, honestly, the kids would probably take off after that. Kids are outlearning their parents with technology...I don't see too many issues whether it be this school or another school.

Rob claimed that technology is a great learning tool to teach existing school curriculum like literacy and math; he believed that his students, despite their low class status, could learn to use technology. He demonstrated that he could use the interactive whiteboard in innovative ways for teaching. Why did he not use the technology in this way when students were present?

Educational research on structural conditions at low-income schools would argue that both lack of time and test pressure prevent teacher flexibility in the classroom. In accord with these arguments, Rob spoke frequently of limited time and test pressure as obstacles to leading better lessons in his classroom:

Technology is so amazing. NASCAR now recruits young drivers by using car simulators to prepare for the road and the challenge...I want to do stuff like that in class for learning, but I can't because of time...We focus on standards because of the testing, that's another thing they don't prepare you for, state testing...the pressures and the grind and what it entails. You don't know you're going to be ridiculed...I was pretty much being watched by my principal and pretty much all the teachers that I was being held responsible for these kids to make them have growth...and how we did that was basically using data to drive instruction, using a state adopted math curriculum and then obviously infusing technology to capture their attention on math, because math is such a tough thing to, you know, to teach the kids.

Our observations in Rob's classroom, however, contradict many of his claims. Rob's lessons often started with a math problem or language arts question from his curriculum, but he would spend considerable time, sometimes more than half the class period, to use the problem set as a starting point to tell stories aimed at engaging his students:

Rob tells the students that today's lesson is on reading comprehension, and they need to learn what comprehension actually means. Rob writes "Comprehension" on the interactive whiteboard. He points to a student and says, "Hey Geoff, raise your hand!" The student is surprised, and does not respond for a moment, then slowly raises his hand, perplexed. I realize that Geoff was not actually the student's name. "It's important to remember your own name, because if you get called on and it's not your name you should know to correct the person calling on you. I've been speaking English for 39 years, and I'm still not perfect at the language. It's something I have to work at very hard and I'm still working at it...Comprehend, is to know the value of what something is. Let's talk about money. No matter what your level of language is, you understand money. If you don't understand the teacher in the classroom, you won't get money in the future."

Although the lesson for the day was reading comprehension, and the task at hand was to work through a multiple choice comprehension practice test on a written passage, Rob used a considerable portion of class time to provide different kinds of lessons aimed at engaging the students.

When discussing his students, Rob spoke plainly about discipline problems he faced in his classroom, and how many of the issues he has to deal with and systemic problems the school faces have to do with intersections of race, gender, class, and immigrant status among the student body:

Rob finishes his lesson and students leave the class. Rob points in the direction of two chairs where students sat. "Those two [boys] are trouble makers. This is a tough school because it's always on the low end for academic performance. It's a school with nearly 99% free or reduced price lunch kids." I ask if the boys tend to struggle more than the girls. "I mean, listen, people don't like to admit it, but these Latino families are very different from the Caucasian families. And the roles, the gender roles, you know, the boys are probably at home telling their mothers what to do. And they don't want to do their homework, the boys. It's hard to teach that. I have to try and keep them under control."

Although I noticed no behavioral issues during any of the observations, Rob's classroom management style was very strict. He created high-stakes question and answer opportunities regularly during his lessons, and when students got questions wrong he would challenge them and ask them publicly why they got the answer wrong ("Do you understand why you're not right?"). During assignments that were intended to be creative, such as a drawing assignment, he would actively police their drawing ("Do not get detailed! This is just a simple picture."). Rob's classroom decorations also mirrored his interactive style, ornamented primarily with posters that listed rules and regulations, or signs that included individualistic directives for learning, such as a poster stating *YOU are RESPONSIBLE for your own actions!* paired with a chart of student test progress (see Figure 2). When asked about his class management strategies during interviews, Rob boasted that the principal hired him "right away" because he wore a crisp shirt, tie, and jacket and spoke confidently about the importance of keeping the class in order. This mirrors existing work that finds principles at low-income schools seek out and hire teachers who are more stringent in their classroom management styles (Engel 2011).

When I asked Rob about dimensions of Brinker's environment that might shape the teachers' use of the interactive whiteboard at the school, he emphasized his role as part of a teacher committee that included the principal in teacher education of the technology's use:

The reason we got the [interactive whiteboards] was because a group of us had heard about this technology as a way to infuse technology for the curriculum, a grant we had at the time, we had funds because of state budgeting for Title 1 schools. There were four of us including the principal, it was a team of us. We went to a training by [the interactive whiteboard company], and we in turn trained other teachers. We broke up into grade levels and trained the teachers...At the beginning we decided it would just be used a strategy to get kids to pay attention a little bit more. Slowly people started to be paying how to pay attention to how it could strengthen their curriculum.

Rob, in conjunction with this team of two other teachers and the principal, served a pivotal role in the acquisition, implementation, and

education of interactive whiteboard use at Brinker. His statement suggests that their education program encouraged use of technology to both get students' attention but also for existing lesson plans. However, Rob's lessons in his own classroom, which fused traditional instruction with assumptions about his student audience, tenets of individualism and responsibility for one's own success or failure, and strict classroom management style, reflected a "bootstraps-teacher" teaching ethos. Messages about whiteboard use from this committee in which both he and the principal participated, faculty paranoia about students hacking into their e-mail accounts, and pressures from both government agencies and the news media regarding test performance filtered through into Rob's classroom practices and established etiquette for teaching with technology.

Despite his skills with the interactive whiteboard and his belief in his students' abilities, Rob's teaching style is shaped by a mixture of external perceptions and expectations with regard to appropriate ways to teach and manage the classroom at this particular educational institution. Although Rob expressed his own belief that students from every social class background could learn technology, and although he knew how to use technology in innovative ways, the moment students entered his class and instruction began he used the interactive whiteboard as if it were a simple blackboard. His authoritarian teaching style inhibited collaborative work, student interaction with technology, and use of new media that could, if employed, present challenges to the locally situated authority structure.

*The Foley School (High SES)*

Teachers at Foley and Flynn, while both serving different student demographics, both employed similarly high levels of dynamic use of the interactive whiteboard, with Flynn's use overall rate of interactive whiteboard use trailing slightly behind Foley and Brinker. At Brinker, Rob's "bootstraps-teacher" teaching style inhibited dynamic use of technology. What accounts for Gaby's and Casey's higher rates of dynamic use of the technology than Rob, who is actually more skilled and experienced at technology use than any the other interactive whiteboard users?

When I asked Casey about the climate at The Foley School, she noted that her colleagues, as compared with other schools where she has taught, really try to get to know their students more fully:

Teachers here go to more soccer games, more dance recitals than many other places. You know, because we try to get to know our kids as whole people.

However, when I asked if it was more demanding to not only teach but also attend student events, she would quickly shift to talking about how there are significant pressures and expectations that teachers face:

This is a really hard place to teach, uh, for a lot of reasons, but, and I think a lot of that is socioeconomic, like our parents have really high expectations and that is a very challenging environment to be in. Because in some ways you feel like, I don't know, like you're serving someone.

Pressures from parents also pervaded teacher interactions with other teachers and the use of technologies in their classrooms. When asked about access to technology and whether or not the school supported teacher use of technology, Casey explained that Foley actively pursued use of new technologies but that it sometimes pitted teachers against other teachers:

We have access and people here would be totally open and excited about [bringing new technologies into the classroom]...the only potential issue I see is that teacher-versus-teacher thing. Because the issues that sometimes occur between teachers that are comfortable with technology and teachers who are hesitant to use technology is, as much as they offer to help, that can cause some resistance on the part of one of my teammates in particular and then it becomes, 'Oh, well Mrs. Green has this and Mrs. So-and-So doesn't.' ...Parents start to say this teacher's doing this and this teacher's doing that, we get a lot of that at our school, especially around technology. This teacher is using technology and this teacher is not, how come, and why not, and I want my kid in that class because they're using something newer and fancier.

At Foley, parents pressure the use of new technologies so that their children are best prepared for the future. Unlike at Brinker, technology at Foley is not simply to distract students or get their attention, but rather teach them new and valuable skills. Parent pressures occasionally caused tension



between teachers who possessed different technology skill sets. It allowed Casey, a teacher who knows technology quite well compared to other teachers at her school, to find support for using technology in her classroom.

The support for technology use at Foley is not, however, without cost. In addition to the strain on relations with other teachers, the pressure to “sell” the school to students and parents is a major force that shapes teaching. Casey talked with us at length about the technology in her classroom and the kinds of PowerPoint presentations she uses. She then told us about problems she faces with the technology in her classroom, and noted the pressure she feels to do “wow” projects with her students:

We’re trying to do so much and I’d rather do less and do it well than do so much and not have it turn out well....there’s a sense of urgency and a sense of pressure at our school to just do this big magnificent projects all the time...like, how are we marketing and selling our program...the culture of Foley, that’s definitely part of it. That’s a different that I see here that I never had to worry about at my public schools where I worked. I never had to sell the program the way you have to sell here.

Casey describes the culture at Foley as a place where technology-infused instruction is not only supported but also demanded and enforced through pressures to market the program to parents to justify the cost of tuition for their child’s attendance. During interviews, Casey had well rehearsed descriptions about the strength of their programs, the high quality of their technology, and the supportive climate teachers create for the students. When asked about the pressures at the school, however, her descriptions became more complicated with explanations about the difficulties she and other teachers face to uphold these educational traditions. Compared with when she taught at other schools, she feels “replaceable” at Foley.

Our observations of Casey’s routine instructional practices reflected many of the themes of servitude and self-marketing she discussed in the interviews. During class, she would routinely refer to students as her friends, constantly praising them for their comments in class and all critiques of student work were very constructive. When students had questions in class, she would often walk to their table and kneel next to them so they could speak at eye level. When students spoke out of turn or had an off-topic

comment, she would say: “Try to stay with us, but that’s a good thought!” In class, all student thoughts were considered good thoughts, but some thoughts were more appropriate for that time than others. Her teaching style was highly enabling of student agency in the classroom. Moreover, when technology failed in the classroom, Casey apologized to students and said she would have someone fix it right away. When she could not figure out how to use her interactive whiteboard in a particular way, she willingly accepted student critiques or suggestions for how to use it better. Frequently, when the interactive whiteboard was used, it was expected that students not only interact with the board but add their own content, use toolbars, and assist other students to collaboratively complete the task at hand.

Casey’s teaching style, molded by pressure from administrators and parents to “sell” the school to their clients, is best described by a “buddy-teacher” teaching ethos. Foley demands “wow” projects, and she believes students need to be treated as equals and be rewarded when they challenge her in class. Moreover, parents recognize the importance of the new field of technology and demand innovative use of technology in the classroom. Teachers are expected to have the highest quality technology and technology instruction available, and if their children report to them that other teachers have better technology, they will threaten to switch classes.

### **Flynn Elementary (Mid SES)**

Although The Foley School (high SES) and Flynn Elementary (mid SES) both possessed high rates of dynamic use of technology, were the reasons behind those rates similar? Foley not only fostered innovative use of technology in the classroom but it also *demand*ed it, and the teacher believed students should be treated as peers and allowed to interact frequently with the whiteboard. Technological changes to the educational field were quickly recognized by parents and teachers at the school. What is the culture like at Flynn? Does it encourage the use of technology in the classroom?

Similar to Brinker, teachers at Flynn frequently talked about classroom management and discipline issues in their classroom. Gaby and the other teachers at school developed strategies to control the classroom when it became too boisterous:

The frog just to get their undivided attention. The rain stick is to quiet down... At the beginning of the school year, the first two days are nothing but rules and procedures... a lot of reinforcements. This is how I am going to get your attention. Okay, let's practice that. When I say think, everybody think of what you did this summer.

In an interview with Craig, he told us that his disciplinary style was the very reason why he was picked for a promotion at the school:

[I was selected] Um probably because of my teaching style. I'm extraordinarily strict but I have fun with students. The kids love me and respect me, but they know that I definitely have boundaries. And my peers have chosen me, or selected me. Often my peers come to me for discipline issues, before they go to the principal, which is a problem.

During classroom observations, I found that students were generally more noisy at Flynn than at Brinker or Foley, but that the strategies for controlling the classes at Flynn were particular to the school. Teachers like Tina often positioned themselves as parent-like authorities over students as a way to regulate behavior:

I have a kind of train whistle which I use and that definitely gets their attention... Every now and then, I will say hey or clear my throat really loud. You know, there are times when they recognize that because that's what mom does.

Tina talked about how doing or saying things "like mom" made for more effective classroom management strategies. She also reflected on how teaching got easier once she became a mom:

When I came back as an elementary school teacher [after having a child], I just had more life experience, I was a mom, you know, it was so much easier to say 'hey, you know, this is the way life is kids... I know exactly what your kids are, what's coming up in junior high and high school, and all this stuff, so I've been through

this and I've had kids and did this, I've had a child who, I know she did her homework, but it never got turned in, I don't know how she lost it, so I do understand what happens with your child, however, I have to count it...I can relate things to that.

For Tina, motherhood provided a legitimacy to her teaching and disciplinary methods. Although Gaby does not have her own children, she used similar strategies to police and promote certain conduct. In her lessons, she would alternate between embarrassing individual students for bad behavior along with rewards for good students by making examples of them and providing award tickets they could obtain to be exchanged for her homemade cookies. The teaching style used by faculty at Flynn is best described by a "teacher-parent" ethos when teachers garner classroom authority and develop strategies for classroom management from middle-class understandings of parenting and discipline.

Gaby used technology in ways to grab students' attention and manage her classroom. For example, she described a interactive whiteboard web application called envision Math that she uses regularly as "kid friendly, grabs attention, just like video games." Gaby also told us that she uses responders, a technology students can use to remotely interact with the board, as a way to see if students "got" the lesson so she can account for student progress and make test preparation easier. Unlike at Foley, Gaby's vision for technology was less about teaching new valued skills with technology and more about grabbing student attention. However, despite her dynamic use of technology in the classroom, such as games and video, she also expressed concerns about its effectiveness in teaching:

Gaby and I walk out to the playground during recess and we talk while she patrols the area. I tell her that I'm excited to see how students use responder technology in an upcoming lesson. She responds by saying that she has a love/hate relationship with the responders, and technology more generally. "Technology does not prepare students well for the major exams they have to take on paper without the help of technology. I try to use technology as a way to get them engaged, to get their attention, but not for actual assessment as it relates to test preparation. Technology doesn't

really help them learn how to take those on-paper tests, even though I know that using technology is critical to future employment once they're done with school."

Although Gaby recognizes that technology may be important to help kids eventually get jobs, she does not believe that it helps with test preparation for exams. Similar to Brinker, the topic of test preparation and curriculum standards came up frequently at Flynn, but classroom observations similarly confirm that although teachers have structured curriculum and focus on test preparation, they also demonstrate flexibility in how they choose to teach the lesson. For example, Tina, a sixth-grade teacher at Flynn, developed a geography activity where students create maps on a computer as part of a project. Craig, a science teacher, infused a lesson on the food tree with videos he found of animals hunting each other, and spent considerable time trying to evoke excitement and disgust from students. In another example, Gaby sidetracked from a lesson on reading thermometers to tell a story about how she is always warm and her husband is always cold, and led a class discussion on gender differences in personal temperature. These examples show that while curricula and testing pressure shape teaching practices, they do not entirely account for differentiated use of technology in the classroom.

During interviews, Gaby told us that very few other teachers took advantage of technology in their classrooms in the way that she does. She was the only one to use a interactive whiteboard at the school ("How the heck do they teach without one?"). She also expressed her belief that her ability to use technology far outpaced other teachers ("...they don't even know how to use a projector"). Unlike Foley, however, the lack of facility with technology and the failure to employ it in the classroom were not considered liabilities. In fact, on several occasions, while talking with us about her abilities as a technology user as compared with other faculty, she would shift her remarks to employment issues and the threat of layoffs:

I don't think there is a lot of technology here at this school...I don't want to come across as 'Hey Flynn, this is great, look at this,' and be looked at as 'What are you talking about, new kid? This is the way we are doing it, don't waste my time, I have always done it this way.' I think when I master something I am more than

willing...to help in any way to show you how to use it.” Gaby then goes on to talk about how she will probably try to get more involved with technology-specific support roles at her school if she is rehired for another year. I ask if she thinks she will be here next year. “I have no idea where I’ll be. Wherever they put me...[last year] I was #31 on the list of rehires. This number was like the ‘Scarlet Letter’ around the school.

Outside of classroom teaching, Gaby did volunteer for technology-affiliated roles at her school. She co-authored grants for new technology with another teacher at Flynn, and she also held instructional sessions for some teachers about the use of interactive whiteboard responders as one way to make test preparation easier. Gaby used her skills with technology to contribute to the faculty and school. While she used her background in technology to show her value, she was careful not to be pushy with teachers who were less sophisticated with technology usage. At Flynn, pressure from other teachers matters a great deal, particularly among younger faculty and during periods of stressful layoffs and among young faculty. The technology-related changes to the educational field of technology are not as widely recognized at Flynn, and so while Gaby uses the interactive whiteboard to grab students’ attention and differentiate herself at the school, she does not use it as often as Casey does at Foley.

### **Limitations and Future Research**

Gaining access to schools for research is always a challenge, and this study was no exception to this issue. Although I was able to strategically select three schools that were useful comparative cases, and the teachers in the study have demographic profiles typical of teachers in the U.S., I was limited by not only the number of hours I could spend in any given classroom but also by the number of months I had access to the schools. While I do not seek to generalize beyond the cases, it stands as an empirical question as to whether or not inequalities persist through differentiated use of technology beyond the contexts of the study. This research makes its contribution by demonstrating that the assumptions behind the nature of the “digital divide” need to be re-evaluated; not only is simple access to

technology not a guarantee of equal use, but the class culture of school contexts can inform whether or not new media technologies are fully adopted. Additionally, this study expands existing work on teacher beliefs and technology by showing how beliefs about students' race and class, as well as institutional perceptions about the value and purpose of technology, inform how technologies are used at the classroom level.

Future research could also investigate whether and how differences in technology use may vary in classrooms across middle and upper class schools. Although I only generated frequency data from interactive whiteboard use based on simplistic categories of traditional use vs. dynamic use, there may very well be important distinctions within dynamic uses of technology that have implications for inequality. Also, given that Foley differs from the other schools because it is a private school, future work might explore how high SES public schools might differ from comparable private schools. A more focused study of these school contexts may reveal new insights.

### **Discussion: Complicating Digital Inequality**

While frequency data for dynamic use of the interactive whiteboard was similar for both Flynn Elementary (mid SES) and The Foley School (high SES), the reasons why technology was used dynamically were somewhat different. At Flynn, teachers engaged in a “buddy-teacher” teaching style that allowed innovative use of technology in the classroom. However, Gaby’s view that technology should be used primarily to grab students’ attention, as well as social pressures from other, more senior and less technologically skilled teachers, minimized the strength of the technological changes to the educational field more broadly at the school. As a result, while she used the interactive whiteboard in dynamic ways she did not use it very frequently. At Foley, where I observed similar high rates of dynamic interactive whiteboard use, the “buddy-teacher” style appeared to foster the innovative use of technology. But pressures from parents to teach new valued skills with technology and the need to “sell” the school to clients demanded that teachers keep up-to-date with technology and its creative employment in their classrooms. Parents encouraged the school to quickly integrate the new changes in the educational field into classroom practices.

Brinker (low SES), however, exhibited a much different scenario. Although Rob is more technologically skilled than the other interactive whiteboard users, his “bootstraps-teacher” teaching style inhibited dynamic use of the technology. While classrooms at Brinker are equipped with new technology, the value of new competencies with technology were superseded by existing school practices. Even when I “control” for the availability of educational technology, how it is used in the classroom has consequences for inequality. Despite high levels of technological skill, Rob did not teach classes using the technology in dynamic ways. At Brinker, opportunities for students’ class mobility offered by changes to the educational field are staved off by his beliefs about students.

These qualitative case studies support the argument that curtailing digital inequality by providing simply access to technology may not sufficiently address disparities across schools that vary by social class. Inequalities may persist due to differentiated use of technology by teachers. Teacher beliefs about students’ race and class and institutional perceptions about the value and purpose of technology structures classroom teaching practices with educational technology. Education researchers, policy-makers, and technologists would do well to consider the role school context serves in shaping the use of innovative technologies in the classroom.

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