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Can Digital Technology Bridge the Classroom Engagement Gap? Findings from a Qualitative Study of K-8 Classrooms in 10 Ontario School Boards

Jessica Rizk [1,*] and Scott Davies [2]

[1] Department of Sociology, University of Waterloo, Waterloo, ON N2L 3G1, Canada
[2] Educational Leadership and Policy and Sociology, University of Toronto, Toronto, ON M5S 1V6, Canada; scott.davies@utoronto.ca
* Correspondence: jessica.rizk@uwaterloo.ca

Abstract: This study examined impacts of digital technology on a key component of the socioeconomic gap in education—gaps in student classroom engagement. Whereas print literacy has long been a source of such gaps, newer "digital divide" theories claim classrooms that use digital technology are perpetuating them further. However, these claims are not grounded in close empirical observation and may now already be dated. We aimed to advance understandings of the impact of digital technology on student engagement by examining robotics, tablets, and smart board usage across a range of classrooms, using a conceptual framework that blends theories of interaction ritual chains (IRC) and cultural capital (CC). Data came from observations and interviews with teachers and students in K-8 classrooms across 10 Ontario school boards. We report three major findings. First, almost all students across socioeconomic strata engaged easily and enthusiastically with digital technology. Second, technology spawned new classroom rituals and cultural valuations. Third, digital technology provided connections between school dictates and students' peer-based and home lives. We argue that digital technology has the potential to narrow classroom engagement gaps that are generated by conventional print media. We end by discussing avenues for future research.

Keywords: digital technologies; student engagement; SES; qualitative methods; digital divide

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1. Introduction

Student engagement has been considered the most pressing issue in education (Newmann 1992). Sociologists have long observed gaps in classroom engagement by class, gender, and race (see Bettie 2003; Cookson and Persell 1987; Ochoa 2013). Historically, direct instruction using print media and oral language—the primary teaching tools in 20th century classrooms (Cuban 1986; Tyack and Tobin 1994)—spawned sizeable socioeconomic, gender, and racial gaps in student engagement. Research has long shown that literacy skills are nurtured not only through classroom instruction, but also through home resources such as having literate and active parents and access to books and other print media libraries, and that those resources are strongly correlated with family socioeconomic status (SES) (Cheung and Andersen 2003; Evans et al. 2010, 2014; Kraaykamp 2003; Lund-Chaix and Gelles 2014; Roose 2015; Tramnote and Willms 2010). Sociological research has consistently found that varying metrics of exposure to print media in the home, such as number of books and magazines, along with years of parents' education and time parents spend reading to their children, are strong predictors of student achievement (DiMaggio 1982; Evans et al. 2010; Kingston 2001; Sirin 2005); Studies of school readiness detect socioeconomic gaps in early literacy and numeracy among preschool children (Duncan et al. 2007; Hart and Risley 1995; Magnuson et al. 2004). These studies all suggest that the home environments strongly shapes print literacy.

In recent years, new forms of digital technology—robotic kits, smart boards, tablets—have been touted as core components of ideal "21st century classrooms". Such class-

rooms aim to harness technology in order to nurture more engaging, collaborative, and creative forms of learning (Ontario Ministry of Education 2016). Today, policymakers see digital devices, along with innovative "gamified" curriculum that incorporate game design elements into lessons, as tools that can engage students, enhance classrooms, and nurture new forms of learning (Chambers et al. 2008; Chang and Wei 2016; Dicheva et al. 2015; Erenli 2013; Hardman 2015; Lee and Hammer 2011; Mousa et al. 2017; Muntean 2011; Nolan and McBride 2015; Ontario Ministry of Education 2016; Simões et al. 2013; Sullivan and Bers 2016; Toh et al. 2016).

A key counter-theory—known as the digital divide thesis (DDT, as described in the next section)—suggests a very opposite scenario—that widespread use of classroom technology will only perpetuate student engagement gaps (Attewell 2001; Cleary et al. 2006; Kalyanpur and Mubina 2005; Monroe 2004; Williams 2000). It is currently difficult to adjudicate between these contrasting claims, since widespread usage of digital technology in classrooms is still relatively new, and since there still is no robust body of research on the impact of that technology on student engagement. Since digital technologies continue to evolve rapidly, have become nearly universal in recent years, and have diffused widely through schools only over the past decade, the original claims about a "digital divide" may be now outdated. This paper contributes to debates about 21st century classrooms and digital divides with qualitative data on student engagement with digital tools across a range of K-8 classrooms. To theoretically interpret the impact of those technologies on classroom engagement, we adapted Randall Collins' work on interaction ritual chains (Collins 2004) and Pierre Bourdieu's work on cultural capital (Bourdieu 1986; Bourdieu and Passerson 1977). This framework offers two advantages over prevailing digital divide theories. First, it contextualizes digital technology alongside other media usage in classrooms, particularly print media, at a macro and historical level. Second, at a micro level, it sensitizes researchers to ways that technology can shape face-to-face interactions in classrooms.

Our paper has several sections. It begins by reviewing the evolution of DDT and recent empirical trends regarding social class and technology usage. It then elaborates on our adaptation of interaction ritual chain theory and cultural capital theory for thinking about student engagement and digital technologies. After detailing our empirical methodology, we report three major findings, and conclude by claiming that digital technology has the potential to narrow rather than perpetuate classroom engagement gaps.

2. Classroom Technology, Student Socioeconomic Status, and the Digital Divide

Twentieth century classrooms before the digital age widely used print text in their pedagogy and evaluations. That usage generated advantages for students from middle class households with highly literate parents and plentiful books and other print resources, as shown in decades of research (Bodovski and Fakas 2008; Cheung and Andersen 2003; Sui-Chu and Willms 1996; Kloosterman et al. 2011; Parcel and Dufur 2001; Roose 2015). Importantly, postwar job markets were sharply divided between blue- and white-collar jobs, the latter requiring print text literacy and hence favoring graduates with higher education credentials.

While classrooms have utilized electronic technology for a half century (see Apple 1991; Budin 1991; Cuban 1986, 1993, 2001), only recently has the use of digital technology become widespread. The emergence of digital technologies in schools 20 years ago initially spawned skepticism. Some claimed they were "oversold and overused" (Cuban 2001), while others dismissed them as largely business-led ventures aimed at commercializing schools (Akindes 2000; Apple and Bromley 1998; Boyles 1998; Noble 1996). In terms of student engagement, scholars extended an emerging narrative about a "digital divide", claiming that classroom usages of digital technology would serve only to reproduce educational advantages for affluent students. Early versions of the DDT in the 2000s (e.g., Attewell 2001; DiMaggio and Hargittai 2001; Natriello 2001) focused on emerging socioeconomic inequalities in access to technology. They reasoned that the same parents that were highly literate and stocked their home with books also owned computers, laptops, and

early models of smart phones. They further reasoned that those homes would grant their children a greater familiarity with those technologies, thereby advantaging them in new 21st century classrooms.

However, since the emergence of the original DDT 15-20 years ago, a societal revolution in access to digital technology has emerged. Whereas in 2004 less than 1 in 10 U.S. adults used social media, by 2015 that rate rose to 65% (Perrin 2015). In 2013, texting replaced telephoning as the modal form of interaction (Lenhart 2012, 2015a), with 73% of adults using cellphones to send and receive messages (Duggan 2013). Smart technology has become nearly ubiquitous, with 95% of children now reporting owning or having access to it (Anderson and Jiang 2018) and nearly 9 in 10 Americans now reporting to be online (Smith 2017). Statistics also show that nearly all Canadians under 45 use some form of digital technology daily (Statistics Canada 2017); even seniors report rising rates (Statistics Canada 2019). Most homes now also have broadband access (Horrigan and Duggan 2015), while the majority of lower SES families report owning some form of digital technology in their homes and basic levels of digital fluency (Lenhart 2015a, 2015b). Nearly 100% of Canadian youth aged 15 to 24 across all household income strata are using internet on a daily basis and own their own device (Statistics Canada 2018). This fast-paced diffusion has made many issues of "access" to digital technology redundant. Very few non-users remain today in society at large (Hitlin 2018), or among students, as school Wi-Fi access is also ubiquitous and widely incorporated in curricula (Anderson and Perrin 2018; Vidgor et al. 2014).

However, as access to digital technology was growing, scholars proclaimed that a "second" digital divide was emerging, one that hinged on quality of access. This new version of the DDT conceded that few disadvantaged youths now lacked access to digital technology and broadband, but claimed that they had lesser quality devices, and used them largely for social and recreational purposes. Affluent youth, in contrast, were seen to have superior devices and used them with greater savvy for school-sponsored tasks (Barron et al. 2010; DeBell and Chapman 2006; Min 2010; Natriello 2001; Warschauer and Matuchniak 2010). However, for several reasons, these revised claims may be either already outdated or empirically unsupported. First, youth across socioeconomic strata may be using digital technology for largely the same purposes—mainly for social networking (Guadagno et al. 2013). Second, it is unclear that parents are children's prime instructors of digital literacy. Plowman et al. (2008), for instance, found that young children exposed to digital technology at home were largely self-taught, acquiring their competencies on their own, and that their parents' motives for exposing them to devices were not for their educational benefits but rather to give themselves uninterrupted time for chores or leisure. Third, digital divides may not be as wide as initially thought. Owning a single mobile device that enables access to information appears to bridge most class and race divides in technology use (Anderson 2015; Anderson and Perrin 2017). Finally, those critics did not anticipate that school-provided technologies and instruction might be able to narrow home-based digital divides. Consider that some of today's most popular digital tools and apps used in classrooms did not exist 10 years ago. Both DreamBox Learning, an online software for mathematics education, and Kahoot!, a game-based learning platform, were released only in 2013[1].

Thus, not only are the vast majority of today's children now accessing digital technologies, but they also appear to use them in roughly similar ways. However, it is worth mentioning that despite greater availability and access to digital tools and resources, there remains challenges for many low- and moderate-income families. For instance, Rideout and Katz (2016) remind us that many families, while having some form of internet connection, remain under-connected, with mobile-only access and inconsistent connectivity. For some, internet access may be too slow, limited in bandwidth, or have capped data limits, while

[1] Some of the most popular games and apps used in 2020 are less than a decade old, such as Prodigy Math Games, created in 2013; Book Creator, developed in 2011; Blackboard App, created in 2014; Class Dojo, developed in 2011.

others are limited to one device that they must share amongst family members. This serves as a reminder to the importance of school adaptation of new digital technologies—although schools have only recently begun to assume technology in a widespread manner, and thus it remains unclear if schools can serve to bridge some of the digital divide. Accordingly, researchers should treat the second DDT as a hypothesis to be tested with new and updated forms of evidence. This paper aimed to conduct such a test. The next section sketches our theoretical framework for conceiving connections between student engagement and digital technology.

3. Theory: Digital Technology, Classroom Interaction Rituals, and Cultural Capital

Pierre Bourdieu offered a famous explanation of class advantages in schools (Bourdieu 1986, 1973; Bourdieu and Passerson 1977). He coined the term "cultural capital" to convey how scarce, yet arbitrary forms of class-based dispositions get valued and rewarded in gatekeeping institutions such as schools. Writing in the 1960s and 1970s France, he attributed the highly unequal educational attainments across social classes to the subtle affinities between public school curricula and pedagogy and the cultural upbringings of the dominant upper middle class. He saw affinities between upper middle class culture and school curricula through things such as fondness with reading, eloquent styles of speaking, and a general familiarity with classic humanities. He implicitly assumed those affinities served to engage advantaged upper middle class students in classrooms. For Bourdieu, print-based literacy was an essential component of cultural capital that was forged at both home and school, although he emphasized that the ability to signal a "flair" with language was more likely bred in upper middle class homes. Importantly, he portrayed a facility with print text as a form of cultural capital, since its subtler forms were bred in advantages homes, and since they offered clear advantages in schooling.

Since Bourdieu's ideas were originally received in the United States during the 1970s and 1980s, empirical researchers have produced several different variants of cultural capital theory (Davies and Rizk 2018). Some equate cultural capital with exposure to "highbrow" culture (i.e., visiting museums, galleries, foreign travel, and having extensive home libraries), while also emphasizing the possibility of lower SES children becoming educationally mobile if they are exposed to that culture (e.g., DiMaggio 1982; DiMaggio and Mohr 1985; DiMaggio and Mukhtar 2004; Jaeger 2011). Others emphasize that what counts as cultural capital can change in tandem with broader changes in any societal field, and that dominant classes will tend to rig cultural values in order to perpetuate their advantages (Lizardo 2008).

We blend these ideas by accepting both possibilities—schools can shift their cultural valuations and promote cultural mobility when they alter their classroom pedagogies. Bourdieu wrote in a period when digital technology was not yet prominent. In this paper, we adapt his ideas to a new era. Whereas middle class families in previous eras could subtly familiarize their children with school curricula and routines via music lessons or museum visits and thereby present themselves as culturally competent (DiMaggio 1982), today's students can find different routes to familiarize themselves with evolving curricula (Paino and Renzulli 2013). These routes may be less inflected by class status than were older forms of highbrow culture. For instance, new pedagogies touted in the 21st century classrooms may signal subtle shifts in the educational field. Digital technologies can alter cultural valuations if schools reward student capacities to successfully navigate them (Rafalow 2018) while also giving fewer rewards to other capacities. Further, these new valuations may be less stratified than older valuations based on print text if newly valued traits are more evenly distributed across social classes.

For instance, digital technology offers today's students relatively wide and quick access to up-to-the minute information. In the print era, students had to gain access to books, often housed in libraries or in their own homes. Hardcopy encyclopedia sets were expensive, costing upwards of thousands of dollars. A well-stocked home library with a broad selection of books would have cost hundreds or thousands more. In contrast, a

functioning if outdated iPhone, costing CAD 200–300, can offer internet access, a phone, camera, and email, often replacing the need for landlines and TVs. Their monthly charges are roughly equal to monthly subscriptions to newspapers and magazines. Compared to acquiring books and other print media, today's digital devices do not require a huge investment. Their sheer accessibility makes retrieving information far quicker and cheaper than old-style book research. And, unlike books, many youth regard hand-held devices to be "cool" (Haste 2009).

Since households vary widely in their ability to nurture the kinds of print literacy that are rewarded by schools, many children experience large disconnects between their home and print-based school activities. While schools partially compensate for such home-based inequalities (Downey and Condron 2016), more families can easily provide access to digital information compared to print-based information. The former depends less on highly literate parents, well-stocked home libraries, and long hours of parent-led reading, while access to digital information requires fewer monetary and time investments. Today there is no shortage of online resources that students (and parents) can access at their own leisure. Many apps, websites, and games used in classrooms are now easily accessed free of charge. Students can also use popular websites such as Khan Academy to learn about a variety of subjects or utilize teacher-led virtual lessons as refreshers.

Randall Collins (2004) offers a micro-level theory of social interaction that we apply to interpret student engagement. Collins posits that successful face-to-face interactions can charge people's emotions, motivating them and forging feelings of solidarity and collective effervescence. Repeatedly successful interactions can become engaging "rituals" whose members continually focus their mutual attention on shared symbols and charge them with collective meanings. Rituals can become increasingly powerful, according to Collins, if their members become savvy manipulators of group symbols that facilitate successful interactions. Those emblems can then provide groups with a mutual focus of attention and strengthen bonds among them. We argue that rituals that are aligned with school dictates can generate student engagement (Davies and Rizk 2018). For instance, regular nighttime reading between parents and children can represent chains of successful rituals that align with school reward systems as long as they engage children with books and improve their reading skills. Since research cited above shows that such rituals occur unequally across socioeconomic strata, these print-based rituals create unequal levels of reading skills outside of schools.

Shifting the focus to classrooms, sociology's rich tradition of classroom ethnography can be energized by a sensitive micro-sociological framework such as interaction ritual theory (IRT). Many sociologists portrayed traditional teachers, particularly those in lower socioeconomic status (SES) schools, as authoritarians who, in IRT terms, conducted "power" or "status" rituals that placed themselves at the center of the interaction. These rituals tended to be highly scripted in which participants were expected to enact distinct and hierarchical roles, punctuated by predictable patterns of order taking and order receiving that served to reinforce their unequal statuses. However, these rituals were also portrayed as either disengaging students, or triggering conflict and disruption as student peers vied to undermine teacher authority (for classic examples, see MacLeod 1987; Willis 1977). However, many classic ethnographies offered a one-sided portrait of disadvantaged children as being either disengaged or disruptive, forgetting that for every "lad" there was an "ear'ole" (Willis 1977) and that for every "hallway hanger" there was a "brother" (MacLeod 1987). IRT can help avoid ignoring such important variations by emphasizing the need for careful, up-close observation.

In this paper, we adapted Collins' theory to explore digital technology in classrooms. Collins emphasized that powerful rituals can be social mechanisms that transform cultural fields, not merely reproduce them. Collins (2011) discusses online interactions as having somewhat weaker impacts than face-to-face interactions, but nevertheless retaining the power to simulate successful rituals. We concur with DiMaggio et al. (2019), who contended that IRT can provide a versatile approach for understanding the implications of the unprecedented

rise in digitally mediated interactions such as e-mail, texting, social media, online meetings, discussion forums, and Zoom. These technologies now mediate a significant portion of people's communications (see also Beneito-Montagut 2015; Ling 2008; Maloney 2013). We next pose research questions on the basis of combining theories of cultural capital and interaction rituals to examine the impact of new technologies on student engagement.

4. Research Questions

This paper provides an empirical test of the second DDT. While original DDT has been outmoded by the near-universal adoption of digital technology throughout society, its updated version certainly remains plausible—just as affluent children have historically had more home resources to engage in print-dominated schools, those children may also have greater resources that allow them to engage more fully in schools dominated by digital technology. Affluent children may have better access to high-quality devices and broadband, and may have more digitally literate parents, and thus it is plausible that they will be more engaged in digitally oriented classrooms than lower SES children. Conversely, the recent trend towards greater societal-wide access and school-based use of digital technology may have very different implications. SES gaps in access to, and literacy with, digital tech may now be smaller than their corresponding gaps in traditional print literacy. If a broader range of children are engaged by digital tech and attain adequate levels of digital literacy, the use of digital technology can potentially reduce classroom engagement gaps. Specifically, that use may generate (i) new sets of interaction rituals that engage students, (ii) new cultural valuations of skills that then become "cultural capital", and (iii) more even distributions of that capital across an array of socioeconomic backgrounds. In sum, our counter-hypothesis is that any new cultural capital valued in digitally based interactions may be less "class inflected" than those associated with print literacy, and as such, they may offer routes for cultural mobility, to use DiMaggio's (1982) coinage. To test these opposing hypotheses, we combined two qualitative methods—interview and observational methods—described in the next section.

5. Data and Methods

This study combined classroom observations and interviews with teachers on student engagement with technology across a range of public elementary-level classrooms. Our analytic strategy was to compare observations and interview findings across multiple school settings that vary widely by neighborhood SES. Those settings ranged from middle class suburban neighborhoods to industrial inner-city neighborhoods. This qualitative design examines SES at an ecological level, rather than at an individual level, capturing between-school differences rather than within-school differences. Many classic school ethnographies such as those by Paul Willis and Jay Macleod similarly drew inferences about SES and schooling processes by focusing on school-wide processes at an ecological level. Since we did not conduct a survey that could have recorded the SES origins of individual students, that lack of data represents a limitation of our method. However, our observational method allowed us to witness micro-level social processes as they unfolded on the ground in real classroom contexts, something that surveys cannot do (for other examples of observations in educational research, see Calarco 2011, 2014, 2018; Khan 2011; Lareau 2003; Milner 2006; Pascoe 2012; Paulle 2013). Our classroom observations allowed us to observe not only the type of digital resources being used in these lower-income schools, but also how they were used by students—whether students were receptive and engaged by the digital tools provided to them, and whether those tools sparked new kinds of interactions and conversations among students. To indirectly capture other relevant processes that occurred beyond our observed classrooms, we conducted teacher and student interviews.

Our data were collected from three large research projects on technology use in elementary classrooms (K-8) in Ontario, Canada. Each phase examined the use of smart boards, robotics kits, or tablets, variously across a range of elementary-level school settings,

including mainstream classrooms, special needs classes, and libraries. Its first phase consisted of classroom observations in two low-income schools as part of the "Ontario Summer Literacy Learning Project" (Davies and Aurini 2010). That project provided summer literacy programs for students in grades 1–3 whose teachers deemed them to have limited literacy skills or few opportunities for enriched summer learning experiences. During the summer months in 2014, we attended two schools—Spring Hill Elementary and Oak Ridge Elementary School[2]—to observe teacher and student engagement with digital technology in their summer classrooms. Both schools were populated by many low-income students who had limited access to digital technology in their homes (this information came from a survey conducted by the program researchers). Both schools were chosen for summer programs because they were located in lower income neighborhoods within a low-income industrial city and had standardized test score averages well below the provincial average. Those programs consciously incorporated digital technology as part of an effort to boost engagement among their students.

The next two phases of the project broadened the range of our field observations from two low SES schools to two middle class schools, and to another set of schools that ranged widely by neighborhood SES. The second phase encompassed 16 classrooms in the "Spencer District School Board" (SDSB) that were implementing digital technology in a variety of educational settings, including mainstream classrooms, English as a second language classes, libraries, and special education rooms. In total, two libraries, four special needs rooms, two English as a Second Language (ESL) rooms, and eight mainstream rooms were observed for over 50 h between spring and fall of 2017. In addition, the first author interviewed 32 teachers across several grade levels in two schools: "Summerville" and "St. Helena". These elementary schools were located in a major suburb within 3 km of each other. Both have a diverse range of students from different socio-ethnic backgrounds, with South Asian and Blacks being the most common visible minorities, and according to census data, both are in predominately middle class neighborhoods. St. Helena has an average family income of CAD 101,000, with 11.8% being recent immigrants, while Summerville has an average family income of CAD 93,000, with 15% being recent immigrant families. Interviews were conducted with teachers either before or after school hours, sometimes even during breaks. Interviews ranged from 30 min to 2 h and were recorded on an iPhone device. Participants were assigned numbers to remain confidential. Although we prepared guiding questions (i.e., Why and how do you use technology?), most occurred organically.

The third phase examined the impact of the Ontario government's 2015 initiative to support math and science teaching in "21st century classrooms" by distributing robotic kits to every school board in the province. Unlike phase two, the nine schools in this phase varied more widely by neighborhood SES. This phase of the project revealed further differences in school-based SES. Some schools already had thriving robotics programs created through their fundraising and other resources, while others were struggling to obtain the tablets and other resources needed to support robotic kits and other new digital technologies. This third phase of our study allowed us to examine whether low SES schools that previously lacked capacity for use of digital technology were able to quickly pivot when presented with new resources and help their students engage that technology and catch up with their peers in higher SES schools. Between January and June 2017, the first author conducted interviews and focus groups with teachers and students and video-recorded observations in 19 classrooms. She conducted 38 in-depth interviews with teachers, 10 focus group interviews (95 participants including teachers and administrators), 6 student focus groups (45 junior and intermediate student participants), and 11 classroom observations (all of which were video recorded) in 9 different school boards.

[2] All school and board names are pseudonyms.

6. Analysis

As noted above, our design aimed to compare uses of technology in lower versus higher SES schools and detect any overt differences in student engagement. Our range of schools allowed us to also examine other bases of comparison, i.e., between mainstream vs. special needs student populations, and between widely established in classroom technologies (e.g., smart boards) and newer ones such as robotics kits (we are exploring these comparisons in other publications). Our classroom observations were recorded in field notes, with close attention to physical body language (i.e., eye contact, gestures, nods, and probs) as students and teachers used technology. All observations were then coded by emergent themes such as "student interactions", "excitement", and "use of technology" using Excel and QSR NVivo. We triangulated these classroom observations with interviews with teachers. Interviews were transcribed using a voice to text software, imported into QSR NVivo, and then coded. Over 20 nodes were created to capture teacher and student views on technology and engagement, such as "access", "benefits", "engagement", and "accountability". Interview codes were developed on the basis of pre-established theories and concepts (i.e., rituals, cultural capital) but also naturally as the first author became immersed in the data (Saldaña 2016).

7. Findings

Three major themes emerged in the analysis: (a) students' accessibility to, and familiarity with, digital tools in the classrooms; (b) the emergence of classroom rituals and cultural valuations associated with digital technology; and (c) close connections between those rituals and students' peer-based and home-based leisure.

7.1. Student Accessibility and Familiarity with Digital Tools

In many cases, educators spoke of technology as a "neutralizer". They witnessed its capacity to provide more common classroom experiences for students. Students who could not afford to bring devices from home were given school-housed resources, thereby alleviating some of the burden that might have been placed on their parents.

> These technologies can help close the digital divide to an extent, because you're providing a resource that not all students would get otherwise. (Grade 2/3 teacher, Summerville)

> Technology is getting cheaper. Soon, money won't be the problem. You can buy a tablet for less than a hundred bucks. Bring your own device (BYOD) is changing access. They have programs for kids in need where cops will come and bring them computers. Technology access is becoming less of an issue. (Grade 6 teacher, Summerville)

Many educators, aware of home-based disparities in learning opportunities, adjusted their demands for student work by allocating more in-class time to using technology. We observed instances in which students used class time and resources (i.e., computer, printer, etc.) to complete work they otherwise may have not completed at home. Many teachers, especially those using robotics, remarked that these classroom resources offered many students their first real experience utilizing technology in a purposeful way—exploring how to build, code, or program:

> . . . [F]or our kids, most of their home situations don't allow for the extras. They aren't the kids that are doing this in summer camp. For a lot of them, it's the first time they've ever seen anything like this. They're just really excited to be working with robotics. (Junior teacher, Robotics Project)

Not only did we observe widespread access to technology, but also an ease among many students in learning digital skills at school. We observed many children acquiring forms of "digital literacy" (i.e., using search engines to research projects, using PowerPoint to showcase learning) on their own with little difficulty. Even among kindergarten students with no prior exposure to technology, we observed its adoption at unprecedented speeds.

> . . . if you really think about it, none of the kindergarten students have used a smart board before, but there's almost zero learning curve when they come to school. They just say, "oh okay" and go with it. It's not like they say "no, I don't want to try it". Whereas you give them a book to read, and they just look at you with blank eyes sometimes . . . (Full Day Kindergarten [FDK] teacher, Summerville)

Teachers commented that their students were acquiring digital skills quicker than they would have with traditional forms of print:

> I had a student with no technology at home, but she just picked up tech skills immediately. She became the most fluid, despite never using it before. I'm not sure I could say the same for a child with no books at home learning to read. (Grade 1 teacher, St. Helena)

The "ease" by which students picked up tech skills was not only limited to mainstream students, but also spread to students with learning disabilities. Consider the following observation from a special education classroom:

> Bobby is a student with Autism Specturm Disorder (ASD) who is nonverbal and illiterate. Despite his diagnosis, he flourishes with technology—using his tablet to "speak"—to tell staff he was "hungry" or "finished". Other times, he used his tablet to watch his favourite YouTube videos, or play educational apps without any probing. Sometimes he's asked to guide "morning calendar" on the smart board or select a daily video. He had little difficulty demonstrating his knowledge on devices.

In contrast, we observed many children treating print reading as a "chore" after being readily engrossed by technology. In classrooms with younger children, we observed students defying teachers much more when asked to sit and read, compared to instances when they would use a digital tool to essentially do the same task on applications such as Raz-Kids that have interactive stories. They appeared to find the sounds, colors, and game-type elements in digitally mediated communications to be more "fun" and aesthetically pleasing.

Classroom Rituals

Traditional 20th century classrooms placed much more responsibility on teachers and parents over student learning, with teachers being the center of direct instruction, and while also relying heavily on parents to direct homework. The use of technology in classrooms appeared to shift pressure to direct learning from teachers and parents towards students (see also Rizk 2020). As teachers increasingly migrated lessons online, we observed that digital technology appeared to allow students and peers to take more control over their own learning, freeing up more time for in-class work, and providing novel opportunities for learning:

> Students understand that if they don't know something, they can use technology to find answers. When I first started teaching, if students couldn't read or go to libraries, they were stuck. They had to wait until the next day to come to school or ask a teacher or their parents. Now, they are accountable for their learning inside and out of school. (Support teacher, SDSB)

We observed that many digital tools appeared to facilitate more decentered classroom rituals in which teachers and students were both mutually focused and shared some authority. Teachers often suggested students "knew more" about technology than they did themselves (which many parents would also acknowledge), thereby shifting immediate classroom authority from teachers to students. Digital tools served to disperse teacher authority and engage students by offering the latter greater autonomy. Both teachers and students emphasized this point:

> Technology gives students greater independence and the ability to self-teach. You can give them a push, but they really take off with it and appreciate that

> level of freedom. They often end up leading many tech lessons. (Grade 7 teacher, St. Helena)
>
> With robotics, you can explore possibilities and build things. Even when you're not following instructions, you can make your own creation, and then teach others. (Student, Robotics Project)

These examples suggest that there are affinities between digital tools and progressive goals of student engagement and autonomy (see (Kohn 2015) on progressive pedagogy). Whereas teachers in traditional classrooms tended to be the main transmitters of school-sponsored interaction, we observed instances in which technology facilitated the transmission of information among student peers themselves. Devices provided peers with common symbols that they could easily master and become digitally fluent and proficient, even those that had minimal opportunities to use them at home. The ubiquity of digital tools in other realms of their lives motivated many students to develop their digital skills on their own time. We often observed students teaching themselves or a peer to navigate a tablet or browse the web, more so than using books.

7.2. Emergence of Classroom Rituals and Cultural Valuations Associated with Digital Technology

Many educators and students we interviewed discussed the need for today's classrooms to prep students for a technology-fueled world in which digital skills are vital for jobs. These teachers tended to incorporate technology into their lessons.

> There are jobs today that didn't exist ten years ago. The goal of schools was to prepare students for factory work, but that doesn't apply anymore. Earlier hands on experiences with technology is what will really prepare them for future jobs. Even without home support. (Grade 7 teacher, SDSB)
>
> Robotics helps us think about the kinds of jobs we can be doing in the future, like engineering or programming and other new jobs for the 21st century. (Student, Robotics Project)
>
> Robotics helps prepare us by doing steam-based activities, because that is where jobs are going to be available. (Student, Robotics Project)

As more educators promote digital skills in their classrooms, they appear to be exposing students to learning rituals that most students appear to welcome. Many teachers used digital technology to teach students skills such as research and coding—"technology has changed the content of the focus of my lessons to research and practical digital skills because I want students to be better prepared with skills they may need to succeed", advised a Grade 6 teacher. Our observations and interviews suggest that technology is placing new valuations on certain skillsets, ones that may become forms of cultural capital that can rival print-based skills.

7.3. Connections between Rituals and Students' Peer and Home-Based Leisure

Students appeared to carry their enthusiasm with technology from school into their homes. This was echoed in our conversations with educators:

> Students can't wait to go home and try some of the tools we use at school. You show them one thing with technology, and the next thing you know, they are telling me "check out my YouTube channel" or "look at this neat thing I learnt". Sometimes they even teach themselves at home and show off to classmates the next day. There is overlap between home and school that was non-existent before technology. (Librarian, St. Helena)

Classroom technology appears to align students' peer interests with school-sponsored activities. We observed students playfully conversing about their school tasks, exchanging phrases such as "I want to beat you at Kahoot!", "How do you print this?", "Did you see my Minecraft server?" Such exchanges, often utilizing internet lingo, forged connections between their peer group interests and school tasks. Peer engagement with various apps

and games became part of their student subculture. Students' enthusiastic buzz that they expressed towards using technology continued outside of school. Schools often provided platforms that could be accessed by home. Students reported logging into games and websites at home in order to sustain conversations with their peers. This extension of school-sponsored rituals generated more school engagement by appealing to peers. Teachers by extension, recognized the plethora of online resources now available to students:

> There are so many different tools students can use during the day or at home. I encourage them to check out Khan Academy or games like Prodigy to further their learning at home. I give them the tools at school so they can continue with it on their own time. (Grade 8 teacher, Summerville)

Teachers frequently referred to online teaching platforms as vehicles for keeping "students engaged at home". They noted the importance of making resources available online for students to access content from anywhere. Many, such as this Grade 7 teacher that we observed, provided options to extend student learning outside of their classrooms:

> The teacher is instructing his students to check the classroom website (or virtual learning environment, "VLE", as it is known). He has uploaded their upcoming assignment. He mentions there are additional links available for students to explore. He encourages them to take advantage of online tools which he suggested can be accessible on any device.

Accessible technology facilitated the utilization of digital platforms, which in turn placed more responsibility onto students to access materials at their own pace and outside of school. Teachers also allowed students to play school-sponsored games, such as Prodigy, on their own time. Consider this observation from a summer literacy classroom:

> Digital technology was used throughout the day as students planed their own activities—some used it to watch educational videos, to read interactively, or log on to websites like ABC-YA for math or language activities. Many of the students were continuing activities that they started the night before at home.

These examples suggest that digital technology can facilitate a homework culture that might rely less on parental push and motivation.

Many teachers we interviewed were also parents and often echoed the sentiment that visible differences in terms of technology quality did not seem to affect students' involvement. Many students appeared to monopolize the digital realm in their families:

> Most kids I've worked with, including my own, are literally doing the exact same things with technology—they are using it to do what their friends are doing. Whatever that may be. (Grade 7 teacher, Summerville)

> Very few restrictions are placed at home from the students in my class. I know because when they come to school, they are talking about the same games, websites, and apps they use at home. Even those who I know for a fact are coming from poorer families. It's part of kid culture now. (Grade 8 teacher, St. Helena)

Others suggested that teachers play an important role exposing students to technology:

> Parents might suggest educational apps, but I think the teacher sets the tone. They are the ones who will tie it into their teaching or get the class excited to follow through with something online. If that interest is sparked in class, it carries into the home. I've seen that happen when I introduce something in class. They do it at home. (Grade 2/3 teacher, Summerville)

Ultimately, educators noted only minor differences by age, otherwise conceding that today, students are largely in control of what they do on digital devices:

> I think more emphasis is placed on screen time for toddlers. But once they get to a certain age, there is less control from parents. Parents aren't monitoring

> their children 24/7. It's just a reality of our busy lives today. Children are using technology to do what their friends are doing and interact with them in this new way. (ESL teacher, St. Helena)
>
> Most people assume middle class or professional families monitor screen time. But, as a teacher and parent, I'm concerned if my kids have fun, and maybe how often they are online, but in terms of what they do, I don't bother. I see my kids and students in class jumping on whatever bandwagon their friends are doing. It's in students' hands now, but they can surprise you. I found two students in my class just last week trying to create an app on their own—with no probing from me or their parents. (Grade 7 teacher, Summerville)

While parental engagement matters, we suggest that unlike print-media, digital technology is providing students with greater opportunities to learn at home and in schools in ways that require far less parental supervision and control. Available and accessible online resources may spark learning and engagement among a range of students.

8. Discussion and Conclusion: Towards a New Research Agenda

Our major finding is that we could not detect marked differences in student engagement across classrooms in settings that ranged widely in terms of neighborhood SES. We found, instead, that most students were, or quickly became, familiar with digital tools in classrooms. Low-SES schools appeared to be able to compensate for any prior disadvantages that their students had in accessing digital technology and gaining facility with it. Further, those tools sparked the emergence of new classroom rituals and cultural valuations that engaged students, and that motivated students to extend school-sponsored activities into peer-based and home-based leisure settings. We posit that students' use of digital technologies is largely self-and peer driven, and emphasize that it helps them not only gain particular technical skills, but also helps peers motivate each other to engage with school-sponsored material, even beyond formal school-based activities. We are aware that skeptics see many working class students as lacking what they call "critical digital literacy" in comparison to middle class "digital natives" (see Boyd 2014; Castellvi et al. 2020; Pangrazio 2016; Wineburg et al. 2016; Wineburg and McGrew 2019), but find these arguments as yet to be firmly grounded empirically and must be clearly conceptualized.

From our findings, we built a central argument—digital technologies, compared to print text, have the potential to reduce disparities in engagement in both students' classrooms and homes. Familial transmission of print literacy has long driven much educational inequality because effective resources for mastering it are very unevenly distributed across households. Disparities in exposing children to foreign travel, galleries, libraries, or museums are persisting and may be widening (Duncan and Murnane 2011). In comparison, digital resources are more readily accessed and rely less on expensive resources and parental intervention. Such resources can provide a mediated experience by which all kinds of students can learn about foreign countries, artists, books, and cultural artefacts. Further, digital technologies may rely less on parental guidance. They appear to generate peer rituals that can align with school dictates and motivate student-driven learning (see Rizk and Hiller 2020).

We qualify this argument by conceding that we do not know if digital technology can ultimately narrow gaps in achievement and attainment. The kinds of engagement that we observed among students may not translate into higher test scores or credential attainments. We may have observed fleeting moments of excitement that may dissipate in the coming years and thus not change established patterns of stratification. However, while we cannot readily conclude that digital technology can ultimately reduce class-based inequalities in school achievement, it does appear to engage a broader range of students than does print media. This offers reasons for optimism, since highly engaged students tend to have higher than average achievement. Engagement is correlated with achievement and attainment (Fisher et al. 2011; Joseph 2009; Kennedy 2010; Khodaeifaal 2017; Moller et al. 2014; Robinson and Mueller 2014; Willms 2003; Willms et al. 2009).

Digital technology is becoming nearly universal in workplaces and households (see Smith 2017; Statistics Canada 2017, 2018). Schools are increasingly integrating forms of new technologies in their lessons and classroom activities. Our study directly observed student engagement with digital technology in classrooms, and indirectly explored that engagement in homes through interviews with students and teachers. We found that most students used technology with a ready ease, and engaged with it enthusiastically, and in doing so created tech-based peer rituals that tended to align with school-sponsored tasks. Assuming that digital technology is becoming a mainstay in education, future research is needed to probe whether and how it is subtly shifting the kinds of capacities being rewarded in schools, whether it can foster achievement, and whether it can perhaps even nurture "deep learning" (see Mehta and Fine 2019).

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