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Potential of One-to-One Technology Uses and Pedagogical Practices: Student Agency and Participation in an Economically Disadvantaged Eighth Grade

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Potential of One-to-One Technology Uses and Pedagogical Practices:

Student Agency and Participation in an Economically Disadvantaged Eighth Grade

by

Maria Dulce Silva Andrade Johnson

A dissertation presented to the Faculty of the School of Education,

Loyola Marymount University,

in partial satisfaction of the requirements for the degree

Doctor of Education

2017

Potential of One-to-One Technology Uses and Pedagogical Practices: Student Agency and

Participation in an Economically Disadvantaged Eighth Grade
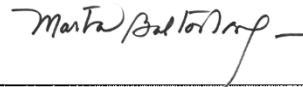
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This dissertation written by Maria Dulce Silva Andrade Johnson, under the direction of the Dissertation Committee, is approved and accepted by all committee members, in partial fulfillment of requirements for the degree of Doctor of Education.

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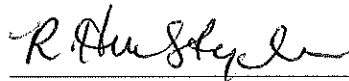
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about respect, about justice, and how much God loves each of us and calls us to do the same with one another.

My life is a tapestry filled with the present, the past, and the future, and you are all part of the colored threads that give it richness and depth. Thank you!

DEDICATION

To my family, including my father whom I never knew.

This one's for you, *paizinho, beijinhos e abraços*.

Mae, David, Blake, my love always and forever.

For all of my friends and colleagues, who've been patient, loving, and kind,

and with whom I intend to enjoy more time together.

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Maria Dulce Silva Andrade Johnson

The accelerated growth of 1:1 educational computing initiatives has challenged digital equity

with a three-tiered, socioeconomic digital divide: (a) access, (b) higher order uses, and (c) user

empowerment and personalization. As the access gap has been closing, the exponential increase

of 1:1 devices threatens to widen the second and third digital divides. Using critical theory,

specifically, critical theory of technology and critical pedagogy, and a qualitative case study

design, this research explored the experiences of a middle school categorized under California

criteria as "socioeconomically disadvantaged." This study contributes to critical theory on

technology within an educational setting, as well as provides voice to the experiences of teachers

and students with economic disadvantages experiencing the phenomena of 1:1 computing.

   Using observational, interview, and school document data, this study asked the question:

To what extent do 1:1 technology integration uses and associated pedagogical practices foster

Margins of Maneuver in an eighth grade comprised of a student population that is predominantly

economically disadvantaged? Probing two key markers of Margins of Maneuver, student agency

and participation, the study found: (a) a technology-enhanced learning culture; (b) a teacher shift

to facilitator roles; (c) instances of engaged, experiential, and inquiry learning and higher order

technology uses; (d) in-progress efforts to strengthen student voice and self-identity.

Accompanying the progress in narrowing economically based digital divides, the data also

demonstrated some tension with the *knowledge economy*. Nevertheless, sufficient margins

existed, associated with one-to-one uses and practices, to result in micro-resistances

characterized by assertion of student agency and democratization potential.

PROLOGUE

This study was informed by my experiences as a non–English-speaking immigrant child of a widowed mother immersed in an all-English speaking classroom, whose educational journey included being the "scholarship" student in various private schools. Originally exposed to Paulo Freire and critical pedagogy during master's work in Latin American Studies, I found that continuing reflection on those ideologies has resonated with my personally encountered barriers and opportunities. At the heart of the learning community is this process of *consientizacao:* "In a humanizing pedagogy, the method ceases to be the instrument by which the teachers…can manipulate the students…because it expresses the consciousness of the students themselves" (Freire, 1970/2000, p. 69).

Within this context, I sought to craft communities that honor learners as agents in their own learning, prioritizing student self-awareness and critical reflection on the systems in which they participate. Volunteering as the technology and media specialist at our son's school, and then teaching large percentages of English Language Learners who also qualified for free and reduced lunch, exposed me to educational technology. I enthusiastically engaged technology in my efforts, encouraging students to use available technology to deepen their knowledge and to develop a sense of agency as they forged the Oregon Trail or challenged Carmen Sandiego and Mario to solve math problems and develop literacy.

Influenced by this early adopter bias, I decided to research 1:1 computing initiatives in my master's and doctoral work in education. Visits to different schools surprised me with the variances of use and practices; I questioned my favorable technology bias, reading about the equity issues emerging from the proliferation of technology into our learning systems. Was

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technology really a helpful tool for all students, or was it a marginalizing factor? The literature affirmed my observations, further noting that the socioeconomic situation of users appeared to be a factor in the variance of technological uses and pedagogical practices.

Conversations with doctoral program professors and colleagues challenged my thinking on 1:1 technology, leading me to reflect again on issues of educational justice through the lens of Freire's critical pedagogy. I had originally thought to investigate the impact of 1:1 on student learning, but my conversations, thinking, and reading kept leading me to another inquiry, closer to my heart and personal journey as an immigrant child entering an unknown environment. As a result, this dissertation explored questions of social justice and equity in the complex dynamic of technology and the extent to which it can be enrolled in a democratizing, humanizing vision for education, providing voice and efficacy to the agency of students who are potentially marginalized, disadvantaged by their economic situation.

CHAPTER 1

INTRODUCTION

The potential for fostering learners' social, educational, ecological, and democratic responsibilities and sensibilities related to technology generally and to educational technology specifically are enormous. Even more, our potential to engage individuals and cultures…could be enhanced with critical theory approaches to educational technology.

— Nichols & Allen-Brown, 2001

Background and Context

Education policy-makers have been launching one-to-one (1:1) technology initiatives that are growing exponentially throughout the United States, as seen in California, Florida, Maine, Michigan, Pennsylvania, Texas, and Virginia, among others (Bebell & Kay, 2010; Boardman, 2012; Crompton & Keane, 2012; Harris, 2010; Keengwe, Schnellert, & Mills, 2012; Lee, 2013; Zheng, Arada, Niiya, & Warschauer, 2014). Articulating a vision for this reality, the National Education Technology Plan of 2010 boldly called for "revolutionary transformation, rather than evolutionary tinkering" (p. 3), claiming that educational technology is essential to our societal and economic flourishing.

Nevertheless, the research has provided inconsistent conclusions about the impact of 1:1 initiatives, ranging from positive learning outcomes to the lack of significant learning effects (Argueta, Huff, Tingen, & Corn, 2011; Bebell & O'Dwyer, 2010; Cuban, 2006; Cullen, Dawson, & DeBacker, 2013; Daniels, Jacobsen, Varnhagen, & Friesen, 2013; Gunn & Hollingsworth, 2013; Lowther, Inan, Ross, & Strahl, 2012). Additionally, various studies in diverse settings have highlighted digital equity concerns regarding pedagogical practices and technology uses that differ along socioeconomic lines. The research has demonstrated that, in many cases, more critical thinking and sophisticated digital literacy skills have been emphasized with economically

advantaged populations versus the lower-order, routine skills that have characterized uses and practices within economically disadvantaged populations.

Other equity issues have included the frequency with which 1:1 has affected students in transformative ways versus ways that replicate existing socioeconomic structures and older systems of learning, with differences that manifest across these boundaries. The findings have questioned the extent to which 1:1 technology implementations with students of economically disadvantaged populations foster democratizing effects on learners and the systems in which they participate (Bebell & Kay, 2010; Boardman, 2012; Harris, 2010; Kemker, 2007; Mouza, 2008; National Education Technology Plan [NETP], 2016; Pack, 2013; Reinhart, Thomas, & Toriskie, 2011; Velastegui, 2005; Warschauer, Matuchniak, Pinkston, & Gadsen, 2010; Warschauer, Zheng, Niiya, Cotton, & Farkas, 2014).

In 2016, the National Education Technology Plan agreed with the extensive body of empirical studies that expressed serious concern over the continuing digital equity gap. The plan's language described the nonacademic achievement outcomes that would characterize what it termed *transformative educational technology*: learner sense of agency, learner belief in themselves as capable and skilled in identifying and solving problems, self-awareness, and forming relationships in collaborative and empathic ways. Further, the recently released NETP update (2017) warned, "Without thoughtful intervention and attention to the way technology is used for learning, the digital use divide could grow even as access to technology increases" (p. 20). The report defined technology uses and pedagogical practices as the critical components in closing the digital use divide.

Statement of the Problem

In the current socioeconomic landscape, educational technology and the Internet have assumed heroic proportions, with claims of advancing academic achievement and creating dynamic, inquiry-based learning environments. Cuban (2001) described the phenomenon as the technology expectation crisis, indicting the deterministic ideology associated with assumptions about educational technology. Rather, he maintained that, in practice, educational technology was marginalizing, minimizing any democratizing effects that the technology might otherwise have produced. Nevertheless, expectations have not only persisted but strengthened. LaFee (2010) quoted Karen Cator, director of education technology at the U.S. Department of Education, "Technology will be in play in every aspect of the education reform agenda" (p. 48).

Perpetuating such a digital divide mitigates the development of the democratizing potential of educational technology and serves the interests of the dominant society (Feenberg, 2010, 2017; Friesen, 2012). The term *digital divide* represents the gap of access to technology and describes the connection between technology uses and socioeconomic differences, particularly in educational settings (Attewell, 2001; Clark & Gorski, 2002; Compaine, 2001; Harris, 2010; Lee, 2013; Warschauer et al., 2014). As technology's role in economies as well as in social and economic exchanges has increased in prominence, digital divide research has evaluated the ways in which lack of access to technology and inequitable uses of technology re-enforce the disempowerment of economically disadvantaged populations.

Researchers have concluded that inequitable access and use of educational technology replicate existing systems of social stratification (Clark & Gorski, 2002; Harris, 2010; Kemker, 2007; Lee, 2013; Pack, 2013; Velastegui, 2005; Warschauer et al., 2014). Whereas educational

technology in economically advantaged settings have provided technology experiences that develop informational and societal literacies, economically disadvantaged settings have often offered less cognitively demanding and lower order uses of technology as well as access differences (Harris, 2010; Kemker, 2007; Lee, 2013; Warschauer et al., 2014). Clark and Gorski (2002) articulated the issue with compelling reasoning:

> A disturbing situation becomes devastating when we recognize that, as with other dimensions of the Digital Divide, those educationally oppressed and repressed by this dimension are the same individuals and groups alienated and excluded by the curriculum, pedagogy, counseling, assessment, and every other facet of formal schooling. (p. 32)

This gap has resulted from the differences in technology uses and pedagogical practices between economically advantaged and disadvantaged populations.

The Three-Tiered Digital Divide

In attempting to provide a frame through which to analyze the concerns regarding digital equity, Hohlfeld, Ritzhaupt, Barron, and Kemper (2008) enunciated the educational digital divide as a three-tiered divide:

1. Level 1: Access (hardware, software, infrastructure, bandwidth)

2. Level 2: Teacher and student uses in learning

3. Level 3: Student empowerment through connection to life experiences and interests

The authors concluded by advocating a dismantling of the second and third levels of the digital divide, citing evidence that the first level was closing.

In agreement with Hohlfeld et al. (2008), studies have reported a progressive "closing" of the first-level digital divide, related to access (Becker, 2006; Cusi, 2007; Gorski, 2005; Kemker, 2007; Reinhart et al., 2011; Warschauer et al., 2010; Warschauer, Knobel, & Stone, 2004). However, a growing concern has appeared in the literature for the second-level digital divide, related to technology uses and pedagogical practices, and the third-level digital divide, concerned with technology uses that empower students to participate in issues relevant to their life situations (Cusi, 2007; Gorski, 2005; Hohlfeld, Ritzhaupt, Dawson, & Wilson, 2017; Kemker, 2007; Reinhart et al., 2011).

The research has postulated that economically advantaged learners typically have technology enhanced higher-order thinking tasks as well as more self-directed and choice-based projects. Therefore, they have been better prepared to take roles in the dominant society versus the remediation and lower-order skill drills that learners who are economically disadvantaged have typically used (Cusi, 2007; Gorski, 2005; Harris, 2010; Lee, 2013; Reinhart et al., 2011; Velastegui, 2005; Warschauer et al., 2010; Warschauer et al., 2014). Pervasive evidence has supported the argument that, in most cases, educational technology and 1:1 learning environments perpetuate and even exacerbate societal inequity that re-enforces class distinctions.

The Digital Equity Imperative

Digital equity is increasingly important for two reasons:

- as the number of 1:1 initiatives grow, so do the potential negative impacts of 1:1 technology on equity;

- the percentage of children living in poverty has escalated, with 21–23% of California children living below poverty levels and an additional 21–23% living

in low-income families (Bohn, Danielson, & Bandy, 2015; Yang, Ekono, & Skinner, 2016).

With the growth of 1:1 learning environments, economically disadvantaged students are increasingly susceptible to imbalances of power, privilege, and democratic participation in the sociocultural system of school. Despite this reality, few studies have comprehensively explored the relationship between technology uses, pedagogical practices, and digital equity impacts on students who are economically disadvantaged.

The digital divide creates a transformational imperative for 1:1 technology implementations to promote humanizing education with uses and practices that support potentially marginalized students in asserting their agency to develop technological identities and voices that strengthen their democratic participation in society.

Theoretical Framework

This study used the theoretical framework of critical theory to examine 1:1 learning environments to evaluate 1:1 learning within its contingent ideologies and dynamic. Critical theory, originating in the philosophical movement known as the Frankfurt School, has prescribed technology as a hegemonic tool with a bias toward the replication of dominant cultural values as well as socioeconomic stratification (Feenberg, 2002). In the broad context of critical theory, Feenberg's (2002, 2010, 2017) critical theory of technology asserts that technology has an ambivalent nature, capable of being democratized through the assertion of individual and collective agency. Since it examined 1:1 technology within an educational setting, this study also consulted Freire's (1970/2000) critical pedagogy perspectives to guide application of Feenberg's critical theory of technology within an educational frame.

Critical Theory of Technology

Within this frame, Feenberg (2002, 2010) proposed a critical theory of technology in which intentional and transformational uses of technology result in spaces the he has called the *Margins of Maneuver*. These margins are situations and conditions in which technology users have opportunities to develop their identities and assert their agency. Student-users, then, would be more skilled to engage in the power relations of the learning community as well as in the dominant society, producing a democratizing effect. Feenberg (2002, 2010, 2017) has argued that when people assume the roles of creator, designer, and actor, the advantages of technology can be leveraged through that agency to promote democratic participation in decisions and actions that affect them and their communities.
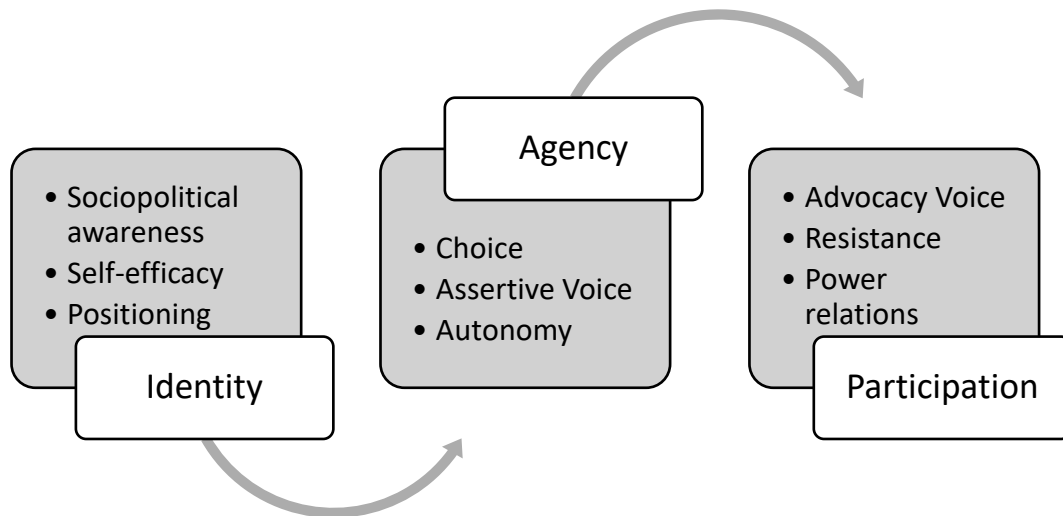
Figure 1. Characteristics of *Margins of Maneuver* in critical theory of technology. (Feenberg 2002, 2010)

Okan (2007) agreed with Feenberg, asserting that educational technology has a complex dynamic that negotiates power between students and societal systems to either marginalize or empower students to strengthen identity, exercise agency, and participate in society. Also

extending Feenberg's critical theory of technology, Friesen (2012) as well as Selwyn (2010) evaluated the role of the dominant class in establishing the ideology of the knowledge economy connected to the technology panacea paradigm. They proposed that the knowledge economy narrative provides a way to minimize the dialogue on social stratification, deferring attention to a belief in technology's ability to close economic and learning gaps. Both authors concluded that technology does not necessarily close those gaps, nor does it necessarily replicate structures of the dominant society. Rather, educational technology is capable of producing democratizing rather than marginalizing effects, depending on its uses and associated pedagogical practices.

To guide these democratizing uses and practices, contemporary theorists of technology agree that the significant characteristic is the fostering of learner agency, the ability of learners to negotiate identity, make choices about their learning, and mediate power relations with the educational system and community (Feenberg, 2002, 2010; Friesen, 2012; Okan, 2007; Selwyn, 2010).

Critical Pedagogy

Paulo Freire (1970/2000) reconceptualized teaching and learning into a participatory model of democracy, emerging to challenge education's social reproduction capacity by using inquiry, problem-posing, and *praxis* to effect transformation. Praxis is an integrative cycle of discovery, dialogue, reflection, and action that develops critical consciousness, particularly in marginalized populations. Freire (1970/2000) argued against the traditional "banking" model of education and for a shift to collective inquiry: "Apart from inquiry, apart from praxis, individuals cannot be truly human. Knowledge emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the

world, and with each other" (p. 72). Critical pedagogy is hopeful, recognizing that people exercising their energy and potential as learners and actors can socially construct liberating knowledge that is relevant to their lives, their histories, and their social positioning.
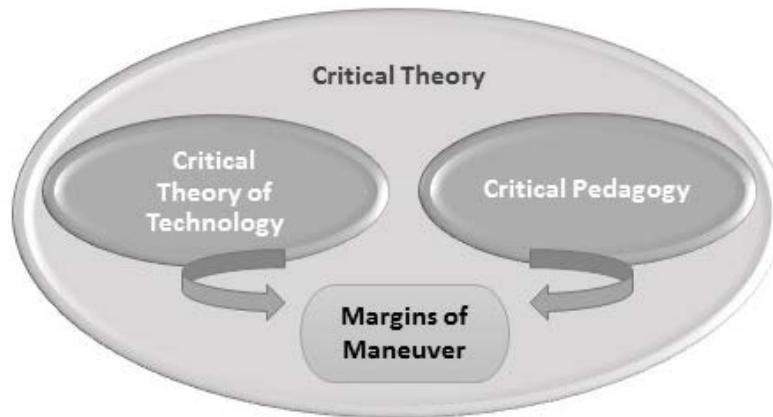
Figure 2. Critical theory of technology and critical pedagogy open margins of maneuver for democratization of technology. (Feenberg, 2002, 2010; Freire, 1970/2000)

Critical stances on pedagogical practices. Within this model, teachers and students engage in complementary activities of inquiry, problem-posing, collaboration, and critical literacy, as well as new modes of assessment (Freire, 1970/2000; Lewison, Leland, & Harste, 2015; McCombs & Miller, 2009; Teemant, 2014). Students are active participants in the learning community who exercise power over their learning and reframe knowledge in response to their reflexive self-awareness. As creators, and thus subject-agents, of their own knowledge, students learn using a variety of sources and perspectives. Students interpret and reframe knowledge in diverse ways, drawing meaning from individual experiences and position learning within authentic situations and dialogic interaction.

Teemant (2014) is a sociocultural educator who realized the importance of critical pedagogy's praxis through her experiences with English Language Learners. She has described

learning as "an outcome of the teacher-student relationship, which is an active, dialogic, social, and culturally shaped space" (p. 50). Teemant and Hausman (2013) applied praxis as a *critical stance* standard in developing and validating a pedagogical rubric, *Six Standards for Effective Pedagogy,* as practice-based recommendations for critical pedagogy. Stressing the importance of identity and agency, Teemant, Leland, and Berghoff (2014) pointed out that students who are part of potentially marginalized populations "need to be comfortable with hybrid identities, competent in reading power relations and challenging assumptions, and agentive in the face of inequities" (p. 137).

Aligned to Freire's and Teemant's stress on critical stance within the development and application of critical pedagogy, Lewison et al. (2015) developed a framework of literacy practices. These focus on Freire's (1970/2000) critical stance in which students interrogate power and culture, consider alternative ways of being, interrogate and reflect on their experiences, and take action to promote justice within their scope of influence. Alongside critical theory on technology, critical pedagogy influences the formation and actions of Feenberg's (2002, 2010) Margins of Maneuver.

Purpose of the Study

This study examined the potential of 1:1 technology uses and pedagogical practices to foster Margins of Maneuver that emerge from strengthened learner agency to provide opportunities for democratic social participation and micro-resistances to the dominant society. Comprised of autonomy, voice, identity, and self-efficacy, agency positions technology within the Margins of Maneuver (Feenberg, 2002, 2010) as a democratizing lever. Investigating the dynamics of these margins evaluated the exchanges of power, assertion of student agency, and

the historicity of the phenomenon of educational technology. The results have contributed to the existing research on a critical theory of technology and on strategies for narrowing the second and third levels of the digital divide within the context of a 1:1 initiative.

Research Question

The research evaluated the following question: To what extent do 1:1 technology integration uses and associated pedagogical practices foster Margins of Maneuver in an eighth grade comprised of a student population that is predominantly economically disadvantaged?

Significance of the Study

The study's findings contribute to existing theory and research regarding the application of critical theory of technology to the educational digital divides and 1:1 technology implementations. These findings shed light on the effects of technological uses and associated pedagogical practices to foster democratizing Margins of Maneuver, student agency, and democratic participation. Many studies have addressed academic achievement outcomes, such as reading, writing, math, and other measurable learning. Nevertheless, few studies have investigated the impact of 1:1 technology on the identity and agency of the learner; and, how these factors empower students who are potentially marginalized students for democratic participation in the dominant society (Friesen, 2012; Oliver, 2013; Selwyn, 2010). This research furthers critical discussion on issues of learner agency and technology, as well as on the design, uses, and purpose of 1:1 technology within the experience of students who are economically disadvantaged.

Analysis of learning and classroom practices that foster learner agency related to technology—defined as autonomy, voice, identity, and self-efficacy—have created analytical

generalizations. The research, then, serves as a platform for future research of these proposed generalizations in other settings, to help fill the gap in the literature, raising potential questions as well as the possibility of replication.

The results of the analysis might inform 1:1 policy recommendations, with positive impacts on democratizing learning outcomes, agency formation, and the digital divides with students who are economically disadvantaged. Additionally, the study's findings give voice to the 1:1 experiences of the principal, teachers, and students at a school with a predominantly economically disadvantaged population.

Given its influence in contemporary society, technology represents a critical set of skills and usage that is essential to power as well as access to political and socioeconomic systems. The socially just educational leader seeks to discover and animate 1:1 technology uses and associated pedagogical practices that foster participatory student decision-making as well as agency. Therefore, this research may help guide socially just educational leaders in formulating policies to implement 1:1 technology integration that leverages its potential to act as a democratizing tool to affect transformative change in their learning communities.

Methodology

Site Selection

The study was pursued in an eighth-grade setting comprised of a majority of economically disadvantaged students with 1:1 computing access that included sufficient bandwidth and other resources. Bandwidth and resources were criteria for selection, so that the research could focus on 1:1 technology integration uses and associated pedagogical practices rather than on technology infrastructure conditions that might affect findings. San Vincente

Unified School District (pseudonym) was one of the largest school districts in California, with a predominantly Latino/a student population (92%). Approximately 91% of the students qualified for free or reduced lunch and about 46% of the students qualified for English Language Learner (ELL) support. The district was completing its three-year old implementation of 1:1 technology, using Chromebooks throughout its sixth, seventh, and eighth grades (SARC, 2015–2016).

Within this school district, the research took place at Granada Middle School whose vision had been to offer a "balanced and equitable education in a safe, respectful and positive 21st century school" that seeks to evaluate and engage the "diverse interests and needs of all stakeholders (school website). Of the 1,328 students, 496 comprised the eighth grade that was the subject of this study. The demographic information indicated that 92.5% of the students were Latino/a and that 96.4% were designated by the state of California as "socioeconomically disadvantaged," based on parent income and qualification for free or reduced lunch. Additionally, 32.9% were ELL while 13.4% qualified for special education services. All teachers held a full credential, and all of the credentialed teachers have had training in methods of teaching ELLs; 100% of the teachers at the school fulfilled the requirements of "highly qualified teachers" (SARC, 2015–2016). Selection factors for the school included the stated commitment to problem-based learning, 21st-century design learning, and 1:1 technology as well as its demographic profile that meets the delimitation of a predominantly economically disadvantaged student population.

Research Design

Because educational technology is phenomenal, causing broad changes in the learning landscape, a qualitative approach was best suited for this study as it appropriately explores and

unpacks the meanings that groups and individuals develop within their social constructions and interactions (Flick, 2014; Lichtman, 2010). The study used a phenomenological case study design because the research questions aligned with a close reading of a social unit—administrators, teachers, and students in a school setting—sharing the same experience of educational technology. Studying the details of the experience in the real-life context of a case study provided insight to the conditions and factors that affect 1:1 technology uses and pedagogical practices, leading to interpretations of the phenomenon with grounded rich descriptive detail (Creswell, 2014; Flick, 2014; Yin, 2011). The study utilized an emergent approach to the data gathering and analysis, coding themes drawn from the observations and field notes, interviews, and documents to categorize data according to patterns, themes, and relationships (Creswell, 2014).

A variety of collection techniques resulted in different sources of data for triangulation, providing stronger validation to the data (Creswell, 2014; Flick, 2014; Yin, 2011). This study's collection methods, mostly grounded in ethnographic methodology, included:

- Observations and field notes of several separate observations in nine classrooms, of students and teachers within the setting of the language arts, newcomers language arts, social studies, dual immersion social studies, science, and science/technology/ engineering/art/math (STEAM) classes, in different learning blocks throughout the day.

- Recordings and transcripts of two interviews with the principal regarding technology uses and pedagogical practices as well as equity implications for economically disadvantaged students.

- Recordings and transcripts of two interviews of six teachers of Newcomers Language Arts, dual immersion social studies, science, and science/technology/ engineering/art/math (STEAM) classes, regarding technology uses and pedagogical practices as well as equity implications for economically disadvantaged students.

- Recordings and transcripts of six student interviews regarding their experiences at the school, and with technology, specifically.

- Documents comprised of the district Local Community Accountability Plan (LCAP), the district technology plan, school websites and communication, student work artifacts, and teacher lesson plans.

The analytical, inductive process consisted of coding for patterns and themes as the study progressed, using hand coding with the digital tool of OneNote Notebook. The coding process used the actual language and actions of the participants to systematically group frequently used words and phrases as well as repeated themes and actions into categories. Examining categorized codes revealed patterns and connections, considering outliers and rival explanations in the data.

Data analysis occurred throughout the course of the study, as recommended by Miles and Haberman (1994). Conducting analysis simultaneously with the various stages of data collection helped to identify potential areas for deeper data gathering and subsequent analysis to develop the rich, thick descriptions needed for case study design (Creswell, 2014; Yin, 2011). Interim notations were prepared to make meaning of the data as the study progressed, considering data implications. Final analysis of themes illuminated the research question to contribute to existing theory, identifying possible 1:1 technology uses and pedagogical practices that have democratizing potential for 1:1 technology implementations.

Delimitations

The scope of this study examined issues of the digital divide in a single educational technology environment: a 1:1 implementation in a predominantly economically disadvantaged eighth-grade setting across various content areas. The study's findings concerned data collected from November 2016 to March 2017. With an intentional focus on examining 1:1 technology uses and associated pedagogical practices that have potential to foster Margins of Maneuver, this study investigated the perceived outcomes, and, specifically, learner agency formation, resulting from those uses and practices.

There are various classifications of societal and educational inequity in the context of digital divide discussions; the research focused on the student's economic situation. The study did not intentionally select for other factors related to digital divides—such as race, linguistic differences, gender, and ethnicity—as the selection focus related to the economic context of the case study population. Because the study focused on technology uses and pedagogical practices with positive impacts on learning and the digital divide, it did not intentionally analyze logistics, funding, equipment, and maintenance. Nevertheless, some of these factors had significance as the researcher examined the data or for consideration in replicated studies.

Limitations

Qualitative data comprised the data source for the study; therefore, quantitative measures were beyond the scope of this study. Students, teachers, and principal interviews, observations, and document data were gathered at only one school site over several months; therefore, the results are limited in their capacity to be generalized.

The researcher's position as a former principal of a computer software company, as well as her early adopter status of educational technology, created the possibility for inherent favorable bias toward technology that might skew the analysis of the data findings or overlook confounding variation. At the same time, the length and breadth of the researcher's experience with consumer and educational technology enhanced the researcher observations and analysis. The researcher experiences varied: designing consumer software; implementing educational technology options from media center to carts to 1:1; developing and training others in diverse pedagogical approaches enhanced by technology. The breadth of experience and longitudinal engagement with educational technology allowed a depth of understanding and authenticity in both data gathering and analysis than might otherwise have been possible.

Definition of Terms

1:1 (one-to-one) computing: A learning environment in which all students have access to a laptop or tablet; configurations may differ from continuous, 24/7 access to modified, scheduled access, depending on the site and implementation. Also known as *ubiquitous or immersive computing.*

Activator (Teacher): A set of teaching practices that describes a more active style of teacher facilitation, in which the teacher prompts, provides feedback and frequent checks, and engages students in reciprocal teaching; higher effect on student learning, according to Hattie's 2009 meta-analysis as cited in Fullan (2013) and Gregory (2016).

Agency: Agency is the ability of an individual to reframe and negotiate his or her identity and choices, as well as exert power and decision-making within the existing historicity of a system.

College and Career Readiness: A term that refers to the set of skills and dispositions that a student should possess to be ready to pursue benefit from college and career; the most recent definition consists of four key components: (a) cognitive strategies, (b) content knowledge, (c) academic behaviors, and (d) contextual and awareness skills (Conley, 2011).

Culturally responsive practices: A set of teaching practices and learning activities that are responsive to student home and cultural background experiences, creating relevant and appropriate learning objectives connected with the reality of student lives.

Democratize/democratization: A term referring to conditions, relations, and practices that foster the full and equitable participation in the resources, benefits, decisions, and power dynamics of a society or social system.

Digital equity: A term referring to the equitable and just participation of all people in the digital aspects of society, from access to usage, across settings, race, gender, and socioeconomic status.

Economically advantaged: A term referring to populations with middle, upper-middle, and upper categories of income and wealth levels, per reporting of government agencies; there are various facets of privilege often associated with groups at these levels.

Economically disadvantaged: A term referring to populations characterized by high levels of poverty and/or low income, per reporting of governmental agencies.

Note on use of "economically:" This term is used in lieu of "socioeconomically" because the marriage of sociocultural and economic factors carries an implicit assumption that lower levels of income or wealth also result in sociocultural disadvantages. The loading of such an assumption reflects deficit thinking in associating wealth with "higher" sociocultural values and

low income with "lower" ones. The researcher assessed the use of "socioeconomically disadvantaged" or "high and low socioeconomic status," therefore, as unjust and inaccurate generalizations, devaluing the potential richness of non-dominant cultures and social structures. For example, people of lower income may have rich cultural traditions and/or strong family bonds that constitute higher sociocultural strengths.

Knowledge economy: Current globalized economy consisting of knowledge-intensive activities in both production and services; privileges intellectual or knowledge capital that contributes to an accelerated pace of technological and scientific advances as well as promoting assumptions that such advances will result in greater socioeconomic equity.

Learning community: This refers to the human and political frames, the people who work together in schools to forge shared meaning, vision, identity, and purpose.

Learning outcomes: The skills, knowledge, and competencies acquired through participation in an organized learning program.

Marginalize/ing: A term referring to conditions, relations, and practices that situate a group of people to the "margins" of participatory decision-making, excluding them from an equitable share of the resources as well as the benefits of a society.

Position/ing: Refers to the visible the ways in which people accept, use, resist, refuse, or exploit the discourses in the systems in which they exist, to constitute and reconstitute their relationships, understandings, and power.

Socioeconomic/al: Factors of sociocultural background and economic class, such as income and wealth, race, ethnicity, gender, etc.

Student-centered or learner-centered: A learning environment in which teachers coach or guide students as they actively learn from each other and on their own; students may often exercise choices in learning goals, activities, pacing, and assessments. They co-construct knowledge and meaning from experiences and multiple sources, and use a variety of tools to evaluate and apply knowledge.

Teacher-centered: A learning environment in which the teacher directs instructional activities, content, and pacing; often accompanies heavy reliance on scope and sequence charts and textbooks with the percentage of teacher talk and activity typically exceeding student talk and activity.

Technology integration: In this study, this term means utilization of various digital platforms and tools as resources to engage students in active models of learning.

Ubiquitous computing: A term used to denote 1:1 immersive technology implementations.

Organization of the Dissertation

The acceleration of 1:1 technology implementations has created an urgent need to provide economically disadvantaged students cognitively rich technology uses and associated pedagogical practices, enabling democratizing rather than social replication effects. This study investigated the potential for fostering student agency and democratic participation, associated with 1:1 technology integration uses and pedagogical practices, in an eighth grade that was predominantly economically disadvantaged. Chapter 1 has provided the context as well as a theoretical framework summary from which the problem statement, the purpose, and significance of the study emerge. The chapter has also described the research methodology,

including site selection and types of data gathering techniques, the limitations and delimitations of the research, and a shared definition of terms essential for understanding the study. Chapter 2 reviews pertinent literature on educational technology and 1:1 implementations. The literature review contains sections on:

- the educational technology landscape, including an examination of empirical studies concerning learning outcomes and digital equity impacts of 1:1 implementations;

- the three levels of the digital divide;

- the theoretical framework consisting of critical theory and critical pedagogy, considering critical student-centered practices;

- the dynamics of learner agency, power, and identity;

- the differentials in pedagogical practices and student uses of technology aligned to economic distinctions of student populations;

- exemplars of educational technology with democratizing impacts on learner agency.

Chapter 3 explains and describes the research methods, the criteria for site selection, and detail regarding the ways in which data was gathered and analyzed. Chapter 4 reports the data and findings of the study. Chapter 5 discusses the findings to highlight the potential of 1:1 technology uses and pedagogical practices to foster Margins of Maneuver, to suggest policy implications regarding 1:1 technology implementations in economically disadvantage settings, and identifying areas of possible future study, with an ending reflection and conclusion.

CHAPTER 2

REVIEW OF THE LITERATURE

> The new technology is here. It will not go away. Our task as educators is to make sure that when it enters the classroom it is there for politically, economically, and educationally wise reasons, not because powerful groups may be redefining our major educational goals in their own image.
>
> —Apple, 1986

In investigating the equity concerns of the accelerating trend in one-to-one (1:1) educational technology, multiple studies in various contexts and settings have reported the beneficial effects of student-centered technology use and pedagogical practices on student learning within a 1:1 environment. These same studies, however, have cited strong evidence for a widening of the second- and third-level digital divides. These divides have resulted from the differing uses and practices between economically advantaged and disadvantaged populations (Amankwatia, 2008; Boardman, 2012; Harris, 2010; Kemker, 2007; Matzen & Edmunds, 2007; Murphy, King, & Brown, 2007; Pogany, 2009; Reinhart et al., 2011; Warschauer et al., 2004; Warschauer et al., 2014). In 2016, and again in 2017, the National Education Technology Plan (NETP) warned that the second- and third-level digital divides were increasing along with the increase in 1:1 technology implementations. Because the second- and third-level digital divides refer to the impact of technology uses and pedagogical practices, this study examined their potential to act as a democratizing rather than a marginalizing lever in 1:1 integration.

The theoretical framework that formed the basis for evaluating the democratizing potential of 1:1 computing was Feenberg's (2002, 2010, 2017) critical theory of technology, in which he designates agency as a central characteristic of what he called Margins of Maneuver— spaces within the uses and design of technology that act to promote democratization. Critical

pedagogy also considered agency essential in any form of democratizing education, placing the learner in the center of the learning. The learner engaged in a dialogic relationship, with the teacher, the sources of information, and the learner's historicity and positioning within society (Freire, 1970/2000). Therefore, critical theory in these two interpretations, one referring to technology and the other to pedagogy, was foundational for this investigation.

This review informs the analysis of digital equity issues, as related to economically disadvantaged learners, to examine the extent to which 1:1 technology implementations have had democratizing effects. The discussion begins by examining the development of the educational technology landscape and the phenomenon of 1:1 computing in education. Subsequently, this review details the digital divides and their reported effects. Next, this chapter explains the theoretical framework for the study, comprised of complementary ideologies: critical theory of technology and critical pedagogy. An examination of learner agency and its long-term effects on economically disadvantaged learners follows. Next, an evaluation of empirical studies sheds light on the effects of technology uses as well as pedagogical practices within economically advantaged and disadvantaged student populations. Finally, this review focuses on 1:1 technology exemplars in economically disadvantaged settings that report democratizing effects fostering learner agency.

From the lens of the theoretical framework and empirical studies, this literature review investigates the following research question:

To what extent do 1:1 technology integration uses and associated pedagogical practices foster Margins of Maneuver in an eighth grade comprised of a student population that is predominantly economically disadvantaged?

Analyzing the extent to which technology can help develop learner agency, to foster critical reflection on the dialogue between the lives of learners and the world, has received little attention. Nevertheless, this review of other comprehensive studies provides connections to develop a critical, transformative stance toward the use of ubiquitous computing in education.

Method: Selection of Literature Resources

This review limited itself to literature published between the years 2000 and 2016 for purposes of relevance, with some exceptions in researching historical context and the theoretical framework. Further, the review prioritized empirical studies from 2007 to 2016, to ensure contextual timeliness of the results and findings of the various studies. The focus of the search for literature was threefold:

1. To evaluate digital equity issues in empirical studies, meta-analyses, and technical reports to identify the factors that would narrow the inquiry and guide the research questions;

2. To uncover a theoretical framework in which to position the digital equity inquiry based on the evaluation of initial readings; and

3. To identify and consult empirical studies specifically concerned with differences in technology usage related to the economic positioning of the study's participants, particularly those with a critical perspective.

The process for the search included search engine parameters in EBSCO Host and ProQuest: "digital equity," "digital equity 1:1 computing," "effects of 1:1 computing," "educational technology low SES," "critical theory of technology," "educational technology and critical theory," "equity in technology uses," "agency and technology," "democratization and

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technology," "leadership 1:1 computing," "teacher beliefs 1:1 computing," "critical theory," "constructivism 1:1 computing," "constructivism and technology," and " critical theory and educational technology." Resources were imported to Zotero, a digital research organizational tool, as well as mapped into a literature review matrix that summarized key findings, theories, methodologies and context, codes, and limitations or significance.

The selected articles were mostly from peer-reviewed educational and educational technology journals, with some journals in the disciplines of sociology and cultural studies; the researcher narrowed selections through a reading of abstracts, key words, and a quick scan of the article. The researcher also consulted various books and dissertations. A critical reading, with highlights and annotations, established common themes that translated into classification codes relative to the research question and cross-referenced with the theoretical framework.

Aspects of the Educational Technology Landscape

The dominance of the knowledge economy and its accompanying ideology of technology as a transformative agent in education has resulted in the exponential growth of educational technology (Friesen, 2012; Halverson & Smith, 2009; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011; Warschauer et al., 2004). In 2002, a market study reported that in 73% of all schools, teachers access and use the Internet regularly for instructional purposes and that 80% of teachers use computers daily (Market Data Retrieval, 2005). Policy makers have predicted that the investment in materials and professional development opportunities would act as a catalyst for educational technology, driving disruptive and widespread changes in teaching and learning (Halverson & Smith, 2009; Shapley, et al., 2011).

Nevertheless, the expected transformation was very limited in scope—student computer uses when compared to teacher computer use for administrative or lesson planning tasks showed low levels of frequency as well as nontransformative tasks that potentially exacerbated inequity (Becker, 2006; Cuban, 2001; Cusi, 2007; Halverson & Smith, 2009; Warschauer et al., 2010; Warschauer et al., 2014). Cuban (2006) specifically challenged the premise that educational technology would improve learning as well as learner self-efficacy and agency; further, stating that until teachers had integrated technology resources into nonmarginalizing practices, technology's transformative potential would be minimalized. This next section describes the evolution of 1:1 computing to explore the potential for technology to foster democratization through promoting learner agency.

One-to-One Computing

In the evolution of 1:1 computing, there have been three significant milestones. In the late 1980s, Apple Computer developed the Apple Classrooms of Tomorrow (ACOT) initiative, providing desktop computers to selected schools (Dwyer, 1994). ACOT also provided participants with computers for home use to leverage the anticipated benefits of ubiquitous computing. Both educational leaders and ACOT hoped the initiative would help students increase their learning and productivity with this level of access. Microsoft Corporation and Toshiba America Information Systems were next into the fray, collaborating in the Anytime Anywhere Learning Initiative (Rockman, 2003, 2007; Rockman et al., 1998). This initiative was more far-reaching than ACOT, providing over 50 schools in various settings with laptops and productivity software. Both the ACOT and Anytime Anywhere initiatives aimed to test the potential of 1:1 computing to improve student learning and create more student-centered learning

environments, but neither had clearly defined desired outcomes or impacts related to the digital divide (Harris, 2010).

Then, in 2002, the state of Maine launched its statewide initiative for seventh- and eighth- grade students, providing each student with a laptop computer, affecting 20,000 students and teachers in its first year (Boardman, 2012; Silvernail & Lane, 2004). The Maine initiative provided teacher training as well as curriculum development and, according to Harris (2010), Maine Governor King did allude to reducing the digital divides as a desired outcome but the Maine report never articulated specific findings on the divide.

Nevertheless, few studies have attempted to measure the democratization impacts of 1:1 computing. In the wake of Maine's "success," other states and districts followed suit with 1:1 technology implementations across Florida, Texas, South Dakota, Pennsylvania, Washington, and Virginia (Amankwatia, 2008; Bebell & Kay, 2010; Boardman, 2012; Holcomb, 2009; Keengwe et al., 2012; LaFee, 2010). Current estimates have predicted that 1:1 computing may reach a 70 to 80% threshold within the next five years, creating a critical threshold to investigate strategies and outcomes for its implementation (Lee, 2013).

Expectations of 1:1 Computing

The claims for 1:1 computing have been that: (a) students will be more engaged in their learning; (b) students will experience deeper and more complex learning; and (c) students will experience learning that is more authentic. Together, these claims have painted a picture of learning responsive to student interests and choice taking place within a more culturally responsive, student-centered environment (Boardman, 2012; Harris, 2010; Holcomb, 2009; Inan

& Lowther, 2010; Kopcha, 2010; Matzen & Edmunds, 2007; Mundy, Kupczynski, & Kee, 2012; Zucker, 2004).

Learners in 1:1 classrooms have experienced more frequent technology use, and have extended their 1:1 classroom experience by using computers more frequently at home, spending more time both on homework and self-directed tasks (Rockman, 2003; Rockman et al., 1998; Russell, Bebell, & Higgins, 2004). Increased use has also resulted in increased student proficiency with technology, being able to use a broader range of tools in software applications. A final effect reported by studies has been that classroom structures have shifted from large group to students working independently or to small groups in more student-directed activities (Boardman, 2012; Harris, 2010; Rockman , 2007; Rockman et al., 1998; Russell et al., 2004; Zucker, 2004).

Digital Divide

D*igital divide,* a term that surfaced in the literature in the 1990s, describes the technology-related increase in social stratification regarding control, privilege, and power among various groups of people based on racial, gender, ethnic, and economic distinctions (Attewell, 2001; Becker, 2006; Becker, Ravitz, & Wong, 1999; Bolt & Crawford, 2000; Compaine, 2001; Hargittai, 2003; McConnaughey & Lader, 1998). A series of national studies commissioned by the National Telecommunications and Information Administration identified this digital divide within education by measuring different sociocultural groups' access to educational technology, considering characteristics of income, race, ethnicity, age, and education (Compaine, 2001).

The lack of access and availability severely impaired the actual impact of educational technology, as reported by McConnaughey and Lader (1998), who asserted that educational

technology increases the gap between the "haves" and "have-nots" because it can only benefit those who have access to computers, modems, and the Internet, which is typically the middle to upper classes. Strengthening this assertion, Attewell and Battle (1999), in their survey statistical study, concluded that the use of educational technology benefits the academic growth of economically advantaged students more than of students who are economically disadvantaged.

From this earlier work, the literature continued to demonstrate a gap of both access and use regarding educational technology, one that aligned with economic and sociocultural distinctions. Various studies have theorized that the digital divide both continues and strengthens socially replicated patterns of inequity (Attewell, 2001; Becker, 2006; Clark & Gorski, 2002; Harris, 2010; Lee, 2013; Warschauer et al. 2004; Wenglinksy, 2005). Because of the increasing importance of technological access and skills to participation in society (Feenberg, 2002, 2010, 2017; Friesen, 2012; Harris, 2010; Lee, 2013), the disproportionate access and use threatens to deny economically disadvantaged students access to equitable participation in social and economic benefits.

Digital Divide Levels

Synthesizing previous digital divide studies, Hohlfed et al. (2008) proposed a three-tiered digital divide framework that subsequent research has continued to utilize. The three tiers of the educational digital divide model relates to technology access, teacher and student use of educational technology, and student self-efficacy outcomes resulting from educational technology uses.

The first-level digital divide concerns itself with inequitable access to devices, software, infrastructure, and the Internet. The first level is foundational, because the other two levels

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cannot exist without first considering the issue of access (Becker, 2006; Harris, 2010; Hohlfeld et al., 2008).

The second level of the digital divide refers to the ways in which teachers and students use educational technology. In situations where access has been available, this level expresses the evidence that economically advantaged communities typically exhibit higher-order uses than economically disadvantaged ones. Additionally, economically advantaged learning communities typically have teachers who are more motivated and trained to integrate technology into higher-order learning experiences (Harris, 2010; Hohlfeld et al., 2008; Lee, 2013).

Finally, the third level of the digital divide is a narrower one, sometimes applying to economically advantaged as well as economically disadvantaged students, although it is closing more quickly for economically disadvantaged learning communities, with their associated human capital and resource allocations. This third level references the student self-efficacy resulting from technology uses connected to student interests and interactions with the larger community, having direct impact on the learner as agent who exercises democratic participation in society (Harris, 2010; Hohlfeld et al., 2017; Lee, 2013; Wenglinsky, 2005). Because more cognitively demanding, higher-order research, critical inquiry, collaboration, and communication uses developed in the second digital divide are necessary to exercise agency and address third digital divide issues, these two levels are intimately connected.

3rd Level: Student Agency

⇧

2nd Level: Classroom Uses (higher / lower order)

⇧

1st Level: Access to Devices, Software, Internet, Infrastructure
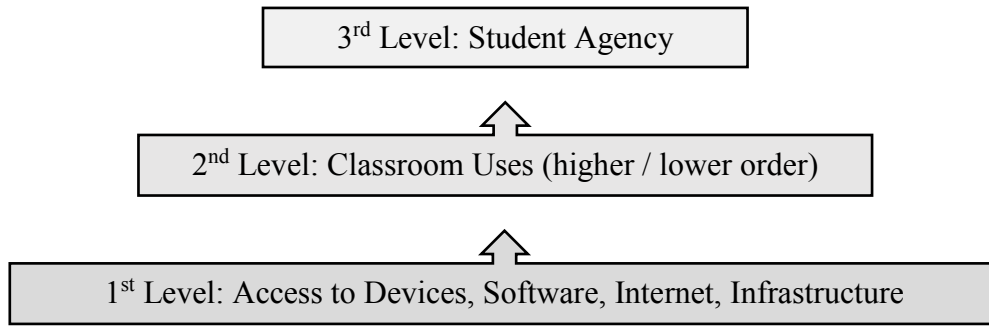
Figure 3. Three levels of the digital divide. (Hohlfeld et al., 2008)

The three tiers or levels of the digital divide consist of access, use in the classroom, and empowerment or agency effects. Much of the current research has demonstrated that the first-level digital divide—comprised of inequitable access to hardware, software, infrastructure, and the Internet—is closing (Harris, 2010; Kemker, 2007; Mouza, 2008; Reinhart et al., 2011; Warschauer et al., 2010; Warschauer et al., 2014). Supporting these studies, the National Center for Education Statistics (2010) reported that the ratio of students to computers with Internet access had improved from the 2000 level of 7:1 to 3:1 in 2008.

As the first-level divide has been narrowing, the second- and third-level divides have appeared to be increasing. The continued exponential growth in access has aggravated the differences in technology use that authentically support learning. As more computers become available and 1:1 implementations continue to expand, the differing uses of technology along socioeconomic lines has become more visible. Studies have demonstrated that economically advantaged students use educational technology for higher-order tasks and for developing voice as well as independently motivated research skills related to their interests. Economically disadvantaged students, however, have shown predominant patterns of lower-order tasks, such as remediation, routine drills, or behavior rewards (Bebell & Kay, 2010; Becker, 2006; Harris,

2010; Kemker, 2007; Mouza, 2008; Pogany, 2009; Reinhart et al., 2011; Valadez & Duran, 2007; Warschauer et al., 2004; Warschauer et al., 2010; Warschauer et al., 2014).

The research on the second and third levels of the digital divide has informed critical theory on technology, supporting the potential for educational technology to become a powerful democratization tool, but one dramatically impacted by the uses of technology. Continuing gaps in use aligned with the economic situations of learners will aggravate socioeconomic disenfranchisement. As such, investigating which technology uses and pedagogical practices hold potential for fostering student agency, thereby helping to close the second and third level digital divides, is a critical concern.

Theoretical Framework

A survey of the literature revealed concerns with the ideology that promotes educational technology as a panacea for increasing learner self-efficacy, empowerment, and independence. Critical theory's role is to "uncover forgotten contexts" in historicizing and contextualizing common "truths" to reveal the underlying power and socioeconomic dynamics (Feenberg, 2002; Freire, 1970/2000; Friesen, 2012; Kellner, 2003). Critical theorists have warned against the programmed conflation of technology with liberating outcomes, identifying the *knowledge economy* as a threat to full democratic participation (Friesen 2012).

To understand this warning, this section first summarizes the nexus of two critical theory branches: critical theory of technology and critical pedagogy. Then, it continues with the background of the Frankfurt School, the foundational community for critical theory. Next, this study evaluates Feenberg's (2002, 2010, 2017) current critical theory of technology which maintains the possibility for the democratization of technology. Lastly, this study consults

Freire's (1970/2000) landmark work on critical pedagogy to apply the critical discussion within an educational setting. The critical stance of critical pedagogy as applied through *Six Standards for Effective Pedagogy* (Teemant & Hausman, 2013) provides practical considerations to the theoretical framework.

The Nexus of Critical Theory of Technology and Critical Pedagogy

Critical theory's interrogation of historicity as well as socioeconomic systems and power dynamics evaluates alternatives beyond the "self-evident" ways in which societies have organized themselves. Within the context of educational technology and 1:1 technology implementations, critical theory of technology (Feenberg, 2002, 2010, 2017; Okan, 2007) maintains that user agency and voice are capable of shaping the design, use, and purpose of technology to result in democratic participation in society. Critical pedagogy emphasizes the importance of agency and voice, as expressed by the learner, to think, reflect, and take action. In doing so, learners strengthen their identity and engage in dialogue with society, their teachers, and one another. These foundational aspects of both theories open up the spaces known as Margins of Maneuver that affect the democratization of technology. Figure 4, below, provides a visual representation of the theoretical framework, its components and connections.
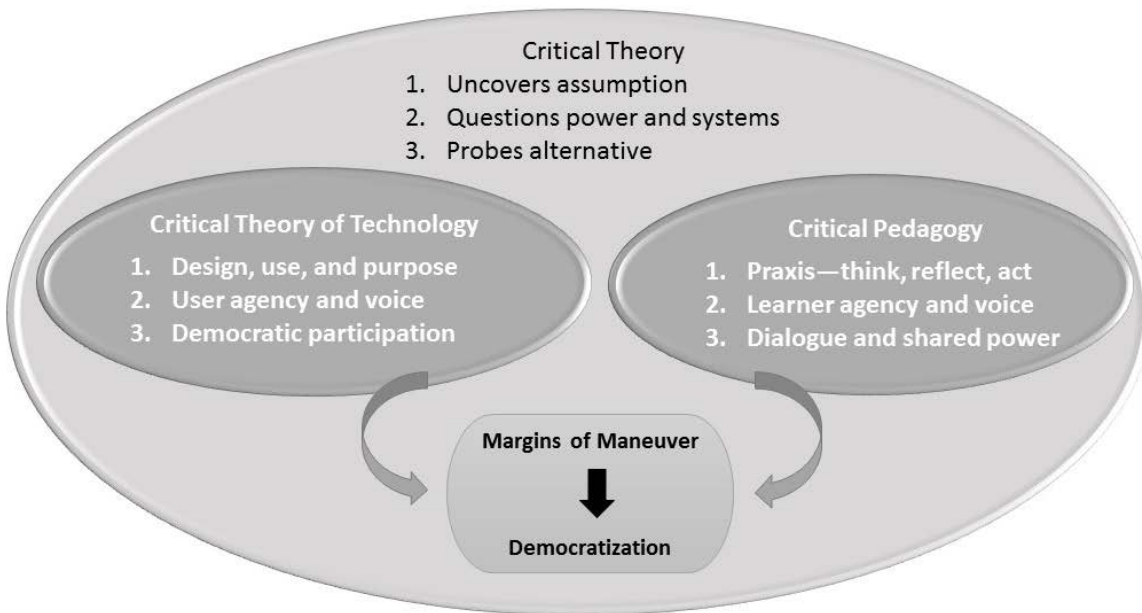
Figure 4. Theoretical framework representation. (Feenberg, 2002, 2010, 2017; Freire 1970/2000)

Critical Theory

The Frankfurt School was a philosophical school, initially comprised of German philosophers working in the Western European Marxist tradition. Central to Frankfurt School thinking was the premise that all objects and events have the potential to be subverted to the interests of the dominant class, or by its nature, to serve those same interests (Feenberg, 2002; Friesen, 2012). As a logical result, all knowledge has emerged from its historical context and carried political implications.

The Frankfurt School critically interrogated the objects and events that comprise knowledge, particularly those presenting themselves as "self-evident." For purposes of this discussion, a "self-evident" truth is one considered true without question, based on its own nature and outcomes. As such, this type of truth is beyond political considerations or examination to uncover the interests that have formulated a particular knowledge as "self-

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evident." Citing Nichols and Allen-Brown (1996, p. 226), Friesen (2012) defined the purpose of critical theory in the following way: to "make problematic what is taken for granted" and to challenge "self-evident" truths that promote the interests of social justice and the oppressed.

From a critical perspective, technology held that privileged position of a self-evident truth, as an event deemed critical to society's development and success. Critical theorist Feenberg (2010) wrote:

> Technology was a key example and source of reification for Lukacs and…the first generation of the Frankfurt School… The agency of the individuals was ever more successfully channeled as they adapted to this technological "second nature" which…had spread from work to every aspect of life. (N.P.)

The apparatus of maintaining technology's benefits and role as a "self-evident" truth was then used to advance the agency of corporate and elite classes, supporting and re-enforcing the existing socioeconomic structure, while mitigating the agency of those being dominated by these interests (Feenberg, 2010; Friesen, 2012).

As a result, many critical theory adherents envisioned technology as a hegemonizing tool of the dominant culture with an inherent bias to advance further standardization and promotion of dominant cultural values. As technology continued to spread, critical theorists in various disciplines probed the nature, design, use, and promotion of technology within the associated socioeconomic dynamics and power exchanges. New critical voices challenged the prevailing critical view that technology had a fixed trajectory and began to discuss the alternative possibilities for technology.

Critical revision: Democratization potential of technology. In a collection of seventeen 1968 papers published in 2000, Theodor Adorno offered the proposition that technology itself is not the problem, but rather the subversion of its potential:

> It is not technology which is calamitous, but its entanglement with societal conditions in which it is fettered…By contrast, those of its potentials which diverge from dominance, capitalism and violence against nature, and which might well allow much of the damage done literally and figuratively by technology to be healed, have withered. (pp. 161–162, note 15)

In a 1965 lecture published in a 2001 collection of his papers, Marcuse agrees that technology's tendency towards oppression results from external influences. As such, technology's rationality for liberating potential has become "withered," requiring counter-action from external forces of those interested in reframing technology's design and uses for democratizing potential.

Critical Theory of Technology

Informed by these critical stances, Feenberg (2002) revised the early deterministic stance of the Frankfurt School, as well as countering the historical instrumentalist assertion that technology was merely a neutral tool without ideology. He developed a compelling argument that technology was neither free of designer or user systemic bias nor determined to be merely a tool of the dominant society.

The author reframed principles of Marxism and Socialism to advance his critical response to the Frankfurt School's defining of technology as a de-humanizing—a "de-worlding" force that inherently created inequities. Feenberg (2002) argued against substantivism, a stance that a "substance" such as a phenomenon or event, has a predetermined effect characteristic. A

tool could not have a determined, inherent effect since its effects were dependent on its uses. Neither, however, was a tool indifferent or neutral, as its very design and being arises from a historical set of social and economic ideologies that continue to affect its uses and the aligned mythologies.

Feenberg (2002) stressed the need to place technology within its socio-historical constructs to understand the conditions and practices that foster liberating versus hegemonizing uses. Therefore, he maintained, technologies were not merely hegemonic substances, but rather could be democratization tools through transformative intentions and uses, citing various examples of Internet-driven movements against the dominant class (Feenberg, 2002, 2010, 2017).

Significantly, Feenberg (2002, 2010, 2017) asserted that, in fact, technology must be democratized in order to provide human agency and moral contextualization to its uses that extend beyond the desires of the dominant class. With society adopting a techno-positivist epistemology, technological power has become the principal lever in society and can either represent the narrow, oppressive interests of a few or constitute a path through which the many may access power and participation in society.

Feenberg's (2002) *Margins of Maneuver*. Because of technology's potential as a democratization lever, within the possible designs and uses of technology and their dialogue with various classes of users, opportunities existed for micro-political resistances capable of "desirable and possible margins of maneuver" (Feenberg, 2002, p. 138). In its most fundamental sense, democratization of technology required new ways of privileging excluded classes,

cultures, and values to provide them with a voice through the exercise of agency over the technology, a role typically reserved to the interests of the dominant class.

The democratization that Feenberg (2002, 2010) espoused as the proper context for a liberating technology enabled its users to exercise power, to act, and to open a wider range of values in the sociopolitical discourse that reflects the potentialities of human existence. The action of reframing technology opens up a "democratic transformation" fostered by human beings with autonomous agency. This reframing transforms the use of technology through feedback loops, distributed control, and increased communication that allows individuals to influence and change the design and uses of technological systems.

The process followed Heidegger's "mode of revealing" (Feenberg, 2002, p. 176) the world pattern, exploring histories, cultural values, social and structural interactions, re-contextualizing them into new relationships as subjects. Feenberg proposed, "It is only because technology has these integrative potentialities that it can be enlisted to repair the damage" (p. 177), transcending its deterministic definition as a hegemonic tool. Thus, the social construction of technology's usage could redirect and democratize the bias of the internal dialectic of technology as historically shaped.

Applying Feenberg (2002) to educational technology. Building on the work of Feenberg, Okan (2007) presented a well-sourced theory that maintained that technology was not neutral because it facilitated and, therefore, embodied certain forms of thinking that created a learner's world orientation. If technology could transform learners into its own image, then positivist logic replaced the more ethical and socio-political understandings so that technology would yield good results for some users but not for others. Okan cited a 2004 example from

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Zhao, Alvarez-Torres, Smith, and Tan of a staircase that is useful technology for those who are walkers, but disabling for those in wheelchairs. Okan concluded that technology was a complex interaction of design and use, built on the user's interpretation, construction, and reconstruction, agreeing with Feenberg (2002). He articulated the elements that have the capacity to affect the Margins of Maneuver:

> Thus, technology use is seen as the result of the interaction of several elements, such as the inherent characteristics of the technology, teacher's pedagogical beliefs and the kind of pedagogical activities that were designed as a result of them, students' own understandings of the potentials of the technology and the negotiations between students and the teacher regarding how the technology should be pedagogically exploited. (N.P.)

Figure 5, below, presents the interaction of the characteristics of Margins of Maneuver.

Margins of Maneuver
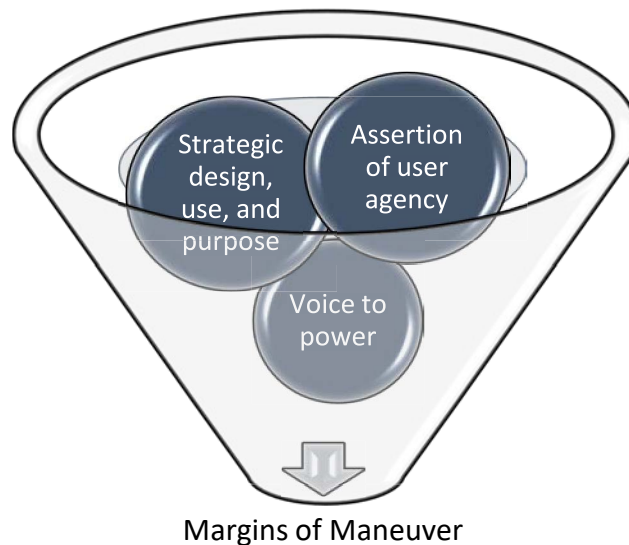
Figure 5. Elements of Margins of Maneuver. (Feenberg, 2000, 2010; Okan, 2007)

Meeting the challenge of the knowledge economy. In addition to this revised critical theory of technology, later voices in the field persisted in issuing warnings of equating the potentiality for democratization with the ideology that educational technology would act as a leveling factor between economically advantaged and disadvantaged learners. Critical theorists such as Friesen (2012) and Selwyn (2010) emphasized the need to maintain a critical perspective on the uses of educational technology, recognizing its historical foundations in the dominant society. As Selwyn asserted,

> The academic study of educational technology needs to be pursued more vigorously along social scientific lines, with researchers and writers showing a keener interest in the social, political, economic, cultural and historical contexts within which educational technology use (and non-use) is located. (p. 66)

These contexts related to educational technology generated an accompanying "self-evident" truth from the iconic status of technology, the knowledge economy, which privileged the techno-scientific paradigm with higher value (Friesen, 2012). Within the knowledge economy, the ideology that technology has its own "agency" that creates new ways of being and doing divorced from the social constructs of its design and uses has served the interests of the dominant society, building a new type of capital (Derry, 2007; Friesen, 2012). This myth construction of the knowledge economy requires a historicizing perspective to reveal its self-referencing fallacy (Derry, 2007; Feenberg, 2002; Selwyn, 2010).

Friesen (2012) attributed the evolution of "truth" status of the knowledge economy to Daniel Bell in 1973. He articulated that Bell's ideology had its roots in the techno-positivist ideologies that framed the latter part of the twentieth century to the present: "In a significant

theoretical move, Daniel Bell as well as those following in his footsteps present knowledge as playing this essential generative, value-adding, profit-making function" (N.P.). This positioning of knowledge and its vehicle of production, technology, within the myth of the knowledge economy has served the role of reifying certain types of knowledge over others, favoring the scientific and technological value-producing types.

The logical result has been a commodification of knowledge, produced and enhanced through technology in education, which narrows both the types of knowledge that are valued as well as severely limiting the pursuit of knowledge as contestable with a multiplicity of aspects and perspectives (Friesen, 2012). Focusing on the Web, the device, the infrastructure-- trusting in the myth of technology's agency in creating new modes of knowledge—has minimized the importance of the social dynamics, power relationships, and practices in the society and systems using the technology (Derry, 2007). Ignoring the socio-historical frame in which technology operates, and the many economic factors that affect the digital divide, has perpetuated the gap between economically advantaged and economically disadvantaged populations because the emphasis shifts to the technical rather than the systemic socioeconomic systems over which economically disadvantaged populations often have little control (Friesen, 2012). Feenberg (2002, 2010) proposed that users are able to exert control within the Margins of Maneuver spaces, thereby democratizing the design, use, and purpose of technology.

Choices in critical uses of technology. Critical theory concerns itself with unpacking the ideologies of "self-evident truth" often associated with dominant social, political, and economic truths (Feenberg, 2002; Friesen, 2012). Spaces within it, however, can foster democratizing forces:

[This] "ambivalence" of technology is distinguished from neutrality by the role it

attributes to social values in the design, and not merely the use, of technical systems. On

this view, technology is not a destiny but a scene of struggle. It is a social battlefield, or

perhaps a better metaphor would be a *parliament of things* on which civilizational

alternatives are debated and decided. (Feenberg, 2002, p. 15)

Critical theory's role in examining uses of educational technology has been to open the "field of

struggle" to identify conditions under which economically disadvantaged learners could claim

the Margins of Maneuver to foster learner agency and democratization.

Critical Pedagogy

Critical pedagogy specifically addresses the influences of sociocultural histories and

systems on societal organization and power dynamics. It advocates for educational approaches

that question and reveal social, economic, and political marginalizing factors to envision

alternative possibilities as well as provide learners with the skills to act in their own behalf, thus

resisting the forces of marginalization. Acting for change is the result of the process of critical

consciousness (Freire 1970/2000; Giroux, 1988; McLaren & Leonard, 1993). This emphasis on

people using their agency to affect and resist oppressive factors is similar to Feenberg's (2002,

2010) and Okan's (2007) emphasis on the importance of agent-purposeful action in the design

and uses of technology.

Paulo Freire (1970/2000) most strongly articulated the tools for critically dismantling the

narratives and activity of dominant power in his seminal work on critical pedagogy. Developing

adult literacy programs in Latin America, Freire established that the recognition of oppressive

systems and learner positioning in that system begins with *conscientização*, the practice of

investigation and reflection that motivates learners to *praxis*, strategic action to address the injustices of the dominant system. Freire stated that critically identifying or questioning sources of marginalization was not enough: "Critical consciousness is brought about not through intellectual effort alone but through *praxis*—through the authentic union of action and reflection" (p. 48).

Giroux (1988) posited the relationship as a dialogue between the "language of critique" and the "language of possibility." As he saw it, the dialogue between revealing injustice and alternative possibilities has created a necessity for "counterhegemonic" practices in schools. The language of possibility is essential to critical educators, "to raise ambitions, desires, and real hope for those who wish to take seriously the issue of educational struggle and social justice" (p. 177).

In teaching economically disadvantaged students, the critical educator would provide students with opportunities to confront and reveal the narratives in their histories and lives. Freire (1970/2000) proposed that a critical dialogue shared by teachers and students removed the distance barriers of the roles of "teacher" and "student." Rather, the two become "student-teachers" and "teacher-students" with a common goal of revealing injustices and redefining identities to assert their agency in reconstructing knowledge.

Critical pedagogy is intrinsically liberating because of the its internal democratic relationships, as found in Freire's (1970/2000) description, "The teacher is no longer merely the one-who-teaches, but one who is himself taught in dialogue with the students, who in turn while being taught also teach. They become jointly responsible for a process in which all grow" (p. 67). A new culture disrupts traditional learning and shifts the teacher's role as a dispenser of

information to an expert facilitator and the student's role to one of co-agent in the learning process. These environments result in less didactic "teacher talk" and more "student talk." Emphasis is on real-life skills, collaboration, and autonomy; reflection that listens and responds to voices of the teachers, peers, the self, and the dominant discourse; higher student engagement and agency in learning. Thus, critical pedagogy is also inherently dialogic.

The role of critical literacy. Because of the literacy context in which Freire developed critical pedagogy, the ability to read was a critical component in strengthening the self-identity of marginalized people, contributing to a stronger sense of self and individual confidence. Literacy was not just providing reading skills, however, but also addressing the sense of powerlessness that marginalized people often felt in the face of oppression by building self-efficacy in the tools and discourse necessary to empower them to assert their agency in the planning and action that is praxis (1970/2000). Critical pedagogy referred to literacy as "reading the world" as well as "reading the word" (Freire & Macedo, 1987).

Literacy, then, becomes a primary form of social action, in which learners develop the ability to problematize social conditions that then become the focus of reflection and dialogue; a "reading" of socioeconomic dynamics and the possibilities of action. Developing students' critical literacy provides them with the skills and opportunities to interrogate power structures and dynamics in their lives, and to assert a position of dialogic agency (Lewison et al., 2015).

Considerations of practice in critical pedagogy. Critiques of critical pedagogy have included the threshold of critical theory terms that sometimes deters educators from attempting to challenge their thinking on more traditional pedagogies (McLaren & Kincheloe, 2007). Addressing issues of identity, power, and agency within various historical, sociocultural, and

ideological perspectives has required educators to reflect on "their own deep-rooted beliefs, ideologies, and values" within the world of their students and communities (Howard & Milner, 2014, p. 207). To help overcome this threshold, Teemant and Hausman (2013) worked with teachers and economically disadvantaged students in the Central Valley of California to develop and validate a pedagogical rubric, *Six Standards for Effective Pedagogy*

Teemant and Hausman (2013) originally thought to use Tharp's *Five Standards* language but realized that Freire's critical pedagogy was necessary to address effectively the needs of students potentially marginalized by their economic situations, placing pedagogy within the contextualization of a learner's community and history. The addition of the *critical stance* standard emphasized using literacy not just to solve a problem or develop literacy, but to problematize and investigate issues of concern to the student, the problem-posing of critical pedagogy.

Standard 1	•Joint Productive Activity •Students and Teachers producing together
Standard 2	•Developing language and literacy across the curriculum •Develop perspectives related to disciplines
Standard 3	•Contextualization •Connecting learning to student lives (culture, community)
Standard 4	•Challenging activities •Teaching complex thinking, higher-order skills
Standard 5	•Instructional conversation •Dialogue, question, feedback, evaluation
Standard 6	•Critical stance •Transform inequity through democratic engagement

Figure 6. Six standards for effective pedagogy. (Teemant & Hausman, 2013)

Resonant with critical pedagogy, the teacher acts as a facilitator, guiding the students to question "conventional wisdom" and generally accepted beliefs to identify areas of injustice and

to reflect on how they can rectify inequity within their scope of influence. This critical stance standard provides a reason for students to acquire academic language and subject-specific discourse so they can engage with the dominant society from a position of agency.

The Impact of Learner Agency

To pursue this study, considering the theoretical framework's impact on the research question necessitated further examination of the impact of learner agency on learning. Learners acting as agents position themselves within a variety of discourses that are most conducive to their learning (Davies, 2000). Greeno (2006) postulated that as learners adopted critical perspectives, framing themselves as authoritative, accountable, and efficacious, they fostered development of agency. Further, Greeno's account of the learner as agent articulated the elements of student authorship, student-initiated ideas and topics, student-defined challenges, and student-formulated questions of existing discourses. These two interpretations of agency established a strong link between student learning and learner agency.

Rainio (2008) defined agency as a characteristic that "develops gradually as a person participates in the community and thus gains understanding, experience, and knowledge of its practices as well as responsibility for the community and access to power" (p. 118). In other words, agency depends on the subjectivities inherent in the interaction of the discourses and exchanges of individuals within diverse communities. Therefore, Davies (2000) argued that learner access to community discourse is essential to the exercise of agency.

This stance requires learners to make sense of learning, to accept or reject various stances and practices of the systems in which they have participated, choosing from alternative positioning of themselves within the systems. From their critical perspective, Moje and Lewis

(2007) viewed agency as the "strategic making and remaking of selves, identities, activities, relationships, cultural tools and resources, and histories, as embedded within relations of power" (p. 8). As agents, learners are efficacious and capable participants who could make choices that appropriated their identities and culture in their learning activities, their talk, and interactions with others (Danby & Farrell, 2004).

Lewis, Enciso, and Moje (2007) suggested that critical learning pedagogies foster this type of agency, opening access and control to discourses of various groups: "Deep participatory learning involves learning not only the stuff of a discipline-science content, for example- but also how to think and act something like a scientist, even if one does not enter the profession of science" (p. 19). Access to subject-specific discourses reconstitutes learner identities and reveals the ways of thinking, believing, acting, and communicating that are often privileged concepts.

Agency, then, is a practice of producing the self in dialogue with the discourses and exchanges of power to claim one's own position within the field of possibilities. Nevertheless, developing agency has presented the paradox of an individual being both in control of his or her own choices as well as submissive to external voices: "At the heart of becoming an agentive subject is the simultaneous act of both submission and mastery: the discourses that constitute us as social beings also condition, shape and dominate us" (Rainio, 2008, p. 9).

The systems found within a classroom often exemplify this paradox, as learners struggle to establish their own spaces of control, autonomy, and voice versus the influences of the sanctioned behaviors and expectations as well as the authority of the school and teacher. Holland, Lachicotte, Skinner, and Cain (1998) referred to this paradox of classroom relations as "a contested space, a place of struggle" (p. 282). The paradox conceptualized agency as lacking

complete freedom from the constraints of discourse; rather, agency recognized, understood, and evaluated these discourses to "resist, subvert, and change" them (Davies, 2000, p. 67). Lewis et al. (2007) interpreted these resistances and subversions as formational in the development of agency and identity.

The Role of Positioning

Holland et al. (1998) explained that the enactment of agent identities took place within the positions that individuals assume, relative to power relations of privilege, deference, and socioeconomic affiliation. The process of positioning placed the personal experiences and narratives of individuals as socially sanctioned positions established in relationship with each other to make sense of the events. This interactive component to the development of agency and identity has made them "fluid, socially and linguistically mediated … that takes into account the different positions that individuals enact or perform in particular settings within a given set of social, economic, and historical relations" (Lewis et al. 2007, p. 4). Students have validated their positioning through appropriation and use of social and discursive resources, including those specific to certain disciplines, some of which have stronger alignment with the privileged preferences of the dominant system (Ares, 2008).

Kinzie's Meta-Analysis of Agency

In her meta-analysis of the literature, Kinzie (1990) discussed learner agency in terms of autonomy, voice, and efficacy. Since Kinzie's motivation for the review was the commonly accepted belief that interactive educational technology would create a student-centered environment, her theories were contextualized appropriately for purposes of this study. She

proposed that the three characteristics are critically interdependent and mutually important to creating effective learners, with impacts on student agency.

Student autonomy. Kinzie (1990) cited the seminal work of Mager (1964) and Merrill (1975, 1980) on learner autonomy, defining it as the belief that learners not only know what is best for themselves, but will also "act on the knowledge" (p. 6). The core reason underlying this assumption was that a reflexive student who is most aware of personal learning preferences and interest could best decide on the appropriate tiers and aspects of differentiation. Significantly, the author pointed out that opportunities for learner control are insufficient to support continued learning development, if the learner does not perceive the opportunities as authentic participation in educational decisions (citing Lepper & Chabay, 1985). Thus, learner choices become paramount to engaging ongoing learner motivation and engagement.

Learner voice and choice. Kinzie (1990) expressed a caveat by Carrier, Davidson, Higson, & Williams (1984) that learners may not always make good choices—resulting in mixed outcomes of learning—and probed for causes of the inconsistencies. The author proposed that the cause was the difference between cognitive, "far-transfer" (longer-term achievement), and behaviorist "near-transfer" (immediate, highly directive) approaches to instructional design, as defined by Clark (1984). Kinzie suggested that while "far-transfer" goals may be more resonant with learner agency, methods of achievement testing are predominantly "near-transfer," leading to instructional design that may not support autonomy and choice.

Choice within critical theory of technology. In this context, both Feenberg (2002, 2010) and Okan (2007) delineated concepts of empowerment and agency related to the user's interests and values that strongly parallel the concept of choice in the studies examined by Kinzie. They

both positioned multiple subject-agents—students and teachers—within socio-culturally and socio-historically defined learning communities that can construct and pose problems together as well as engage action responses to and from these realities. Critical theory explicitly referenced and called for an intervention of social choices into technology that can distribute agency and outcomes throughout the system rather than center them in the interests of economic, social, and political elites, creating a democratizing effect.

Learner self-efficacy. Kinzie (1990) presented findings regarding student perceptions of learner control and motivation to lay foundation for examining the connection between motivation and self-efficacy, citing Crandall, Katkovsky, and Preston (1962), Findley and Cooper (1983), Hartner and Connell (1984), Stipek and Weisz (1981), and Wang (1983). In all of these studies, increased student perception of their own competence (self-efficacy) and topical or thematic relevance, tied to student choice and interests, positively affected learning.

The Role of Voice

Cook-Sather (2006) noted that concern with student voice arose concurrently with concern over the exclusion of students from conversations regarding their learning. The author defined student voice as the "power to influence analyses of, decisions about, and practices in school" (p. 363). Further, fostering student voice by listening and engaging students in dialogue mitigated the effect of marginalizing experiences in the students' background. The importance of opportunities for students to exercise voice is essential to the development of student autonomy in learning. The subsequent sections of this review provide a framework for understanding issues of student agency in a 1:1 learning environment.

Evidence for Economically Dependent Variances in Technology Uses and Practices

The literature has demonstrated the ways in which technology uses empowered or restricted student agency, finding there were variances attributable to economic distinctions of student populations in elementary, middle, and high school settings. The findings have documented the existence of the second- and third-level digital divides, regarding uses and student-mediated interactions with the community. The next section describes research evidence that compared 1:1 technology practices in economically advantaged and disadvantaged contexts, evaluating their effects on fostering learner agency, a necessary component for democratizing educational technology (Attewell, 2001; Becker, 2006; Feenberg, 2002; Freire, 1970; Harris, 2010; Lee, 2013; Warschauer et al., 2010).

Persistence of Reliance on Lower Order Skills over Time

Warschauer et al. (2004) studied 64 classrooms across eight high schools in Southern California, of which three were predominantly economically advantaged and five were predominantly economically disadvantaged populations. Using qualitative methodology, researchers coded their findings from the seven months of classroom observations, teacher interviews, and student focus groups to assert that the access level, or first level, of the digital divide was closing.

They noticed no such pattern in the second digital divide, observing that the students and teachers in schools with predominantly economically disadvantaged populations used their 1:1 resources to focus on remediation as well as discrete skill building with skill drill practice. Additionally, students in schools with predominantly economically disadvantaged populations

researched definitions rather than the more open, complex concepts researched by students in economically advantaged schools. Schools with predominantly economically disadvantaged populations did not foster skills in presentation and synthesis; these students tended to produce summative, definition-bound PowerPoints while students of more privileged economic backgrounds analyzed various materials, drawing conclusions and citing a variety of resources. Further corroborating their findings, Warschauer et al. (2004) cited similar findings across the state of California in the 2002 California Tech Assistance Project Report.

Ten years later, another multicase study by Warschauer et al. (2014) found similar key differences in how students used the computers, affecting the participation and learning outcomes for students from economically disadvantaged households. This study used a mixed-methods approach to study fourth- and fifth-grade classrooms in three school districts with a 1:1 initiative in California, Colorado, and Alabama. The study differentiated uses of the 1:1 technology by economic distinctions and ethnicity, using pre- and poststandardized testing data to perform comparative statistical analysis as well as qualitative coded observations, interviews, and focus groups.

Researchers documented positive learner outcomes with writing and literacy as well as growth in learner attitudes toward learning. Nevertheless, teachers assigned drill and practice as well as low level, largely rote tasks more frequently seen in economically disadvantaged environments, particularly those without strong administrative structural support.

The 10-year time lapse of these studies paralleled the persistent discrepancy in uses between economically advantaged and disadvantaged populations demonstrated in other studies throughout this time (Bebell & Kay, 2010; Becker, 2006; Harris, 2010; Kemker, 2007; Mouza,

2008; Pogany, 2009; Reinhart et al., 2011; Valadez & Duran, 2007). This persistent pattern in the research supports the assertion that there has been insufficient progress in closing the second- and third-level digital divides. Given the resources available to promote educational technology, the lack of progress is oppressive to economically disadvantaged populations and serves to replicate the class stratification of the existing socioeconomic order.

Disproportionate Use of Student-Centered and Critical Thinking Practices

In their three-year mixed methods, multicase study of the Berkshire Wireless Learning Initiative, Bebell and Kay (2010) researched between 524 to 1893 students (depending on year of study) in five public and private schools, two of which consisted of predominantly economically disadvantaged populations. Researchers utilized pre- and poststandardized testing data, other achievement data, and writing assessment results to complete a relational statistical analysis. Qualitative coded observations, interviews, and focus groups complemented the quantitative data. Corroborating other research, the study found positive results on the impacts of 1:1 computing in English and language arts, especially in writing, as measured by state standardized assessment.

Although the research found that learners who were economically disadvantaged benefitted more from the immersive technology in writing and discrete skills testing than those of economically advantaged populations, these learners had substantially less exposure to student-centered and critical thinking experiences mediated by technology. Researchers concluded that student populations that were economically disadvantaged were not being given the opportunity to develop new critical digital literacies.

The lack of such opportunities limited rather than fostered student agency as it restricted student ability to learn skills necessary for autonomy or for problematizing examination of their environments. The immediacy of the impact on standardized test scores aligned with Kinzie's (1990) discussion of "near transfer" goals which can obscure the development of learner agency.

The researchers made note to qualify the higher positive impact on standardized test scores of economically advantaged versus economically disadvantaged students, considering that students with economic advantages might already have had an inherent disposition to that type of assessment as indicated by a higher baseline. This qualification of what might otherwise be judged as a "leveling" or gap-closing outcome of 1:1 supported the finding that evaluation systems served to measure factors that replicate expectations of existing social structures. Coupled with the finding of the lack of opportunity for learners who are economically disadvantaged to experience pedagogical practices and critical thinking within the context of the 1:1 technology implementations, the study supported the continued presence of the second- and third-level digital divides.

Other studies, both case studies and statistical analysis of questionnaires or secondary data, further validated a more generalized application of this conclusion, spanning various times and geographical contexts. The research presented a compelling argument documenting the second- and third-level digital divides pertaining to student use of technology (Becker, 2006; Harris, 2010; Kemker, 2007; Pogany, 2009).

Kemker's (2007) statistical analysis of the statewide Florida Tech Resource Survey, a validated instrument consisting of 47 questions, administered to public elementary schools, was

particularly significant given its scope. The researcher differentiated responses by socioeconomic distinctions to conclude that no statistically significant difference existed in access. There was, however, a statistically significant difference in laptop frequency of access favoring economically advantaged populations. Likewise, there was little relative difference between the curriculum-based software, with an accompanying statistically significant difference favoring economically advantaged populations in the use of analytical, higher order software tools. The gap between economically advantaged and disadvantaged learners to work with tools that strengthen critical thinking and analysis, key capital in the knowledge economy, has threatened to continue social stratification patterns.

In addressing the critical need to address those gaps, the studies have identified certain types of pedagogical practices and technology uses with positive impacts in narrowing the second- and third-level digital divides. These studies aligned with critical theories that intentional technology use is critical to developing agency and, thus, to the democratic participation of its users. The consulted research has unanimously aligned with critical theory that student-centered approaches are the most promising practices to achieve that goal (Feenberg 2002, 2010; Freire, 1970/2000; Friesen 2012; Okan 2007; Selwyn, 2010).

These perspectives on implementing 1:1 technology with a critical lens suggested that student-centered environments and practices have strong potential for positively impacting the development of agency in populations that are predominantly economically disadvantaged, while recognizing that such environments are limited in number in that particular context.

Student-Centered Practices in 1:1 Implementations

In his case study of a middle school in the Maine Laptop Initiative, using observations, questionnaires, and interviews, Boardman (2012) advanced the thesis that 1:1 and educational technologies inherently supported student-centered practices because they provided tools that "create a changed and 'expanded' experience" (p. 17), allowing students to construct, test, hypothesize and evaluate various models and structures. He wrote that, "Technology opens the potential for student and teacher as co-creators of the learning experience, with technology as the mediating factor" (p. 33). Ashmore (2001) mailed questionnaires to 1,210 teachers at 74 schools nationwide, yielding a data set of 356 teachers, and concluded, "Technology acted as a catalyst for the changes in teacher beliefs…Learning became more student-centered as well as interactive" (p. 3).

An and Reigeluth (2012), Matzen and Edmunds (2007), and Pogany (2009) agreed that ubiquitous computing fosters student-centeredness, deep learning, and engagement. Donovan, Hartley, and Strudler (2007) posited an even stronger posture, "Prior research implies that the use of technology in some way encourages this shift toward more student-centered or constructivist classrooms…An alternative explanation is that the introduction of a 1:1 computing initiative *requires* a shift toward student-centered practices" (p. 280). The next section examines this shift—or its lack—providing a more in-depth explanation of the association between 1:1 technology and student-centeredness.

Student-Centered Practices and Student Agency Outcomes

Pogany (2009) conducted a multisite, qualitative case study using coded observations, interviews, focus groups, and artifacts. He studied four pilot 1:1 schools in South Dakota after

three years of implementation. In examining the resulting changes, the study concluded that 1:1 computing was a driver of student-centered practices because it personalized learning to student interest and ability.

Further, Pogany (2009) concluded that 1:1 initiatives implemented in student-centered environments do have positive impacts on student agency outcomes. These practices enabled learners to find and use authentic data from multiple sources. Learners were then able to use this data and the resulting knowledge within personally relevant experiences that placed them in a contextualized environment to enable open inquiry and communication of information.

Pogany's (2009) conclusions regarding student-centered practices and 1:1 technology implementations were based on the results between one school with a predominantly economically disadvantaged population using student-centered practices in contrast to the other schools. Students who were economically disadvantaged demonstrated higher positive growth on their achievement, learner identity, and learner autonomy resulting from the use of 1:1 technology, than economically advantaged students (who already had strong learner identities).

By contrast, Pogany (2009) observed differentials in technology uses and pedagogical practices in sites that were not student-centered that assigned less cognitively demanding tasks to students who were economically disadvantaged. These types of tasks had little to no impact on identity and autonomy, two characteristics identified as necessary for developing agency (Kinzie, 1990; Lewis et al., 2007).

Research has identified critical, student-centered practices as a necessary lever to foster learner agency, thereby promoting democratizing uses of 1:1 technology (Feenberg, 2002, 2010; Friesen, 2012; Okan, 2007; Selwyn, 2010). Nevertheless, much of the research on 1:1 computing

reveals that teachers still construct learning experiences through their eyes and the filter of their experiences rather than offering students transformative learning with deep curriculum (Boardman, 2012; Matzen & Edmunds, 2007). Closing the belief-practice gap, then, is central to sustaining changes in 1:1 uses that foster learner agency within the Margins of Maneuver.

Impact of Teacher Beliefs and 1:1 Classroom Practices

Critical factors to successful 1:1 technology implementations—as demonstrated in the literature—were teacher beliefs about technology, their self-efficacy and teaching philosophies, and perceived peer as well as administrative support particularly as sources of professional development. Boardman (2012) and Pogany (2009) both asserted the importance of teachers in 1:1 implementations as they make the final in-classroom decisions related to practices and uses of the technology to further learning. Amankwatia (2008) expanded this claim, adding that lack of alignment of teacher beliefs and new technologies have resulted in struggle and even resistance to pedagogical shifts.

Teacher Beliefs about Technology's Impact on Student Learning

Inan and Lowther (2010) conducted a study that surveyed technology integration, collecting data from 1,382 teachers in 54 K–12 schools in Tennessee to hypothesize a path analysis model to measure possible predictors of successful technology integration and their relationship. This study examined the effects of teacher beliefs and organizational conditions on technology integration.

It found that teacher computer proficiency and attitudes toward technology's impact on student learning, as well as school conditions of access, peer support, and training, have the most positive impact on technology integration. Inan and Lowther (2010) concluded that,

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The current study supported the hypothesis that teacher belief is one of the essential

factors that explain technology use. The finding is in alignment with the abundance of

previous research that suggests that the personal beliefs and dispositions of teachers may

relate to technology integration in the classroom. (p. 148)

Chandrasekhar (2009) focused on 1:1 deployment at three different public schools, using

the case study method to study six teachers in an Orange County school. The study found that

one of the key factors in determining the efficacy of implementation was how well teachers, led

by existing beliefs and attitudes, adapted to the new environment and the new teacher roles in a

1:1 laptop learning environment.

In another study, Bebell and Kay (2010) researched an initiative in western

Massachusetts that provided 1:1 computing to all students and 160 teachers in five public and

private middle schools. The study found that teachers had adapted and transformed their

practices to accommodate technology, with adaptations varying in depth in direct relationship to

teacher readiness and willingness to experience a "radical shift" in their pedagogy.

An and Reigeluth's (2012) study added further support, concluding from an online

survey of 126 K–12 teachers in Texas and Arkansas that there was a positive correlation between

positive attitudes toward technology with a move towards student-centered classrooms. While

70% of the teachers surveyed reported that such a move created more challenges of increased

planning time, these same teachers felt the change was worth the effort because of its positive

impacts on student learning.

A common theme in all of these studies was that teachers were motivated to make shifts

in pedagogical practices and technology uses if they believed the shifts had positive impacts on

student learning (An & Reigeluth, 2012; Bebell & Kay, 2010; Boardman, 2012; Chandrasekhar, 2009; Pogany, 2009). As Reinhart et al. (2011) concluded, the importance of these shifts in teacher beliefs have direct impact on the second- and third-level digital divides and can either create marginalizing or democratizing variances in the implementation of technology in educational settings.

Effects of Deficit Thinking

When teacher beliefs focused on either the challenges of technology integration or on untested assumptions regarding the economic situations of learners, they were reluctant to adopt new teaching and learning practices supportive of democratizing uses of technology. Shapley et al. (2011) conducted a wide-ranging experimental study comprised of 21 treatment and 21 control middle school cohorts with 70% or more of the treatment schools' populations classified as economically disadvantaged.

Inconsistent uses and pedagogies, varying by teacher, were identified as the dominant reasons for variances in achievement test scores and other learning outcomes. Focusing on the perceived lack of support and adopting a "this too will pass" compliance mentality, many teachers did not change their practices and participated in lesser professional development than provided. Other studies reported a similar correlation between negative expectations of 1:1 technology implementations and lack of transformational change, documenting the negative effects of teacher inconsistencies in practices and beliefs (Bebell & Kay, 2010; Jones, 2013; Silvernail & Lane, 2004; Windschitl & Sahl, 2002).

Detailing another aspect of teacher practices, Warschauer et al. (2004) found that teachers underestimated the home access of economically disadvantaged students. This deficit

assumption proved unfounded; however, teachers had already allocated class time for lower-level "practice" tasks based on the erroneous assumption. Additionally, teachers were reluctant to engage in deeper, longer inquiry projects over time that might necessitate research and work at home. The dual impact on the second- and third-level digital divides resulted from a mistaken teacher belief, even though the teacher concern had been to ensure that all students had access to learning regardless of whether they had computer access at home.

The study also uncovered that many teachers felt constrained by state testing mandates. Teachers anticipated that "at-risk" students needed more time with drill and practice as well as remediation, given their perceived skill and background knowledge levels. Researchers cited this same type of deficit expectation of learner skill and background knowledge as one of the primary reasons for learning gains reversing themselves after positive outcomes, since teachers explained those losses with examples of student low literacy skills. Warschauer et al.'s (2004) study demonstrated that deficit belief systems affect sustainability of transformative uses of 1:1 technology implementations as well as the adaptation of learning activities in economically disadvantaged environments.

Teacher Attitudes about Self-Efficacy and Professional Development

Effective professional development led to increased teacher self-efficacy, which has had the demonstrated effect of overcoming resistance and motivating in-depth adaptation of teaching practices toward critical technology integration (Bebell & Kay, 2010; Becker, 2006; Inan & Lowther, 2010; Pogany, 2009; Polly & Hannafin, 2010; Reinhart et al., 2011; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010; Warschauer et al., 2010). Bebell and Kay emphasized this relationship by asserting that teacher attitudes toward change and adaptation to 1:1 technology

were influenced by district-supported sustained professional development, both system-wide and job-embedded, technical support, and peer collaboration opportunities.

Valadez and Duran (2007) studied five Southern California schools with predominantly economically disadvantaged populations compared with one economically advantaged school, all of which had 1:1 technology implementations. Researchers conducted a quantitative statistical analysis of a survey instrument, measuring the correlation between use, socioeconomic distinctions, and teacher beliefs and practices.

Valadez and Duran (2007) concluded that teachers in economically advantaged schools have significantly more professional development in culturally responsive student-centered uses of laptops and more support for subsequent in-class implementation. Concurrently, teachers in schools with predominantly economically disadvantaged populations employed less creative uses, focusing on lower-order, less cognitively demanding tasks, and also received less professional development and support.

When professional development has modeled student-centered technology integration as a distinct strategy, teachers have been likely to repeat the modeling. Without sustained re-enforcement and practice, transfer to the classroom typically became discrete student-centered practices within a largely traditional classroom (Glazer, Hannafin, & Song, 2006; Matzen & Edmunds, 2007). As Reinhart et al. (2011) reported, the result of inadequate professional development on using technology to transform learning experiences into student-centered environments further marginalizes learners in a 1:1 classroom who are economically disadvantaged.

Combined with the second- and third-level digital divide literature, teacher readiness, and attitudinal and practical discrepancy between uses of 1:1 technology in economically advantaged and disadvantaged settings led to a consideration of the impacts of leadership and organizational conditions covered in the next section.

Impact of Leadership Beliefs and Organizational Conditions

Various investigations have demonstrated the importance of leadership to 1:1 technology implementations that have positively impacted learning, measured by performance-based achievement tests and other academic assessments (An & Reigeluth, 2012; Bebell & Kay, 2010; Chandrasekhar, 2009; Donovan et al., 2007; Inan & Lowther, 2010; Pogany, 2009; Silvernail & Lane, 2004; Warschauer, 2004; Warschauer et al., 2010; Zucker & McGhee, 2005). As Shapley et al. (2010) have written in their study of the Texas 1:1 initiative:

> Specifically, committed leadership (at the state, district, school, and classroom levels) has been associated with stronger implementation. Effective leaders articulate a compelling vision of how laptops advance teaching and learning, develop policies and procedures that support change, foster collaborative environments, and marshal needed resources. (p. 10)

Because administrative leadership has been central to crafting organizational conditions, it is an important part of any implementation model analysis (Bebell & Kay, 2010; Boardman, 2012; Chandrasekhar, 2009; Donovan et al., 2007; Pogany, 2009; Polly & Hannafin, 2010; Silvernail & Lane 2004). These conditions comprised infrastructure considerations: processes for program, support and evaluation; strategies for creating community, student, and teacher characteristics of agency as well as efficacy, positive attitude, and pedagogical readiness (Amankwatia, 2008;

Chandraksekhar, 2008; Inan & Lowther, 2010; Pogany, 2009; "Walled Lake Consolidated Schools," 2007; Zucker & McGhee 2005).

This section first discusses the interaction of leaders and their social systems. Next, it examines leader modeling and accountability measurement of fidelity to practices that support 1:1 technology implementations as well as the existence of multi-tiered leader support.

Interaction between Leaders and their Social Systems

The complexity of educational change has resulted from shifts in underlying social systems and structures that have created demands on leaders and teachers. Boardman (2012) positioned the school at the center of an open system model adapted from Dellar (1994), Banathy (1992), and Hoy and Miskel (2005). He viewed the school as a system with "permeable borders" through which flow influences from external stakeholders and policymakers. Internally, the learning happened in a "zone" of internal factors such as resources, fellow staff members, administrators, histories of relationships, structural regulations, pedagogic culture, curriculum and classroom operations, shared beliefs, and communication patterns. Within this model, structural norms and hierarchical systems were important, comprising team-based agreements, support, state mandates and assessment procedures, curricular decisions, and contractual obligations including evaluation protocol, training, and availability.

Boardman's analysis complemented Bolman and Deal's (2002) system frames. He stressed structural and political frame considerations, noting that they carry strong implications for administrative vision implementing 1:1 computing that is transformative, not just substitutive. The human frame interacted with the structural and political frame, as highlighted by Donovan et al. (2007) in identifying diversified professional development, collaborative

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planning time, training, and sustained support as essential to creating high impact 1:1 technology

implementations. Leaders demonstrated empathy with the message that feelings of insecurity and

dissatisfaction are natural to systemic change, an effective practice in negotiating the political

and human frames. Along with support for human values as well as training in technology and

pedagogy, these types of leadership behaviors promoted the transformative potential of 1:1

technology implementations (An & Reigeluth, 2012; Ashmore, 2001; Bebell & Kay, 2010;

Boardman, 2012; Chandrasekhar, 2009; Donovan et al., 2007; Inan & Lowther, 2010; Pogany,

2009; Silvernail & Lane, 2004; Warschauer et al., 2004; Warschauer et al., 2010; Zucker &

McGhee, 2005).

Leadership Modeling, Accountability, and Fidelity to Initiative

Boardman (2012) reported findings that attributed significance to administrative

modeling of technology use. Teachers attributed their willingness to use technology on the

principal's active use of it, in establishing digital communication as the preferred medium of

information exchange.

Additionally, Keengwe et al. (2012), in a study at a rural Midwestern high school,

reported that administrators needed to establish accountability for technology integration. This

accountability first identified compliant computer use that is irrelevant to instruction; then,

provided necessary support; and, lastly, evaluated fidelity to the measures in terms of classroom

practices.

In reporting on the effects of leadership accountability on long-term, transformational

change, Shapley et al. (2010) reported a slowing and even reversal of implementation fidelity in

over 50% of the schools between years three and four. Researchers offered a possible

explanation that this finding demonstrated a need for leadership to continue active implementation of immersive technology to the point of sustainability to impact learning for all students.

This reversal trend, found in several other studies (An & Reigeluth, 2012; Boardman, 2012; Warschauer et al., 2004), pointed to the expediency of reform initiatives that do not seriously consider systemic transformation. With this "near-transfer" lens, mentioned in Kinzie's (1999) research, leaders and organizations focused on immediate performance achievement results and changed their focus to other matters after achieving the short-term goal.

Aligned with Carolyn Shields's (2012) understanding, this phenomenon was indicative of the transactional rather than transformative type of leadership, attending to reforming the object rather than to the reformulation and re-invention of systems that are liberating and just. The implication of the study, in light of Shields's concept of transformative leadership, pointed to the importance of leadership commitment not just to raising achievement tests, but also to providing democratizing uses and access to technology, viewing learners as agents rather than objects whose value lies in performance.

Leadership Support (Attitudinal, Technical, Professional Development)

A frequent explanation for the gap between theory and practice in 1:1 technology implementations has been that teachers are often not provided administrative support in ways to shift from teacher-centered practices to student-centered ones (Donovan et al., 2007; Polly & Hannafin, 2010). Without explicit support, teachers have typically reverted to traditional practices, without developing new pedagogies for connecting learning, technology, and curriculum (Keengwe et al., 2012). The literature has articulated the important role of leadership

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support in providing appropriate and effective development of teacher skill, thereby increasing the organizational capacity for transformational change (Boardman, 2012; Glazer et al., 2006; Matzen & Edmunds, 2007).

In addition to technical support and professional development, teacher perception of administrative support has impact on their readiness to adapt practices. In the Shapley et al. (2010) study, teachers indicated that administrative leadership was relatively constant during the first three years, with approximately half of the teachers reporting perceived high levels of administrative support and half of the teachers reporting perceived partial levels of support. The qualitative aspects of the study revealed that teachers recognized that leaders provided consistent, positive support: "We had the right combination of encouragement and push…That constant, positive pressure moved me forward" (Shapley et al., 2010, p. 46). Likewise, when leadership's focus changed to another initiative—as already discussed—the initial positive learning outcomes associated with the 1:1 implementation began to show reversal. Not only do leaders need to be sensitive to long-term and in-depth fidelity in order to lead transformational change, but leaders also have to possess a "far-transfer" lens (Kinzie, 1999).

Notwithstanding the positive effects of support demonstrated in Shapley et al. (2010), leadership policies had negative impacts on one of the measures of implementation. Many students could not take home the laptops—an important finding to any study of digital equity since a policy of home access has been a significant determinant in promoting equity. By providing access at school and not at home, these types of 1:1 technology initiatives were limited in their approach. An ethical and moral educational leader would need to seek solutions to the

security issues inherent to children carrying laptops home, such as seeking community support or grants to allow a second system at home.

Exemplars of Democratizing 1:1 Implementations

Although smaller in number, empirical studies evidencing characteristics aligned with critical and student-centered technology usage demonstrated the potential for the transformative interventions possible in the Margins of Maneuver, as advocated by Feenberg (2002, 2010, 2017) and Okan (2007). The growth in applied technology skills addressed the second- and third-level digital divides, providing students with an important advantage regarding participation in the dominant society. The predominance of the disparity of student technology uses according to economic distinctions was an unnecessary one and is not a presubscribed fate of students who are economically disadvantaged, as demonstrated in several exemplars.

Fostering Learner Agency: Autonomy, Efficacy, and Voice

Although Shapley et al.'s 2011 study focused on achievement test results, the researchers also found that 1:1 implementations accompanied by the Texas immersion model of student-centered practices developed greater learner self-efficacy regarding technology. Students who were economically disadvantaged benefited from 1:1 uses, with technology use exhibiting a statistically significant effect on learner skills in the more cognitively demanding areas of Internet research with search engine fluency blogs, multimedia document management, and presentation alternatives.

As previously noted, the focus of teachers and leadership on the "near-transfer" goal of achievement testing caused some reversal of these nonachievement learning gains as the "near-transfer" goals were achieved. These reversals accompanied reversals in teacher practices to the

more traditional teacher-centered environments away from the student-centered practices with which they had successfully implemented agency-promoting technology uses with middle school learners who were economically disadvantaged.

Boardman (2012) and Harris (2010) found that students who are economically disadvantaged using technology in an engaged, student-centered manner demonstrated marked gains in traditional achievement as well as nonachievement outcomes, such as critical thinking. These findings were consistent with expectations of applied critical theory of technology and critical pedagogy. Boardman (2012) reported that students developed a deeper understanding and a wider breadth of content knowledge. Students stated that learning was more relevant and that they were better able to find as well as process information.

Harris (2010) employed a mixed-methods study in looking at five Northern California schools, of which four were economically advantaged and one was predominantly economically disadvantaged. Students and teachers at all of the middle and high schools reported greater collaboration and more openness in dialogue during learning between students as well as between students and teachers. This outcome strengthened student agency in the learning process as collaborator versus passive recipient and demonstrated more democratic student-teacher relationships.

At Chavez High School, the only economically disadvantaged site in Harris's (2010) research, students, teachers, and administrators felt that the overall learning culture at the school had moved toward democratizing access:

> They noted that the school culture had evolved to one of community and exploration, where students and teachers were more connected,…and parents felt more comfortable

interacting with one another and the school staff. Additionally, the laptops encouraged

students to explore areas of study that were previously under-emphasized at the school.

(p. 131)

With the fostering of student choice and willingness to extend beyond the more traditionally

available learning options, teachers and administrators also felt that the implementation of 1:1

computing was breaking the social reproduction cycle, citing the number of students who were

beginning to exceed the educational expectations of their parents.

Inquiring into Issues Related to Student Interests

Harris's (2010) research also found that Chavez High School students extended their

worldviews beyond their immediate world and neighborhood. Learners leveraged the 1:1

technology to open their thinking and cultural capital to a much broader range of thought and

background experiences, available virtually and through digital content. The frequency of

collaboration and communication blurred the lines between academic and social interactions,

bringing the learning into the real lives of students rather than as a discrete performance-oriented

process, although the emphasis on traditional testing persisted of necessity (Harris, 2010).

Kemker et al. (2007) focused their 1:1 study on the use of "authentic instruction," defined

as meaningful, real tasks that require higher-order skills and thinking. The research found that

students who were economically disadvantaged grew in their autonomy, voice, and confidence in

their roles as learners. Students developed the capability to work successfully in more

unstructured outdoor settings, conduct experiments and observations, stay on task, and

collaborate with one another. They also posed their own problems from their experiences of the

community, using the computers to research, write, analyze data, communicate, and work on web site design.

Motivation and self-perception all had measured improvements as the technology became a "seamless tool" for exploring real data and concepts, allowing students to evaluate patterns and relationships, opening their thinking in constructing new approaches and ideas to what was known or thought to be known. Students with these types of characteristics demonstrated lower academic anxiety and confidence in their ability to meet the challenges of systemic power structures, resulting in potential for speaking to the dominant culture and fostering their role as subject agents in society.

In another study of an urban elementary school, grades three through five, comprised of mostly economically disadvantaged students, Mouza (2008) examined the benefits of a well-supported laptop initiative, using a quasi-experimental design comprised of matching treatment and control classes. Laptop students were enthusiastic, not just about using the laptops but about learning as exploration and creativity, pointing out that when they did not know something, they were able to use the technology to explore possible answers, even making distinctions between knowing something and understanding it.

Over time, students demonstrated a preference for educational and productivity tools on the laptops versus games, whereas the comparison control group students preferred games, chatting, and music sites. Student uses of technology enabled discovery of their historicity, as in one student's interview response, "Because you can create timelines with all things you did in the past…we did a timeline on ourselves about our past and future" (Mouza, 2008, p. 461). Another effect was student confidence in their agency as learners, as shown in the student quote,

"I feel really proud when I teach the teacher something. The teacher is always teaching us, so now I feel like it is my turn to teach you" (p. 465). Students who might otherwise never have found their voice declared, "I feel really smart because I think laptop classes are for smart kids" (p. 465). Researchers concluded that uses of the laptop computers empowered students with confidence in their own learning, thinking, questioning, and problem-solving abilities, as well as in their academic achievement in mathematics and critical literacies; they also cited increases in motivation and persistence. This study demonstrated the efficacy of 1:1 technology in fostering a sense of power so that students grew in their ability to assert their agency over both the content and methods of learning.

Importance of Critical, Student-Centered Practices

In a qualitative case study of a second-grade classroom in a large urban school district with 70%+ learners who were economically disadvantaged, Felderman (2010) found that educational technology facilitated negotiation of multiple perspectives, including those of their own histories and neighborhood. In doing so, students strengthened the formation of their identities and gained a greater sense of efficacy. Although not a 1:1 implementation, critical, student-centered practices helped students explore the social justice issues in their lives and to create podcasts that expressed serious social issues of concern to them. The democratizing effects enhanced with technology that enabled voice and access to the dominant society was noteworthy in its effects.

Describing a similar pattern in the democratizing impact of student-centered practices, Shapley et al.'s, study (2011) indicated that laptop teachers, supported with mentoring and professional development, used 1:1 computing to create meaningful work and complex,

authentic tasks that helped students situate themselves as subject agents who constructed their knowledge. Harris (2010) found that student-centered practices coupled with 1:1 implementations "enabled students to take primary agency within their learning" (p. 182). Teacher pedagogical practices that fostered personalized learning, variable pacing, and dynamic discovery and reframing of knowledge that drew connections to student lives and experiences increased learner access to power in to the digital divide.

The ability to draw connections to their lives and experiences not only increased relevance, but also enabled long-term conceptual learning with critical pedagogical practices. Both studies identified the important connection between higher-order laptop uses in the hands of motivated and efficacious teachers in bridging disparities in educational access within the second- and third-level digital divides.

Mouza (2008) found that the strongest correlate to the liberating effects of 1:1 computing on student agency, identity, and self-efficacy was the intentional attention to professional development that successfully guided teachers to develop student-centered learning environments. Teacher interviews in Kemker et al.'s (2007) ethnographic study revealed positive teacher attitudes toward 1:1 and student-centered practices as well as positive beliefs about the learning abilities of the students.

Conclusion

The rate of 1:1 technology implementations has been incrementally accelerating, creating an urgent need to support digital equity by offering students of economically disadvantaged households the experience of cognitively rich tasks to foster a stronger sense of self and agency that enacts long-term change in the relationships with the dominant culture. As shown in the

studies, economically disadvantaged students have done better and developed better attitudes toward learning when allowed and encouraged to spend more time in rich exploration activities, problematizing community and life events, and simulation modeling, in which they exercised choice and voice, as critical pedagogy would recommend. Yet, as many of the studies demonstrated, students who were economically disadvantaged typically engaged in mundane tasks, such as drills, test preparation, and other lower-functioning activities.

The second- and third-level digital divides are a real phenomenon. Continued inability or lack of will to close these gaps has strong possibility for further marginalizing learners along lines of economic distinctions as their digital literacies and sense of agency remain underdeveloped (Felderman, 2010; Harris, 2010; Mouza, 2008; Reinhart et al., 2011; Valadez & Duran, 2007; Warschauer et al., 2014). Further, technology used for drill and practice and other lower order tasks has demonstrated a tendency toward negative impacts on student achievement (Kemker, 2007, citing multiple sources).

This review raised the question of why so few 1:1 technology implementations among economically disadvantaged populations rely on practices with negative versus positive impacts. As identified, one dominant factor between what educators know and practice was the pressure to raise "achievement" scores on mandated testing, spending time and technology uses on discrete skill building and remediation. This might suggest a need for different types of professional development that promote the integration of personalized learning with more complex cognitive tasks, to allay teacher performance fears while increasing equity. These approaches would support teachers in finding their voice, to act on the responsibility of being an

educator of purpose, and to resist within the Margins of Maneuver (Feenberg, 2002, 2010; Freire, 1970/2000; Teemant & Hausman, 2013).

The majority of the studies in this literature review spoke with one voice in assessing the mismatch between the outcomes of standardized testing and the aforementioned "currency" skills. Students of economically advantaged households acquired many of these skills in their higher order use of technology at school and at home with typically well-educated families as well as in their extra-curricular lives. Students who were economically disadvantaged had mostly limited home and school uses and, in some 1:1 technology implementations, were not allowed to take home laptops to protect against possible violent theft. A critical approach requires attending to all factors of the power dynamics of technology use, including those that occur outside of the school, such as in the homes and communities of economically disadvantaged populations.

Researchers might even have overstated the case for positive outcomes within a 1:1 computing environment, given the tendency to want to publish positive versus negative findings. Many of the studies acknowledged some level of bias resulting from the ideological or socially situated position of the researcher, and many of the samples were too limited to bear individual generalizations. They did span a variety of contexts, however, which justified foundational generalizations that supported the theoretical framework. The task remains to articulate practices with democratizing potential in 1:1 technology implementations for empowering student agency and democratic participation.

The limited amount of exemplar studies documenting the empowerment of student agency through the transformative beliefs and practices of teachers and educational leaders provided radical hope for closing the second- and third-level digital divides to actualize the

democratizing potential of 1:1 computing. Despite the limited number of studies displaying a consistent pattern of positive effects, further study might uncover other critical factors in teacher as well as leadership beliefs and practices that will produce a hopeful but cautionary stance toward the literature review findings.

The alignment of critical theory of technology and critical pedagogy has had strong resonances, providing a foundation for pedagogical practices with a commitment to just and transformative systems. The ethic underlying these practices, as operationalized within the *Six Standards for Effective Pedagogy* (Teemant & Hausman, 2013), was significant to identifying uses and pedagogical practices in 1:1 technology implementations that are liberating and democratizing. Whether in marked successes, such as the Harris (2010), Kemker et al. (2007), Mouza (2008), and Felderman (2010) studies, or in mixed successes, as in the other research, the literature review suggested that the potential to transcend the digital divide was as real as the divide itself. Overcoming this digital divide with democratizing uses and practices would result in empowering students who are economically disadvantaged to be actors in their own learning and agents capable of dialogic interaction with the dominant society.

CHAPTER 3

METHODS

Participation in the events to be observed and to parallel conversations with the persons in the field is the more appropriate way of getting to grips with the subjective perspectives and the life world of the participants. The problem of appropriateness of methods is solved in the field of observation particularly by combining different methods in ethnographic studies.

—Flick, 2009

The purpose of this qualitative study was to explore 1:1 technology—implementations to evaluate the extent to which technology integration uses and associated pedagogical practices hold potential to promote learner agency in economically disadvantaged contexts to open Margins of Maneuver. Critical theorists have asserted these margins as an essential democratizing factor (Feenberg, 2002; Okan, 2007; Teemant & Hausman, 2013). Mouza (2008) has theorized that providing students with 24-hour access to a computer and the Internet would help to close the digital divide; other literature has contested this prediction. Although the first level of the digital divide—concerned with access to equipment, bandwidth, and the Internet—is closing, the second -and third-level digital divides are widening. The second-level digital divide refers to the teacher and student technology uses while the third-level digital divide alludes to ways in which students can use the technology to problematize and address issues that are personally relevant to them (Clark & Gorski, 2002; Harris, 2010; Lee, 2013; NETP, 2016, 2017; Pack, 2013; Velastegui, 2005; Warschauer et al., 2014).

To explore the potential of 1:1 technology to close the second- and third-level digital divides, this study sought to discover the ways in which agency manifested itself within the discourse and activity of classroom learning. Further, the study sought to provide voice to the experiences of administrators, teachers, and students within an immersive technology

environment in a predominantly economically disadvantaged community. The results of the investigation also proposed possibilities as recommendations for 1:1 technology implementations policy with democratizing potential.

A qualitative phenomenological case study was used because it best suited the complexities of the theoretical framework of critical theory of technology and critical pedagogy to examine the phenomenon of ubiquitous computing (Creswell, 2014; Flick, 2014; Hatch, 2002). Qualitative research generates rich, detailed data that builds an in-depth understanding of the phenomenon for studying its associated social and systemic relations. Collecting that data within the real-life context of case study has allowed for close examination within bounded conditions and interactions. The resulting insight into 1:1 technology integration uses and associated pedagogical practices explored the potential of the 1:1 initiative to foster Margins of Maneuver (Yin, 2011).

This chapter discusses the research question, the research design with its rationale, site and participant selection, and methods of data collection and analysis. The chapter also provides a researcher reflection on the process to describe one experience of a case study using qualitative methods. Within the design, context, and methods, this chapter addresses issues of validity, dependability, and transferability of the data, to contribute to existing critical theory on technology and suggest policy alternatives for democratizing 1:1 technology integration.

Research Question

This study evaluated the research question of:

> To what extent do 1:1 technology integration uses and associated pedagogical
> practices foster *Margins of Maneuver* in an eighth grade comprised of a student
> population that is predominantly economically disadvantaged?

Research Design

Qualitative Methodology

This study used an exploratory qualitative phenomenological case study design because the approach generated the richest set of detailed data to explore the research question (Creswell, 2014; Flick, 2014; Lichtman, 2010). Creswell (2014) described the steps comprising a qualitative research design:

1. the positional stance of the researcher;

2. the collection of participant understandings and actions from a variety of sources;

3. a focus on a phenomenon;

4. the study of the context or setting of the participants;

5. the validation of findings;

6. the interpretation of the data; and

7. the creation of an action agenda.

Qualitative methods revealed the complex nuances of a phenomenon while the case study design allowed for a close look at the events and social dynamics within a bounded system (Yin, 2011) delimited with criteria aligned with the theoretical framework of critical theory.

The strengths of using the case study approach facilitated direct and indirect observations and interactions with people and events to generate a dynamic body of data and documents (Yin, 2011). Despite Yin's finding that recorded and transcribed data did not require triangulation in a qualitative case study, observations, interviews, and document analysis provided triangulation to strengthen the reliability of the study.

This study was conducted from November 2016 to March 2017, during the 2016–2017 school year of the research site. The case concerned an eighth grade comprised of predominantly economically disadvantaged students. Observations began with an all-day visit for introductions, recruitment of teacher participants, and beginning to establish relationships at the site. To gain a deep understanding of the case, the researcher interviewed the principal and six teachers, observed nine classrooms with approximately 288 students, and collected and analyzed both district and school documents.

Participants of the learning community—the principal, teachers, and students—have been directly affected by choices relevant to the implementation of 1:1 technology. Therefore, their voices and experiences provided the most relevant, first-hand data to explore ubiquitous computing within an economically disadvantaged context.

Research Setting

The San Vincente Unified School District (pseudonym) was one of the largest school districts in California, with a predominantly Hispanic (92%) student population. Approximately 91% of the students qualified for free or reduced lunch and about 46% of the students qualified for English Language Learner (ELL) support. In an attempt to address the learning needs of its student population and close the learning gaps, the district adopted a "Mastery and

Competencies" approach to learning. Additionally, the district implemented 1:1 technology, using Chromebooks or iPads in fifth through 10th grades, providing parent training and materials in multiple languages, insurance that allowed the Chromebooks to go home with students, and availability of a low-cost, community Internet provider (SARC, 2015–2016).

The study took place at Granada Middle School which had articulated a vision of 21st-century learning design, "College, Career, and Beyond," and personalized learning. The school had made a substantial commitment to an integrated curriculum offering of science, technology, engineering, art, and math (STEAM), with Saturday Robotics and Maker clubs which met voluntarily throughout the year. Total enrollment was 1,328 students, of which 496 comprised the eighth-grade population that was the subject of this study. The average class size was 33 students per class, with 92.5% being Hispanic and 96.4% designated as "socioeconomically disadvantaged," based on how many students qualified for free and reduced lunch. Additional demographic data stated that 13.4% of the populations qualified for special education services, and 32.1% were English Language Learners (ELL). All of the school's teachers were credentialed and had been trained in methods of teaching ELLs, fulfilling the requirements of "highly qualified teachers" (SARC, 2015–2016).

The school was in its fifth year of Program Improvement (PI), and had been meeting its Annual Yearly Progress (AYP) goals. Based on state-mandated testing, slightly more than half of male students (58%) had not met the English Language Arts (ELA) expected standards, while 35% of female students had failed to meet them. The gap between standards and measured student competencies was greater in the area of mathematics, with 70% of male students and

58% of female students not having met the standards. The school's API score was 737, placing it in the lower 30% of California schools.

 The school was selected because of its stated commitment to problem-based learning and 1:1 technology as well as its demographic that met the delimitation of a school with a predominantly economically disadvantaged population. Additionally, the principal's efforts at stemming expulsions and suspensions through positive behavior interventions (PBIS) and social-emotional learning supports had been transforming the school's learning environment. The principal was a Latino male who grew up and went to school in the neighborhood. The faculty consisted of 24 females and 17 males, mostly White and Asian, with a few Hispanics, despite the predominant Hispanic population. There were various opportunities for parent participation through Site Council, school performances, family nights, Back to School night, and parent trainings, to name a few of the options. Extracurricular opportunities for students included the Art Club, athletics, the Technology Club, Yearbook, an Art-Song Competition, Speech and Debate, and a Social Justice Club.

Sampling Criteria

The study sampled nine teachers and their classrooms for observations, the principal and six teachers in a variety of subjects for interviews, and six students. During initial visits to the site, the researcher met all interested eighth-grade teachers in the content areas of English Language Arts (ELA), math, social studies, dual immersion social studies, science, and STEAM. After the study was explained, informed consent forms were distributed; more signed consent forms were collected than the anticipated teacher participant total.

Given more responses than had been anticipated, the researcher used both purposeful and convenience sampling to select teacher participants. A "purposeful sample" meant that participants were selected based on the researcher's judgment as to which teachers would be most representative of the phenomenon being explored. Additionally, convenience sampling factored the researcher's perception of teacher receptivity and willingness of teachers to begin observations and interviews in a timely manner (Creswell, 2014; Flick, 2014; Hatch, 2002).

The researcher initially thought to establish selection criteria, such as level of professional development or technology integration, but changed to a purposeful sample. This allowed for the possibility of typical and atypical practices to see how the case functioned in either situation. This decision supported the inductive, emergent nature of the research design (Creswell, 2014; Flick, 2014; Lichtman, 2010; Yin, 2011).

The researcher visited the classrooms of teacher participants, explained the study, and distributed bilingual invitations to participate, Parent of a Minor Informed Consent Forms, and Minor Assent Forms to all interested students. The researcher worked with the principal and teachers to communicate with parents whose students might be interested and collected a Signed Parent of a Minor Consent Form with the accompanying signed Minor Assent Form. The six students were a convenience sample, depending on agreement to participate.

Data Source: Observations

An all-day site visit in November 2016 was in the nature of a grand rounds observation, immersing the researcher in the culture and climate of the school as well as establishing the researcher's presence in the school community. These initial preparatory contacts and meetings built rapport between the researcher and participants to generate honest, reliable, and useful data

(Lichtman, 2010), and rapport building continued throughout future visits. Nine teachers

comprised the observation sampling, as presented in Table 1.

Table 1

Context for Observational Data Gathering

8th-grade classroom Total: 9 classes	Environmental features	Lesson(s) observed
STEAM Design Class	Large room in 4 sections: lab tables for teacher and students; 3-D Printers and sample work; tool area; materials area	Students working in groups to design a model high school; criteria—innovative uses, environmental sustainability. When design is completed, students will build model.
Science Class #1 Science Class #2 Science Class #3	Lab tables in rows and other groupings, teacher lab table at front with whiteboard and projection system.	Lessons on gravity and force through researching roller coaster design, then building their own coaster, ending with an iMovie to present and reflect on learning.
Social Studies Class #1 Dual Immersion **(DI)**	Desks in fan style with some students facing front, others facing each other; white board and projection system.	The lessons covered early monetary and fiscal policy, the Lewis-Clark Expedition, and Native American issues. Class warm-ups tie curriculum content to current events .
Social Studies Class #2	Desks arranged in rows; white board and projection system.	The lessons covered early monetary and fiscal policy as well as the era of Andrew Jackson.
Language Arts Class #1 Newcomers Support	Desks arranged in groupings; teacher desk at front; white board and projection system.	Lesson studying characteristics and nutritional information of foods and fruits; focus on building academic language.
Language Arts Class #2 Newcomers Support		Lesson studying habitats and ecosystems; focus on building academic language; writing collaborative report.
Language Arts Class #3 Honors		Lesson on Act 2 of *The Diary of Anne Frank*; some students reading roles in whole class oral reading. Students do responsive postcard activity on theme.

Classrooms had common characteristics of Essential Question displays as well as motivational or content posters, as shown. The table also provides a short description of the topic and activities of the lessons.

The first observation took place in November 2016; other scheduled observations spanned from November 2016 to March 2017. Each observation was a full class period, about 40 to 50 minutes, with the exception of one shortened observation in the English Language Arts class during which students were reading a play.

Observation protocol. Observation protocol consisted of the researcher sitting at the back of the classroom, recording field notes of the activity and discourse in the classroom using OneNote Notebook on a laptop. The researched recorded the following activities and discourses: the type of learning activity, expected student skills, teacher demonstrations and explanations, teacher and student talk, teaching strategies, types of problems investigated, classroom management practices, frequency and types of technology use, student behaviors, technology mediated opportunities for collaboration and communication. After the observation, the researcher further reduced field notes by notating and commenting on raw notes.

Data Source: Interviews

Teachers selected represented five academic content areas: Newcomers ELA, Social Studies, Dual Immersion Social Studies, Science, and STEAM; allowing for rich descriptive data across the five blocks that comprised the majority of the learning day. The variety across the content areas also provided a large, representative sample of the students, approximately 288 students altogether.

The researcher individually interviewed the principal, six teachers, and four of the students, and two additional students participated in a pair interview. Two semistructured interviews occurred during the course of the study. The semistructured interview used a question protocol designed to probe key information related to the research question, but deviated from the question protocol based on participant responses or when otherwise deemed appropriate by the researcher (Hatch, 2002).

The researcher recorded the interviews and kept them in the secure digital notebook, then sent the recordings to a professional transcribing service. Transcriptions were submitted for participant checks that helped to strengthen the reliability and credibility of the data.

Participants. The majority of teachers and the principal participants had five or more years of teaching experience at the school. The principal had taught and served as assistant principal at the school before becoming principal. The principal and teacher participants represented diverse years of teaching experience, with the majority having a strong history with the school. Robert, the Dual Immersion Social Studies teacher, had selected teaching as his second career choice; for the others, teaching had been and remained their first career choice.

The majority of the teacher participants were involved with the school community in additional capacities, such as offering enrichment classes on iMovie during the holiday breaks or coaching various athletic and enrichment activities. Teachers William and Leslie were AVID mentors and taught related elective classes on study and organizational skills as well as facilitated AVID collaborative tutoring twice per week. AVID is the acronym for a global school program that stands for "Achievement Via Individual Determination"; its stated philosophy is to use best practices to prepare traditionally underrepresented students to succeed in high school

and higher education as well as in their later careers. The following table presents the context for the principal and teacher participants.

Table 2

Context for Principal and Teacher Participants

Pseudonym 1leader 9 teachers	Role at school	Participation	Years at school	Age range
Ray	Principal	interview	5 4 as Asst. Prin.	40s-50s
Tanya	STEM design and math teacher	interview observation	9 11 as teacher	30s
William	science teacher	interview observation	11 11 as teacher	30s
Luke	science teacher	interview observation	11 11 as teacher	40s
Shelley	science teacher	interview observation	4 4 as teacher	20s
Robert	Dual Immersion (DI) social studies teacher	interview observation	2 3 as teacher	30s
Drew	Social Studies Teacher	observation	24 24 as teacher	50s–60s
Anna	Newcomers Language Arts, Math, Science Teacher	interview observation	5 5 as teacher	30s
Megan	Newcomers Language Arts, Math, Science Techer	observation	4 24 as teacher	50s
Leslie	Honors Language Arts Teacher	observation	2 8 as teacher	30s

The six student participants were all eighth-graders who had been at the school since sixth or mid-sixth grade. They studied a range of honors, academic, and English Language Development classes, and participated in a wide variety of activities, as shown in Table 3.

Table 3

Context for Students Participants

Pseudonym 6 students	Grade, gender	Participation	Years at school	Involvement at school
Katherine	8th grade, female	Pair interview	3	AVID, PAL, School Council
Skylar	8th grade, female	Pair interview	3	AVID, PAL
Lauren	8th grade, female	Interview	3	AVID, debate, athletics
Sam	8th grade, male	Interview	3	School Council, athletics
John	8th grade, male	Interview	2 ½	former newcomer, robotics club
Tyler	8th grade, male	Interview	3	athletics, robotics interest

The researcher interviewed sampled administrators and teachers twice, at the beginning and end of the data collection cycle, ending in March 2017. Interviews served two purposes in data collection: (a) to provide a deeper, up-close understanding of the participant's motivation, thinking, and subjective interpretation of the phenomenon; (b) to reveal the layers of meaning of the participant's experience. Sometimes, data provided in the interviews were not evident in the observations or documents and interviews were the only access to the insights provided by the subjective views of the participants. Additionally, interviews provided a window into observed behaviors and practices comprising the classroom discourse (Hatch, 2002).

Interview protocol. Interviews took place on the school campus to provide convenient access; the researcher recorded each interview and placed it in the One Note Notebook for later

transcription, as well as taking notes during the interview. At the beginning of each interview, the researcher reminded participants of the conditions of anonymity and confidentiality that comprised part of the consent to participate. They were also asked to confirm their understanding that transcriptions would be provided to them for approval and/or any need to clarify points of the interview. Each interview lasted between 20 and 60 minutes, depending on the participant.

The researcher asked participants a series of questions, beginning with lower perceived risk ones to the higher perceived risks one, as rapport built with the participant through the process. The first interview had open-ended questions that emerged from reading several dissertations on digital equity, adapting the concepts and probes of their interview questions to this particular study (Harris, 2010; Pack, 2013; Velastegui, 2005). The second interview used questions drawn from the themes and notations resulting from open coding the initial observations and the first interview. The responses to these questions elicited additional information for coding and analysis. Copies of the semistructured questions are in Appendices A–D.

Data Source: Documents

Collecting documents and student work was stable, "objective," and nonintrusive to the classroom learning situation or school daily operations (Creswell, 2014; Yin, 2011). This study collected: District and School Technology Plan; District Local Community Accountability Plan (LCAP); district and school websites for vision, programming, professional development, lesson plan, and assignment exemplars; and some student work samples created with the Chromebooks or iPads. Finally, a list of the educational software used by teachers and students was collected. Because documents were a record of events in the study not subject to interpretation by the study

participants, they provided a source of data that increased the study's reliability or provided additional insight of data collected through interviews, observations, and the focus group.

Data Analysis

Qualitative analysis relies on the researcher to investigate the meaning of the collected data to create inductive generalizations, "a search for patterns of meaning in data so that general statements about phenomena under investigation can be made" (Hatch, 2002, p. 161). Hatch further suggested a series of steps for analyzing the data, to be completed as data is collected rather than at the end of the data collection cycle. This allowed for deeper reflection and for connections to be discovered as the observations progressed, as well as to develop subsequent interview questions (Flick, 2014; Hatch, 2002; Lichtman, 2010).

In line with the recommendation for ongoing analysis during data collection, recorded interviews were transcribed promptly and reviewed for patterns and themes. Immediately following the observations, field notes were reviewed and commented upon to ensure that thinking about the observation was captured. Combining analysis of the interviews and observations in an iterative process allowed the researcher to narrow the focus of the study, resulting in more critical observations as the course of the study advanced. Second interviews could then explore emerging themes or topics as well as serve as opportunities for participant checks and feedback.

Hatch's (2002) Steps of Inductive Analysis

In preparing and analyzing qualitative data, one must follow a precise methodological approach. The first of these was to identify the frames of analysis that emerged from the data. Next, the researcher created domains based on the semantic relationships that the frames

revealed. Each pertinent domain was then assigned a code name, while those that were irrelevant to the study were put to the side. The researcher proceeded to a second reading of the data, this time recording where the relationships underlying the domains were found in the data. The researcher also identified any domains or categories that were not well-supported by the data, as well as looking for themes in the data that were discrepant findings, outside of the expected relationships in the domains. The data within domains were then analyzed, after which themes were investigated and identified across the domains. The researcher regrouped and re-arranged codes into domains, and domains into themes several times before the ones presented in Chapter 4 emerged as the most compelling explanation for the data. A master outline was prepared each time the regrouping happened, and a trial analysis using the themes was attempted and revised when the regrouping occurred several more times.

Coding and Thematic Analysis

Creswell (2014) described coding as pattern matching, the process of finding correspondence between two or more data to establish themes. As Creswell has suggested, the researcher begins coding by first consulting the literature review, finding items in the literature that resonate with the researcher's experiences as recorded in the data. Codes that are not expected, or confounding, were examined in the same way to evaluate if they had a logical foundation either in the literature review or in the researcher's experiences.

To ensure accurate analysis, the researcher codes were based on the actual language of the participants as well as ~~om~~ noninterpretive descriptions of activity. Frequently used phrases, ideas, and actions were grouped into categories. Relationships between the categories and the theoretical framework were discovered, as well as outliers or unexpected relationships. Axial

coding (Creswell, 2014) processed these preliminary open categories into broader "chunks" and themes.

A theme is the common thread that extends throughout an interview, a set of interviews, or observations, including observational discourse. The theme might be underneath the text, so establishing the thread of categorical relationship was helpful in identification of the themes. Once they were identified, the themes of the data provided significant links between the data and the analysis of the phenomenon under investigation (Creswell, 2014; Flick, 2014).

Notations were prepared throughout the coding process to postulate possible explanations to the discovered patterns as well as identify what further probing was necessary. The coding process continued until the data presented a rich account of the experiences of the study participants and of the phenomenon under consideration. The process is detailed in Appendix E.

Criteria of Trustworthiness

Qualitative studies have different criteria for determining validity and reliability than quantitative studies, as the investigation is nonexperimental and relies on study of the natural setting of the phenomenon. As such, there are three aspects to evaluate when gauging the trustworthiness of a qualitative study: credibility, transferability, and dependability.

Credibility

Credibility relies on lack of bias, and qualitative research is particularly susceptible to this threat of bias since the data and its significance are mediated through the lens and perspective of the researcher. The researcher had already acknowledged a favorable disposition toward 1:1 technology as well as a strong reaction to inequities, power abuses, marginalization, and their structural and systemic sources. To mitigate this bias, the researcher specifically looked

for discrepant evidence that would contradict attitudes toward 1:1 technology, which the researcher originally viewed as having an unquestioned positive effect on learning. A search through the literature provided the researcher with additional information—both theoretical and empirical—documented in the literature review.

Prolonged engagement. As recommended by Hatch (2002) and Yin (2011), the course of the study established a period of prolonged engagement with the phenomena within the context of an eighth grade comprised of a predominantly economically disadvantaged population. At the last interview, when the researcher inquired whether the school would be open to return visits in the following year to update the data, the principal replied, "Sure, you're one of us now. You're here more than I am-just kidding." This exchange assured the researcher that she had spent sufficient time at the site to develop a reliable emic perspective.

The data collection of interviews, observations, and document analysis spanned four months—November 2016 to March 2017. Points of contact comprised 36 hours of observation recording activity and discourse, three hours of principal interviews, 13 1/2 hours of teacher interviews, and six hours of student interviews.

Participant checks. Hatch (2002) recommended that the researcher provide participants with an opportunity to review the transcripts of interviews before they would be presented as data in final form. The researcher provided principal, teachers, and students a copy of the interview transcript, and reviewed them with the participants for accuracy. None of them had any revisions or clarifications to make, indicating that the transcripts provided an accurate record of the interviews. These checks helped to assure the trustworthiness of the study's presentation of the perspectives of the principal, teachers, and students.

Triangulation. Triangulation consisted of using multiple sources of data to increase the trustworthiness and reliability of the findings of the study (Creswell, 2014; Flick, 2014). This study triangulated the data by diversifying the sources of data between interviews, classroom observations, and document analysis. Another level of triangulation happened within the interview process itself as multiple participants' responses revealed the common aspects of different accounts of the phenomenon. Interview questions probed the same aspect of the phenomenon from different perspectives, providing higher reliability than would otherwise be the case. Additionally, the classroom observations were diversified by academic subject and teacher participants, strengthening the triangulation effect of the collected data in establishing a high standard of reliability.

Negative and discrepant case analysis. Because the researcher expectations of reality might not coalesce with the realities found in certain aspects of the phenomenon, or in the varying perspectives and discourses of the participants, some data did not support or contradict the emergent findings from the data. Creswell (2014) recommended presenting contradictory data as an assurance of the trustworthiness of the study. As such, this research described the data that conflicted or countered the emergent general themes within the discussion of each theme, increasing the trustworthiness of the study.

Transferability

Transferability asks the question: to what extent can the findings of this study within the context of an exploratory case study be transferred to contribute to theory, best practices, or policy? Because this study had rich, thick data, the findings, although limited to a single case study, are more transferable. Given that the literature demonstrated that the experiences with 1:1

technology of students who were predominantly economically disadvantaged had common characteristics in various settings across the country, the challenges of the digital divide and the ways in which technology uses and pedagogical practices help to deconstruct the digital divide had already been identified across a diverse number of contexts.

Therefore, the recommendations and implications of this study enhanced the transferability of the study. Nevertheless, transferability might be effected by the policies and context of the case study school and its participants that have a distinct character as a case study.

Dependability

In qualitative research, dependability is a measure of the extent that a study and its findings may be replicated (Creswell, 2014). The methodologies have been described with sufficient details—and the literature references have provided a sufficient trail of theoretical and empirical evidence—that the study might be duplicated. By checking the transcripts and field notes carefully, cross-checking codes and organizing them using the OneNote digital notebook, the researcher prevented drift and misclassification as well as provided a visual representation. The study established a clear set of findings and their characteristics that might be used to check for replication in similar studies and future research.

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Positionality and Reflexivity

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As already discussed, bias reflects the way in which a person approaches the world and, therefore, the phenomenon under study. Acknowledging the positionality of the researcher and assuming a reflective stance through the course of the study mitigated the effects of researcher bias.

Positionality

The researcher has already acknowledged her early years as an immigrant and ELL, who experienced liberating educational experiences that helped form an identity and voice to overcome barriers to entry and full participation in education, the workplace, and society. Embarking on a journey into the profession of education immersed the researcher in four years of teaching learners who were economically disadvantaged, most of whom were also ELL. This frame provided very strong opinions regarding the role of education in either replicating or disrupting socioeconomic stratifications, with experiences that validated a bias that social replication was often more common than the liberating role of education.

Later experiences, both as teacher and teacher-leader, within a school dedicated to educating highly able but psychologically challenged learners, confirmed researcher opinions about education and marginalized populations: that education could be either liberating or marginalizing, but that many times, tended to sway toward the marginalizing aspect.

The researcher's background in consumer software and status as an early adopter of personal computing, both professionally and personally, established a favorable predisposition to the use of technology. Having researched its applications, along with promising uses and practices, in master's research and for several professional development presentations, the researcher has an affinity for technology use in education. As a Microsoft Innovative Education Expert and Microsoft Certified Educator, as well as a technology teacher leader at school, the researcher's favorable bias toward technology was as well-established as her belief in socially just, equitable education that acts to increase the democratic participation of all participants.

Therefore, the two biases remained in tension throughout this study. Exploring the favorable disposition toward technology led to questions of what conditions, beliefs, and practices would foster democratization and equitable use of technology in education. The literature provided a rich theoretical framework that balanced the two biases. One bias balanced and offset the other, as shaped by the theoretical framework, relative to the investigation that was the subject of this study. Awareness of both biases, evolution of the research question, and the research design aimed to reconcile conflicting realities, minimized the effects of bias.

Reflexivity

Qualitative researchers enter the world that they study, becoming part of the world, while at the same time holding themselves at a distance as observer. Developing the capacity for self-reflection, to recognize the influence of bias in interviews and follow-up questions, in field notes, and so forth enabled the researcher to stand in dialogue with the data (Hatch, 2002). This meant self-monitoring emotional responses to participants and events during interviews and observations, and withholding judgment during the collection of data. Being exacting in the meta-cognitive process of reflection during the informal, preliminary stages of analysis as well as during the formal stage of thematic analysis strengthened the effects of attachment to the world that was the subject of the study. This reflective activity also served as an additional mitigating factor on researcher bias.

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Reflection on the Research Process

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In the process of immersing in data collection, coding, and analysis, several reflections regarding the researcher's path formed important insights, perhaps because of the depth of immersion and the breadth of exposure to the site, whose intensity surpassed former research

studies. The first of these was the importance of the research question in providing the frame through which the process evolved. At first, the research question was a series of questions with repeated patterns, as often appears in studies; in the development of this study, there was a question relating to technological uses, another relating to pedagogical practices, another relating to agency. Questions were revised several times—but always separately—until discussions with peers resulted in a single, focused question. Because within the context of the study, technological uses and pedagogical practices are so intrinsically bound together, it was more appropriate to bind them together in the research question and indicate their relationship by putting the word "associated" as a bridge between the two elements. Additionally, to keep the emphasis on the Margins of Maneuver rather than on agency or democratization potential, it was best to name it in the research question and explain its components in the articulation of the theoretical framework. Both of the changes in the evolution of the research question helped to focus the researcher's thinking and analysis subsequent to the collection and coding of data. This was a significant insight for the researcher, and shared with students whom the researcher advised in their culmination research essays.

Another epiphany resulting from the research process was the awareness of the importance of suspending one's personal beliefs, assumptions, and even key points from the literature when conducting observations and interviews. In order for the data collection to sustain integrity, the researcher needed to be mindful of the classroom discourses and events, as well as attentive to the interviewee to deepen the conversations with ever more relevant questions. Only once that process had occurred did the researcher entertain the application of the literature review and her own thinking in marking significances on the raw transcription of the data.

Although learned during research methods classes, the rigor of actually being mindful in disregarding already-existing thoughts strongly emerged during this study. Mindfully recording reduced the intrusion of researcher bias on the data.

Similarly, the recommended stages of data collection that included intermittently coding and thinking about the data throughout and simultaneously with the collection process were invaluable in guiding the next step of observations or interviews, or even consulting documents, for further illumination of emerging patterns. Even the process of confronting and questioning unexpected emergences moved the researcher to a deeper understanding and to investigating alternative explanations. The same was true for the entire process of coding, as the researcher rearranged codes multiple times and visually connected them as the data grew and new potential connections became visible. The process was similar to moving pieces around on a Rubik's cube to see new facets revealed searching for the optimal fit.

Lastly, the researcher discovered the importance of language choices relative to bias or assumptions, both in the wording of research and interview questions as well as in the recording and interpretation of data. Language provides a reference for thinking and communicating; formulating questions that attempted to be value neutral, not infused with the researcher's implicit expectations, were important in engaging honest responses and reactions that reflected the participants rather than the researcher. The immersive qualitative research experience had many lessons for the researcher to guide future practices and thinking in both research and nonresearch activities.

Conclusion

Using an exploratory qualitative phenomenological case study analysis, this study explored the potential of 1:1 technology to foster student agency and participation in an eighth grade comprised of a predominantly economically disadvantaged population to foster learner agency. The medium for this assertion of agency occurred within spaces of resistance and transformation that Feenberg (2002, 2010) has referred to as the Margins of Maneuver. To maintain the trustworthiness of the study, various sources of data from diverse participants and perspectives were collected over a period of four months—interviews, observations, and documents. As such, the data in this study were triangulated and collected over a prolonged period of engagement with the phenomenon and study site. Inductive findings emerged from coding that identified domains and categories, followed by thematic analysis. The researcher disclosed her positionality: strongly held beliefs related to social justice, equity, and democratic participation in society, as well as a favorable disposition toward technology. The exploration of the literature, the use of the theoretical framework that held these positional beliefs in tension, and reflective practice mitigated potential bias throughout the course of the study. Chapter 4 describes the data and findings of this study, while Chapter 5 provides a discussion of the findings and their implications for policy and best practices as well as possibilities for future research.

CHAPTER 4

FINDINGS

> Case study data is drawn from people's experiences and practices so it is
> seen to be strong in reality…Good case studies build on this to explore
> alternative meanings and interpretations…Because the data contained in
> case studies are close to people's experiences, they can be more persuasive
> and more accessible.
>
> —Blaxter, Hughes, and Tight

Restatement of the Purpose of this Study

The various levels of the digital divide have had a significant educational equity impact

given the growth of technology integration and one-to-one (1:1) implementations in learning.

The first level digital divide refers to access to computers, software, and the Internet. While the

second-level digital divide refers to the differential between higher order and lower order uses of

technology, the third level articulates the ways in which these uses address the realities of the

learner's issues and community. Research has demonstrated that the first level digital divide is

closing, increasing the number of students who learn with technology, causing an exponential

growth in the second- and third-level digital divides, which has widened the learning gap

between economically advantaged and disadvantaged students (Hohlfeld, et al., 2017; NETP,

2016; Pack, 2005; Reinhart & Toriskie, 2011; Velasgui, 2005).

With an equivalent concern for democratizing technology, critical theorist Andrew

Feenberg (2002, 2010) proposed that technology has potential for spaces termed *Margins of*

Maneuver. These spaces are opportunities for uses, designs, and purpose that both foster user

agency as well as being formed by that agency, which then strengthens the user's participation in

the dominant society. Critical theory on technology aligns with the use, design, and purpose

emphasis of the research on the second- and third-level digital divides (Harris, 2010; Mouza,

2008; Okan, 2007; Reinhart et al., 2011; Teemant & Hausman, 2013). This alignment has created a compelling proposition that technology uses and pedagogical practices that foster Margins of Maneuver provide an effective path for closing the second- and third-level digital divides.

Within this context, the purpose of this study was to explore the potential of 1:1 technology to open Margins of Maneuver and impact learner agency as well as democratic participation in the case of a middle school with a high percentage of students who were economically disadvantaged (School Accountability Report Card). The results contribute to existing critical theory on technology by investigating technology integration uses and pedagogical practices within an economically disadvantaged educational setting. Further, this study's results have informed educational policy with possible alternatives regarding technology uses and practices that affect equity within the second- and third-level digital divide. Lastly, the study has provided voice to the technology experience of the principal, teachers, and students at the selected middle school case site. To guide this purpose, this study used a critical theory framework to evaluate the middle school's 1:1 implementation with the following research question:

> To what extent do 1:1 technology integration uses and associated pedagogical practices
> foster *Margins of Maneuver* in an eighth grade comprised of a student population that is
> predominantly economically disadvantaged?

Context of this Study

One-to-one (1:1) technology initiatives have been growing exponentially throughout the United States (Bebell & O'Boardman, 2012; Keengwe et al. , 2012; LaFee, 2010). Regardless of growth, research has reported mixed results and competing accounts of 1:1 computing, from positive learning outcomes to lack of efficacy in achieving desired transformative effects (Argueta et al., 2011; Cullen et al., 2013). In this environment, the National Education Technology Plan (NETP, 2016, 2017) has found that 1:1 growth may threaten to exacerbate educational gaps as the increase of 1:1 implementation has also increased the impact of technology uses. Although there have been many studies on the effects of 1:1 computing on academic achievement, few studies have investigated the potential of the uses, design, and purpose of educational technology to foster Margins of Maneuver. A critical need exists to evaluate technology uses and associated practices that foster these spaces to promote student agency and democratic participation, creating effective equity pathways.

Setting

This study used an exploratory qualitative phenomenological case study design to gather and analyze data regarding the case of Granada Middle School in the San Vincente School District. The researcher investigated alternative districts to find one that had a depth of commitment to 1:1 and to its potential impact on the learning and lives of students who were predominantly economically disadvantaged. San Vincente had determined in planning processes, as evidenced by its website communications, that grant monies would be used to generously resource the development of 1:1 technology to enhance learning in its middle schools with plans to expand to elementary and high schools over time. A preliminary look at its district documents

evidenced a high level of carefully articulated implementation of 1:1 seemingly directed at promoting the long-term welfare of its students.

The purposive criteria applied in Granada Middle School's selection was that it had an ongoing 1:1 initiative with a very committed principal and staff. The website and a preliminary inquiry visit communicated a dynamic school re-inventing itself to revision learning in support of providing an equitable future for its student population that was predominantly (96.4%) economically disadvantaged (SARC, 2015–2016). In the preliminary visit to inquire about the principal's willingness to allow access to the school, the principal and several teacher leaders manifested a singular purpose in using technology and a shift to student-centered, personalized learning to open up aspects of experiences and the world to their students. They appeared to be open and implementing new approaches, to be willing to make mistakes in the effort to promote student well-being, and to enjoy the mission they had commonly adopted—whatever challenges it might also present.

The school provided parent technology classes and training, low-cost insurance for the 1:1 devices, and a negotiated low-cost Internet provider alternative, all elements identified by the literature as necessary to a socially just implementation. A wide variety of activities enhanced student learning, ranging from service clubs to speech and debate to robotics, extracurricular athletic teams, and an extensive arts program that included visual arts, dance, and music. Tutoring was available before and after school, both from teachers as well as from other students. Parents were warmly welcomed at the school office and were provided with information quickly. When visiting the site, the researcher observed a comfortably busy level of student interactions and an active student, faculty, and staff presence for one to two hours after

the last bell had ended the formal learning day. With its positive activity and environmental

initial profile, the researcher anticipated that Granada Middle School and its learning community

would be a rich source of data for pursuing the research question.

Some of the themes articulated by the district and the school site as motivation for the

emphasis on technology integration and student-centered, personalized learning were themes that

have permeated the narratives of the dominant society:

- college and career readiness;

- preparation for being valuable members of a globalized technologically-
dominated economy;

- increased mastery of knowledge; and

- an emphasis on high achievement and/or success.

These themes could have easily served the interests of social replication. They could also have

presented opportunities for resisting the dominant narratives because the purpose of

democratizing technology to serve other themes also appeared in website communications:

- students as co-creators of learning;

- student agency;

- integrity and human-centeredness; and

- authentic participation in society.

What Feenberg's (2002, 2010, 2017) critical theory of technology describes as the ambivalence

of technology paralleled an initial observation of the ambivalence of district and school site

themes in communication.

It is this ambivalence that opens Margins of Maneuver, spaces to be framed depending on the intent of those who use technology and design-associated pedagogy to democratize technology's purposes and outcomes for students who are economically disadvantaged. Therefore, Granada Middle School within the San Vincente School District was an exemplary selection for a research site, given the parameters of the research question and the discussion in the theoretical framework literature. Additionally, the demographics combined with the purposes and practices reported on the websites, characterized the type of 1:1 implementation that would test critical theory of technology and critical pedagogy alongside the claims and concerns of the National Education Technology Plan (2016, 2017) regarding the potential benefits of 1:1 technology as well as the second- and third-level digital divides.

Data Sources

From the period of November 2016 to March 2017, the researcher gathered data, beginning with a school site visit, noting impressions of the site as well as meeting with the principal, staff, and potential teacher participants. Documents for analysis included district and site Technology Plan, sample units or lessons, exemplar student work, and information published on school and teacher websites. From the teachers who had signed Informed Consent Forms, the researcher selected participants. Criteria was purposive, consisting of the researcher's judgment of a representative sample, as well as convenience criteria of availability and responsiveness. The researcher scheduled interviews with students who had returned the Parent Consent and Student Assent Forms. After the all-day site visit, the researcher scheduled observations of classrooms in STEAM (integrated science, technology, engineering, art, math), science, social studies, and language arts, described in Table 4, below.

Table 4

Classroom Conditions and Lessons during Observation

8th-grade classroom Total: 9 classes	Environmental features	Lesson(s) observed
STEAM Design Class	Large room in 4 sections: lab, printer and display, tool and construction, materials "cage"	Follow-up to SketpUp; student teams designing environmentally sustainable high schools on large grid paper to prepare for digital entry
Science Class #1 Science Class #2 Science Class #3	Lab tables in groupings; teacher lab table at front with white board and projection system. Various posters; essential question on board	Lessons on gravity and force using roller coaster design and building, ending with an iMovie to demonstrate learning. Groups at lab tables used devices throughout learning; jigsaw home/expert groups; info on Google classroom; teachers modeled steps
Social Studies Class #1 Dual Immersion **(DI)**	Desks arranged in fan style; various posters; essential questions on board; white board, projection system	Early monetary and fiscal policy, the Lewis-Clark Expedition, and Native American issues. Class warm-ups tied to current events. Content on Google classroom. Students used devices and paper notebooks.
Social Studies Class #2	Desks arranged in rows, all facing front; various posters; essential questions on board; white board, projection system	Early monetary and fiscal policy as well as the era of Andrew Jackson. Lecture, Chromebooks periodically (4 wks., approx..) for students to work with Pro-Con and other websites
Language Arts Class #1 Newcomers Support	Desks arranged in groupings; teacher desk at front; various posters; white board and projection system.	Characteristics and nutritional information of foods and fruits; focus on building academic language. Students research on their devices; allowed to use translator to make meaning; writing and oral reporting of work product.
Language Arts Class #2 Newcomers Support		Habitats and ecosystems; focus on building academic language; students research on their devices; allowed to use translator to make meaning; writing collaborative report. Choices for presentation of product.
Language Arts Class #3 Honors		Lesson on Act 2 of *The Diary of Anne Frank*; some students reading roles in whole class oral reading, other students listening as they follow the text; teacher displays text on board, with pencil tracking. Responsive postcard activity on theme.

The observation protocol consisted of the researcher recording notes that described the school and classroom environment, the learning activities, the uses of technology, and the interactions between the teacher and students. The researcher then reflected on the observation notes, raising new questions, noting patterns, and identifying areas of focus for subsequent observations.

The interviews utilized a semistructured protocol, using predesigned probing questions that still allowed for adaptability to participant responses to pursue different inquiries as they emerged from the conversation. Second interviews probed issues identified through coding analysis of the initial data. Interview questions are in Appendices A–D.

Participants

The researcher observed nine teachers and interviewed the principal, six teachers, and four of the students, while conducting a pair interview with an additional two student participants. The researcher simultaneously recorded the interviews and had them professionally transcribed, with transcriptions provided to participants for them to check accuracy or clarity. These participant checks helped to strengthen the reliability and credibility of the data.

Principal and teachers. The principal and the majority of teacher participants had a strong history with the school. The principal had taught at the school before assuming an administrative role that had lasted nine years—first as an assistant principal, then as principal for five years. Most of the teachers had been at Granada Middle School for five or more years; the majority of participant teachers had been at the school their entire careers while Robert, the Dual Immersion (DI) social studies teacher, Shelley, a science teacher, and Leslie, an ELA teacher, had been at Granada Middle School two, four, and one year, respectively. Teaching was a first

career choice for all the participants, except for Robert, for whom it was a second career choice.

Table 5 describes the principal and teacher participants.

Table 5

Background of Principal and Teacher Participants

Pseudonym 1 leader 9 teachers	Role at School	Participation	Years at School	Age Range
Ray	Principal	Interview	5 4 as Asst. Prin.	40s-50s
Tanya	stem design and math teacher	Interview Observation	9 11 as teacher	30s
William	science teacher	Interview Observation	11 11 as teacher	30s
Luke	science teacher	Interview Observation	11 11 as teacher	40s
Shelley	science teacher	Interview Observation	4 4 as teacher	20s
Robert	dual immersion (di) social studies teacher	Interview Observation	2 3 as teacher	30s
Drew	social studies teacher	Observation	24 24 as teacher	50s-60s
Anna	Newcomers language arts, math, science teacher	Interview Observation	5 5 as teacher	30s
Megan	Newcomers language arts, math, science teacher	Observation	4 24 as teacher	50s
Leslie	honors language arts teacher	Observation	1 7 as teacher	30s

Teacher participants were active in the school learning community in various capacities: enrichment classes during holiday breaks, coaching athletics or debate, advising AVID ("Achievement Via Individual Determination"), and the Social Justice Club. Most of the teachers

offered before or after school office hours as well as tutoring and supervising peer tutoring sessions or Saturday elective activities. This level of teacher extracurricular participation indicated their commitment to ensuring the highest quality of teacher-student interaction and providing needed support for individualized learning needs.

Students. The six eighth-grade student participants had been at Granada Middle School since sixth or mid-sixth grade. They studied a variety of classes, ranging from honors to academic to English Language Development classes, and were active in diverse activities as shown in Table 6 below.

Table 6

Background of Eighth Grade Student Participants

Pseudonym Total: 6 students	Gender	Participation	Years at School	Involvement at school
Katherine	Female	Pair Interview	3	AVID, PAL, school council
Skylar	Female	Pair Interview	3	AVID, PAL
Lauren	Female	Interview	3	AVID, debate, athletics
Sam	Male	Interview	3	School Council, athletics
John	Male	Interview	2 ½	Former Newcomer, Robotics Club
Tyler	Male	Interview	3	Athletics, robotics interest

Female students were all AVID members; Katherine served as vice-president. Katherine and Skylar were also in PAL, a nationally recognized program focused on "Peer Assistance and Leadership." Both AVID and PAL help young people become skilled in higher-order thinking, resilience, and participatory action. Another activity was a voluntary elective Saturday program that included STEAM maker and design activities as well as the Robotics Club. John, a recently

arrived male newcomer student had not yet been reclassified as a fluent English student while Sam and Tyler, the other two male eighth-graders, had been recently reclassified as fluent English students. The student participants' diversity of experiences and genders, and the dominant Latino/a ethnicity, comprised a fair representation of the eighth-grade population at Granada Middle School.

Data: Security and Analytical Methods

A database was kept in Microsoft OneNote, a digital notebook with audio recording and multimedia capabilities; data were organized by type of data, with subfolders, pages, and subpages for observational notes and interview transcripts. Other tab sections were set up for collecting documents, coding notes, and coding schemas. Additionally, coded data pages were kept in their own folder section, completing the chain of evidence, as recommended by Yin (2011). The digital notebook was password protected, with another password assigned to each section for observational and interview data.

The first phase of analysis was open coding; the researcher looked through documents for repeated phrases and descriptions that displayed a particular behavior or attitude, and assigned each of these an identifying code. Documents were open-coded after examination; after each observation, the researcher commented on the raw field notes, and open-coded them. The researcher recorded interviews, and sent them for professional transcription; then, she checked them against interview notes as well as submitted them to participant checks for their verification of the accuracy of the transcript. After the checks, transcripts were also open-coded. The researcher created a customized list of "tags" in the OneNote digital notebook that were then assigned. After completing the open coding, a summary page filtered by codes created a visual

schema for the axial coding phase that looked for connections and patterns to organize codes into

categories, or domains. Several different regroupings occurred, as the data gathering continued,

revealing new patterns and connections. The researcher framed the final code groupings into

themes that emerged from the data, reducing the data to shed light on the research question. The

researcher grouped confounding and negative findings, as they appeared in the data, under the

appropriate themes.

Summary of Key Findings

Feenberg (2002, 2010, 2017), supported by Okan (2007), Selwyn (2010), and Friesen

(2012) applied critical theory to technology, asserting that despite its hegemonic potential,

technology can create possibilities for learners to exercise their agency to purposefully and

critically participate in the dominant society. These opportunities were labeled Margins of

Maneuver, defined as spaces in which technology uses and practices foster agency, thereby

functioning as a democratizing factor that mitigated technology's hegemonic and social

replication possibilities. Several empirical studies agreed, arguing that the quality and nature of

the uses of 1:1 technology and associated pedagogical practices can become a democratizing

lever while noting the necessity for these uses and practices in order to reduce or close the

second- and third-level digital divides.

In investigating the research question on this point, the study found several trends and

patterns that emerged from the data. The rich data characteristic of qualitative methodology

resulted in the emergence of six themes that were further categorized into category patterns or

domains:

1. *A Technology-Enhanced Learning School Culture for College, Career, and Beyond*

    Spurred by district vision and school leadership, school culture was committed to

    integrating 1:1 and other technology into learning experiences. The goals of technology

    integration were to develop problem-solving and critical thinking skills to enable students

    to participate fully and ethically in society. Two focus areas of the culture were expressed

    in the mottos "Designing 21st Century Learning" and "College, Career, and Beyond."

    Domains: *District and school culture; college, career, and beyond; institutional and peer*

    support; student concerns with technology.

2. *Teachers as Facilitators.* The shift to teachers as facilitators was well-evidenced in the

    data, with teachers frequently referencing themselves as facilitating or guiding the learning

    process. The principal, teachers, and students as well as the observational data

    demonstrated the connection between the 1:1 implementation and the strengthening of the

    role of teacher facilitator. This shift established a horizontal power distance that is

    characteristic of democratic environments in most of the observed classrooms. By the

    teachers' own evaluation, they were still developing and working at becoming even

    stronger facilitators of learning. Domains: *Collaborative student-teacher relationships;*

    communication and easy access to teachers; teacher "activator" behaviors.

3. *Engaged, Experiential, and Inquiry Learning.* These approaches to learning facilitate

    potential for Margins of Maneuver. There was strong evidence that 1:1 availability

    promoted an engaged, experiential, and inquiry learning environment that challenged

    learners to be become active creators of knowledge. Supporting students in the

    development of their agency as learners was a significant finding because of its connection

to opening Margins of Maneuver. Domains: *Energetic activity and focus; autonomous student learning, individually and in collaboration with other students.*

4. *Instances of Higher Order Technology Uses.* Higher-order technology uses promote critical thinking, creativity, and communication, as contrasted with lower-order uses like routine drills, flat use of information as regurgitation, and template-like presentations. Evidence revealed that higher-order uses were evident in the STEAM design and robotics activities as well as in iMovie and research activities in science, DI Social Studies, and Newcomers Language Arts. There were, however, incidences that demonstrated lower order uses of technology. Domains: *Critical use and sourcing of information; subject-specific discourse.*

5. *In-Progress Efforts to Strengthen Learner Voice and Self-Identity.* Strengthening learner voice and self-identity is an essential element of fostering agency. The school appeared to be in a transition toward strengthening student voice and self-identity, with the majority of teachers and the principal acknowledging this outcome as a goal while also acknowledging that efforts were developing as participants navigated the multiple shifts that accompany the 1:1 implementation. Domains: *Culturally responsive learning; academic self-confidence versus self-identity.*

6. *Purposeful Awareness of Economic Disadvantages.* Data demonstrated that the learning community was consciously aware of the economic disadvantages characterizing the majority of the student population and school families, further potentially affected by their ethnicity and fluency variations in the dominant language. Having grown up in the community, the principal expressed a passionate concern and commitment to providing

diverse opportunities that enable all of the students at Granada Middle School to thrive.

Most of the teachers expressed similar resolve; the longevity of teachers at the school also

evidenced dedication to educating poor or low-income students. Student statements also

indicated knowledge of the factors causing their potential marginalization. Despite this

unity of purpose, intention of using 1:1 technology to develop responses to the economic

disadvantages was inconsistent, indicating a growth area for developing the Margins of

Maneuver and their democratization potential.

The body of this chapter reports the evidence for the six themes and their respective associated

domains, providing support for the findings that resulted from data analysis. Additionally,

consideration of discrepant findings appears within the theme to which they pertain. The

reporting and analysis is organized by theme and domain.

Discussion

Theme 1: A Technology-Enhanced Learning School Culture for College, Career, and Beyond

District and school culture. As stated in the Technology Plan covering the years 2015 to

2018 and the associated Stakeholders Report (May 19, 2015), the district had committed to 21st-

century design learning and problem-based, inquiry learning, both of which emphasized the

centrality of student-centered pedagogies. The Technology Plan was developed by considering

feedback from all constituencies and formed a standing Technology Plan Stakeholder Team to

meet bi-annually to review progress as well as identify new needs or strategies.

The stated goal of this commitment was to "increase students' academic achievement

through technology integration in support of teaching and learning." At the same time, the

Technology Plan named other explicit goals as high student engagement, learning relevance, and

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motivation to enable students to participate as "leaders, workers, and citizens" in society, who use design thinking to "tackle complex real-world problems in human centered ways."

Granada Middle School's culture was aligned with the district vision, expressing commitment to student engagement in the document record of the school; for example, the introductory message on the principal's website stated that "learning and achievement will be at a deeper level" with "stronger connections" to student interests. Defining his role as "vision holder," Ray, the principal, clarified his leadership vision:

> The expectations of 21st century skills and to make sure anything we do when it comes to our curriculum; when it comes to one-to-one technology, I think we need to be aware of what the future is holding for us and, kind of, our programs and initiatives lead us in that direction.

The principal was sensitive to the necessity to gain skills that empowered students to meet the future demands of active participation in the resources and decision-making of society, viewing his role as one of engaging faculty and staff in that common purpose.

Teacher interviews showed appreciation for the principal's collegial approach, his openness and budgetary as well as implementation support of their ideas. Robert, the DI Social Studies teacher, expressed best the teacher assessment of their relationship with the principal:

> Having all these new ideas, as a new teacher, it's been great. I try to come up with new ideas that haven't been done before. Our principal is open to it all, coming and observing me and saying, "go with it."

In addition to the finding that the school has a strong commitment to technology-enhanced learning, the data revealed a strong participatory school culture.

Student interviews evidenced a strong perception that they authentically participated in this school culture when they talked about membership on school committees that made decisions about learning, technology, and other issues at the school. Katherine remembered her exercise of power in one of these committees when they considered eliminating the computer lab, "I told them how I feel…I fought for that computer lab when they asked me." She expressed these words with a broad smile and an assertive fist on the table, nonverbal expressions of her feeling that her expression of will had the desired results. With a similar smile and affirmative head nod indicating his assertion of agency, Sam recounted his experiences in the STEAM Design class: "I'm in charge, me and my team, like, we decide everything, …I mean, we want it to be good so we're gonna' do it, you know." The principal, teachers, and students spoke with a unified voice on experiences of empowerment associated with the strong district and school technology-enhanced culture.

College, career, and beyond. The District Technology Plan emphasized college and career readiness (CCR) as one of the central goals of the district's vision of technology-enhanced learning. The district's well-circulated motto, in documents and website messages, was, "Preparing all students for success in college and career." The Local Control and Accountability Plan (LCAP) for years 2015–2016 and 2016–2017 allocated a substantial portion of its funds to programming and initiatives designed to increase student performance measured with CCR metrics: state testing and admission to postsecondary colleges and universities, and post–high school persistence in advancement to the second year of college. District allocation of funds to technology integration and the development of digital skills explicitly aligned in support of the larger CCR goal.

Noticing that Ray, the principal, used "College and Career and Beyond" rather than just CCR, the researcher questioned him with a carefully constructed open-ended question, not expressing any sentiments or ideology to avoid loading or socially affecting his response with researcher bias. The question elicited a long and genuine explanation, full of personal history and passion that demonstrated his concern for the students of Granada Middle School, not just as their principal, but also as a person who grew up and belonged to their community:

> They don't know what the choices are so I think that's why I say it a lot; I know it's something our district believes in and we want to prepare our kids for that, but I truly take that as a challenge that, you know, I want our kids' college and career ready and beyond. I grew up here. This is my hometown…and I don't recall many conversations growing up that those were options…
>
> You know, growing up, I used to get a lot of, if you make it out of here and you make it to college, you have to do something good for yourself so that you can get out of the situation, and then you can live in the nice suburbs. I've always felt that was the wrong message. You know, if you want to build a really strong community and you don't want to repeat the cycle of poverty, then you have to get out there and do something positive and come right back to this community and make this a better place for the people who live here with you.
>
> So, when I talk about college and career and beyond, it's personal. Because I truly am passionate about that…I think for me it's very personal.

These words evidenced a strong commitment to college and career and beyond as a path as well as a hopeful vision for encouraging change-makers in communities of predominantly economically disadvantaged populations.

Ray continued his explanation: "The beyond is always whatever it is that happens to help you make a life for yourself. And we're all getting college and career ready and beyond at any given moment in our lives both personally and professionally." Ray's interpretation of CCR within the "beyond" expressed intent to empower students in economically disadvantaged situations with skills that enabled an increased exercise of agency in making situationally relevant choices.

Teacher statements echoed this commitment, with the majority expressing the need to help middle school students prepare for a successful transition to high school so that they would be able to go to college. William, one of the science teachers, identified the connection between 21st-century learning and CCR: "A lot of it is, I think, a lot of those goals are like centering around twenty-first century, and how that's gonna' help them getting ready for college, you know." Luke, another science teacher, agreed: "We have a 21st century learning department at the district, so if we want, to like, have a biology school within a school, that's well-supported. It's important-a lot of them wouldn't get the opportunity." The teacher commitment to learning, enhanced with technology, exemplified in these statements connected with the broader "beyond" understanding of CCR.

The AVID students also demonstrated this future awareness, with Lauren expressing a desire to be the first one in her family to go to college and possibly run for president. This

discourse between Katherine and Skylar typified the student concern with their futures, discussing their experiences with various adult "connections:"

> Katherine: I go, like, my motto is if you don't go out to seek it, then it's not going to come to you…there was a professor there (*at the AVID field trip*) that was giving me opportunities because I was talking to her…There was this really great program where it's like you're in high school but you're taking college classes…I was, like, oh, I really want that.

> Researcher: A dual enrollment program?

> Katherine: Uh-huh, it's called Upward Bound…She was, like, well here's my card if you ever want to talk to me…I'll help you, like, fill out the forms and I'll make sure you will get in for next year.

> Skylar: I have connections to some people, too, who, like, have done something really great and, like, have a really high paying job, like my uncle…So, I'm like can you give me pointers? I want to be a history teacher, so can you, like, show me? I mean, he went to Chapman and he's a lawyer. And, he said, yeah, like, that sounds great, just go do it.

These eighth-graders perceived college as accessible and were seeking information and what they called "connections" to help them achieve those goals, albeit with a certain "cronyism" or concern for a "high paying job" that resonated with the dominant culture. Both students embodied the assurance found in observing and interacting with the students as a whole, focusing on possibilities rather than what others might term the "deficits" of their individual situations.

Institutional and peer support. The district LCAP document for the years 2015–2016 and 2016–2017 evidenced significant budgetary support for technology integration and the 1:1 initiative, as shown in Table 7, below.

Table 7

LCAP Technology-Related Budget Allocations

Year	Professional Development: Tech integration, restorative practices, standards, and bi-literacy	Tech Access school/home	Low-Income student access: Problem-Based learning and STEM/STEAM	Library and computer resources access and parent tech training
2015-2016	$6,000,000	$19,150,000	-0-	$3,200,000
2016–2017	$5,000,000	$8,000,000	$27,700,000	$3,800,000
2017–2018 proj.	$4,960,000	$7,800,000	$26, 670,000	$3,670,000
2018–2019 proj.	$5,020,000	$7,900,000	$27,000,000	$3,700,000

In the 2015–2016 LCAP, the district had originally projected similar dollar allocations to Technology Access at School/Home and to Professional Development; the category for Low-Income Access to Problem-Based Learning and STEM/STEAM did not exist. It appeared as if some of the funds in the categories of Technology Access and Professional Development were redesignated as part of the institutional goal to strengthen student capacity in Problem-Based Learning and STEM/STEAM. The Technology Plan and LCAP report also highlighted efforts to provide equitable access: EveryoneOn and ConnectEd provided families with low-cost Internet hotspots; foster agencies provided access and devices to foster students; the Digital Citizen

Academy gave parents the opportunity to check out Chromebooks and a hotspot for home use. Along with bandwidth and asset management upgrades to the devices and software, the district demonstrated a strong level of support to technology integration.

When asked directly about the extent of district and school support for technology integration and the 1:1 implementation, teachers and students alike expressed that support was satisfactory. The slow roll-out as well as the recall of devices were cited as major challenges. The availability of help with how to work with the technology, the information and training provided to parents, the video trainings for students, the presence of a technology specialist on campus, and availability of professional development were all cited as institutional supports. The voluntary nature of professional development participation was named by several teachers—Shelley, Luke, and Anna—as a factor that mitigated the progress of the implementation.

The principal stated that he had an open-door policy with teachers, encouraging them to come to him with ideas or requests that would improve learning, particularly with the 1:1 initiative. He also said that he communicated his acceptance of failure or need to tweak ideas to the teachers, to support them in trying out innovative methods. Teachers confirmed both statements in their interviews.

When it came to peer support or peer mentoring programs, teachers reported that there was no formal plan in place. Peers were available and willing to help, if asked, but there were no regularly scheduled peer observation times or job-embedded professional development plan that relied on peer interaction and accountability. Luke, one of the science teachers, reported that he had recently been named as a technology integration support teacher, so that he was available to

help other teachers on campus; yet no teacher interviewed seemed to know of his appointment at the time of the interviews.

Student concerns with technology. Students expressed reservations about losing personal interaction, as in these examples:

It doesn't show you little tricks about how to do this faster or better because it's like technology; you can't talk to technology. (Skylar)

Yeah, I don't know why we need the computer for that. I feel like it's more respectful that if you want something, …like, if you really want something, you go to a person. (Katherine)

Sometimes, I don't really like the devices because I like talking to a person face to face, sometimes, and, like, that would probably help with the racism because they can get to know each other instead of texting. (Tyler)

Skylar expressed an additional concern about the lack of Internet at home, but the other students had Internet access at home. Finally, most of them admitted to the potential distraction of social media as a challenge. Despite these reservations, students unanimously liked their experience of learning with 1:1, citing more independent learning and immediacy of information as the main reasons. Katherine expressed particularly strong concerns with technology integration, but thought using her device was a positive experience, helping her to access information and sustain focus.

Students all said they would appreciate the ability to use technology to interact with students in other places and to investigate issues that were important. Lauren and Sam described ways that they would like to use the devices:

I, like, want to find out more about, like, how to make it safe for everyone. I mean, you know, 'cause it, like, bothers me, you know, that some people aren't. Like, what could I do. (Sam)

I think we could be using the technology maybe to do research and then maybe finding ways to improve the situation. (Lauren)

Students were aware of the potential that existed with their device and information access to investigate and take action on topics that concerned them.

Summary. District and school culture strongly supported a technology-enhanced learning environment aligned with 21st-century design learning and CCR, which had been personalized and disseminated into a more transformative vision by the school principal. District resources supported technology, evident in significant budget allocations in the LCAP documents. The principal's openness to innovation and his belief in its ability to serve the empowerment of economically disadvantaged populations further supported the technology culture. Participants confirmed this support, even as they expressed low satisfaction with the slow roll-out and recall of devices. Even though students had concerns with technology integration, they did admit positive learning results and expressed a desire to use the 1:1 devices to address personal and community issues, indicative of attitudes characteristic of Margins of Maneuver.

Theme 2: Teachers as Facilitators

According to the literature, shifting to the role of teacher as facilitator of learning is a critical characteristic of using educational technology as a democratizing influence. Findings in this area showed an affirmative shift from teachers as dominant information deliverers to more collaborative facilitators of learning. Ray, the principal, stated that Granada Middle School had been working at shifting teacher perception of their role, confidently asserting that about 75% of the teachers at Granada Middle School had shifted to a facilitator role versus one of information delivery.

Ray's efforts to distill the vision for this shift were supported by the way in which all six teachers interviewed used the word "facilitator" in describing their role in the classroom, talking about "helping" students and "guiding" them in discovery of learning. Tanya, the STEAM design teacher, illustrated the shift in role perception in expressing her excitement with helping students acquire skills to brainstorm, research, design, layout, and construct buildings and devices:

> I teach math the rest of the time, and it's just so exciting to come into this space
> and know that we're going to be doing something they find real, something that
> really gets them going creatively. I can just be facilitator, not like when I'm
> teaching math.

While acknowledging that the STEAM class is more student-led than math, Tanya used the language of "guiding" and "facilitating" in referencing her relationship with students in the math class, showing a well-established identity as teacher-facilitator. Other teacher statements and

pedagogical strategies recorded in eight of the nine observed classrooms demonstrated the strength of the intentional shift to facilitating teacher roles.

1:1 Technology supporting and driving facilitation. The interview data demonstrated that 1:1 technology has played a complementary role in infusing this shift into Granada Middle School culture. William, one of the science teachers, stated that the convergence of 21st-century learning found in the school and district culture coupled with the 1:1 technology implementation had accelerated the shift to teacher as facilitator: "The devices, yes…shifted a lot of ideas on learning and put it more on the students."

Many of the other teachers—Luke, Shelley, Robert, Anna, and Tanya—agreed that devices made it easier to be facilitators since students became more independent with the devices, changing the dynamics of the classroom. Although 1:1 devices were not the only lever in driving the shift, acknowledging the impact of cultural factors, the outcome of their use has resulted in more facilitative pedagogical practices. Robert acknowledged some of the challenges in being a facilitator in a 1:1 environment:

> As a teacher, it's hard for us to trust the students with technology. We just need to trust them; here it is, go with it; as long as you're walking around and interacting with them, it's OK. That's part of, like, facilitating and guiding too, you know, makin' sure students are using devices for learning.

Despite the difficulty of trusting release to students in the use of technology, Robert expressed commitment to providing students with that freedom and the importance of circulating through the room, interacting with students and providing feedback, as part of the facilitation role.

Collaborative teacher-student relationship. The teacher-student relationship had become more collaborative and collegial resulting from the shift to facilitator. The researcher noted the strong atmosphere of give-and-take discourse and behaviors in eight of the nine observed classrooms. Conversation flowed easily and continuously between students and teachers, and they worked together with a common learning goal, each one playing a part in the learning. Respect and appreciation for each person in the room characterized the exchanges, setting a tone that was mostly inclusive and cooperative rather than dominant or exclusive.

All the students interviewed appreciated the nature of these collegial relationships and the independence and learner status resulting from them. Eighth-grader Katherine described her interactions in various classes, including the after school tutoring a student can request from a teacher:

> They don't tell us exactly what to do, you know. They give us hints, like, oh what do you think you should do? If it's a problem you forgot, it might come back to you and say, oh, I can do this, and they're, like, oh, yeah, that's what you do and then, like, the other students who might have the same problem are learning from you.

This theme of not being told what to do, and the emphasis on learner discovery, was reiterated by another student, Sam: "Yeah, the teachers are cool, like, they don't order you around and stuff. They let you know, like, what you're supposed to learn, and they just, like, help do it, you know?" Students expressed that in classrooms utilizing the 1:1 devices, teachers "helped" them learn rather than "ordering them around" or directing them exactly in what to learn or do. Student interviews and classroom observations demonstrated a developing tendency to share

discourse and power in learning accompanying the previously noted shift to teachers as facilitators.

Behaviors in science and the Newcomers Language Arts classes illustrate the development of the collaborative teacher-student relationship. These classes exhibited active teacher circulation, as they stopped to chat and offer assistance as needed and frequently modeled tasks and use of the 1:1 device, helping students to get over particular difficulties. At the same time, teacher behavior was empowering, not rushing to assist learners but rather asking guiding questions or providing assurance of student ability to achieve learning goals. Shelley, for example, when asked for more directed help replied, "I'll do the first one for you, then you do all the rest—you'll be an expert by then." This relaxed message is a powerful reminder to students of their roles as collaborators in the learning process. Shelley's modeling of mutual respect extended to the simple act of collecting quizzes, in which she always said, "Thank you." The students were appreciative of this courtesy, "You're so polite." Shelley's continual interest and support for her students and their learning created a strong level of collegiality in the room.

William, another science teacher, also provided support, redirection, and modeling of device use to students. At one observation, he was speaking with another teacher about the new science maker space, alternating to circulating among students to help or provide redirection. His behavior demonstrated confidence in students' ability to sustain their own learning as he kept one eye out for when he needed to return to help clarify or refocus. One student, who regularly joked with William and other students, told William that some Google classroom information was wrong. Within the collaborative atmosphere William set in the classroom, the student felt

comfortable using his iPad to research and challenge the information provided by his teacher. William, for his part, was comfortable announcing the student's findings to the rest of the class.

During the Newcomers Language Arts observation, Anna coached writing with the Newcomers: "I want to hear you talk…on paper. Use lots of interesting details. Use your words not ones copied from the book." In the second half of the period, more students raised their hands for help, especially one group. Anna went over to the group, answered their questions and asked more questions, encouraging students to express themselves, switching between Spanish and English as appropriate. Having modeled the process of collaborative learning, Anna reminded them, "You guys have to work as a team." These notable events exemplified the finding that Granada Middle School teachers both saw themselves as facilitators as well as interacted collaboratively with their students.

However, the Honors Language Arts class exemplified another less frequent reality at the school in which teacher-directed instruction dominated the learning interaction. The teacher explicitly prescribed instructions, delivered information, and used templates for student work. At times, there were some instances of "coaching" students during one of the observations. The teacher appeared skilled in the process of "nudging" students but often retreated to a more directive style of communication. As suggested by teacher and student interviews, this finding reflected that some teachers at the school were struggling with their role as facilitators concurrent with the shift to integrating their devices into learning.

Communication and easy access to teachers. The changing relationship between teachers and students had improved communication, so it had a more open, dialogic nature, and facilitated easy access to teachers. Observing students and teachers interact in multiple classes

revealed frequent instances of banter, an easy camaraderie that made the classrooms enjoyable experiences. Students were excited about looking up information and talking about it with their teachers, asking for the teacher's opinion or assistance as they worked, as demonstrated in their tone of voice and the periodic joking exchanges. The atmosphere evidenced a high horizontal power index; although the teacher was still the authority figure, students engaged and spoke dialogically with the teacher with confidence in the majority of classes observed.

An exchange in Shelley's science class exemplified the nature of teacher-student communication. After using the iPad to solve a particularly thorny problem in building the roller coaster, a student beamed and smiled when Shelley pointed him out as the "professional" who would be able to help other students. In a later conversation in class, this student joked with Shelley, "You'll have to pay me since I'm the professional. And, the student has become the leader," circling his fingers in the air to end up pointing at himself with a huge smile. Using his iPad to resolve questions on his own, without the teacher doing it for him, produced a strong sense of self so that he felt free to banter with the teacher from that position of strength. These types of exchanges were common in the observed classrooms, with the exception of the Honors Language Arts class that did not use iPad devices. William's explanation of how 1:1 devices had improved communication and access to teachers supports the possibility that technology makes the difference: "It opens up the classroom more and I think with conversations back and forth. Students messaging me and things like that outside of the classroom. They are thinking about things. They have more access I guess."

Students shared the assessment that communication and access were characteristic of school culture at Granada Middle School. Eighth-graders Skylar, Katherine, and John were quick

to describe their school as a family, saying that talking with most of their teachers was like talking with friends, even with the principal: "I know, like, I talk to my principal as if he's just a friend." The data supported the finding that 1:1 devices have strengthened the lines of communication that had already characterized school culture and provided ease of access to teachers as a direct result of digital availability.

Teacher "activator" behaviors. Activator behaviors characterize a facilitator who engages actively with the students in learning, avoiding the misperception that facilitation is less involvement in student learning. One such activator is the use of open-ended or layered, guiding questions, demonstrated in most of the classroom observations. Questions were both utilitarian, asking students to demonstrate procedural and informational competencies, and generative, eliciting student questions, discussion, and thinking, especially in contestable areas. Examples of these contestable areas evident in observations and interviews consisted of: the treatment of marginalized people, immigration, uses of money, credibility of information, the use of genetically modified organisms, and the implications of cloning. In many cases, students and teachers utilized the 1:1 technology to continue finding information to deepen the inquiry into these areas. Questioning and discussing these areas are indicators of Margins of Maneuver in a technology-enhanced educational setting.

Robert, the DI Social Studies teacher, articulated how a 1:1 environment supported generative questioning and discussion:

After they find something, a primary source or an article or video, it's time to ask and get them asking and discussing: …Is this something we can use to answer questions we have, or is it just part of the reason why we have the question? And, what is everybody's bias?

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How does that get in the way of everything that's out there? … You saw it in class

today…One of our main things in this class is why? What's your evidence? And learning

what to do with that evidence, even stuff that's different than what we think.

The observational data confirmed his statement, as the pattern of questioning and inviting

students to explore alternative explanations occurred throughout his class. He continued to

discuss the challenges of encouraging students to use the devices to access information

throughout the learning:

They feel more in charge of what they're learning…I mean, it's a challenge

sometimes to keep an eye so they are not doing something else. But, pretty much,

we have so much going on that they are using it for helping them learn what we're

talking about.

While acknowledging that students can go off-track, especially with devices in hand, Robert

emphasized that activating purposeful learning was the incentive to keep students engaged,

balancing curriculum with their freedom.

Contrastingly, in science classes, new learning usually initiated a teacher question-student

responses-teacher explains discourse, characterized by a greater reliance on utilitarian

questioning and a dominance of teacher over student questions. As the learning progressed

through the unit, the researcher noted an increase of student-generated questions that were

sometimes quite probing. Discussing a unit on cloning, Luke, one of the science teachers,

described such a reaction to one of the directions in the unit:

It was like well why would they choose these different colored mice in their

experiment? Well let's think about it. If you took something from the brown

mouse and put it in another brown mouse would it be easy to tell? …So that was

the one I got, well, why is this? Why would they have to do that?

Shelley reported a similar experience, surprised at how quickly the students related to the issues

of cloning:

You know, when we were doing the mouse closing unit, there were times where

people made choices about, like, what color they wanted the clone to be, or how

big. And, I mean, it's not a big stretch for adults, I think, to, like, ask why? But, I

was surprised that my kids got there so quickly.

Both teachers reported similar results with the unit on genetically modified organisms, and

reflected that they wanted to be more deliberate in activating these types of questions.

Lauren, an eighth-grader in the DI Social Studies, explained her learning experience as

one in which teacher-activating questions led students to generate their own questions: "You get

a general question, then you get to make your own questions about what you find out. There are

specific things, too, like, make sure to find this, find that." Not all her experiences involve this

type of activating support; she reported that it was mostly in science and DI Social Studies.

Tyler, a student in a social studies class not taught by Robert, agreed that his experiences in the

STEAM design and science class differed from his experiences in Language Arts and social

studies, saying that those teachers "really just talk to us instead of using the iPads or discussing"

to help students discover and generate learning. The inconsistencies from class to class, evident

in these student comments, again suggested that some teachers were struggling with shifting to

facilitator and activator behaviors in a technology-enhanced culture.

Targeted feedback—another activating behavior—was observed in the STEAM and

science, DI Immersion, and Newcomers Language Arts classes. Feedback that moved students to

engage their learning included direct coaching as well as asking students to use their resources to

modify their learning process or product. The feedback was both whole class, public to a small

group, or private to individuals. Feedback timing was concurrent with the learning, enabling

students to use the devices to research and/or modify thinking as well as talk with their

classmates about how to move forward, when appropriate. Some feedback consisted of short

coaching statements:

> When you do this, what do you think now?
>
> See how they were overlapping, that was the problem…
>
> Yes, then the marble comes out that way. (Shelley, science)
>
> That's not enough, go deeper…
>
> She's sharing; why aren't you writing down what she's sharing?...
>
> You're annotating, you're talking, you're filling in your charts. (William, science)
>
> If I put "sp" on your paper, what does that mean?
>
> It means to use your iPad dictionary to check your spelling.
>
> (Anna, Newcomers Language Arts)

Teacher statements best expressed the necessity for teacher-activator behavior in continuing the

cycle of learning and deepening of skills that benefit student learning. The value of activator

behavior focuses the teacher on mindful interaction with students throughout the process of

learning, establishing the co-learner relationship indicative of critical pedagogical practices that support Margins of Maneuver in a 1:1 environment.

Drew, a social studies teacher, who had a mostly teacher-centered lecture style, aptly demonstrated the impact of using 1:1 devices on shifting teacher practices. Drew's first lesson was dominated by teacher talk, which happened 85–90% of the time; nevertheless, he used the activator of open-ended questions with longer wait times that did encourage student participation. Most of the students were highly attentive to his dramatic effects, references to student culture, and joking, placing them in good spirits. Without using devices, Drew engaged students with the force of his personality, demonstrating more teacher-centered rather than facilitative behavior.

After talking about the Trail of Tears, Drew asked students to use Chromebooks to work on a pro-con learning activity, using a website with teacher-selected materials. The activity involved more student interaction with learning facilitated through the 1:1 device. Students worked as Drew circulated to suggest, direct, and question, keeping the discussion lively. In this situation, the use of Chromebooks gave the students more ability to focus on the learning versus attending to Drew's personal attributes and humorous teaching style. The activity also exhibited a change in Drew's behavior, as he engaged in the frequent consulting, clarifying, reflecting, refocusing, and coaching that typifies the activator-facilitator role rather than dominating the conversation in the classroom.

Summary. The use of 1:1 technology created an environment conducive to shifting the role of teachers to facilitators, both assisting in the shift as well as driving the shift with the change of the classroom dynamic. Teacher-student relationships became more collaborative as

students gained more independence in their learning through the immediacy of availability of resources and instructional help on the devices. Combined with an increase in democratic communication and ease of access to teachers, the 1:1 technology supported a horizontal power index in classroom relationships, empowering students to challenge one another and encouraging teachers to invite students into collegial learning rather than the traditional teacher-dominant system. There were teachers who demonstrated few facilitative or activating behaviors, indicating they were struggling with the shift to become a more active, collaborative teacher using the technology to help support the learning. Nevertheless, there were strong indicators of shifts in pedagogical practices that lay the groundwork for Margins of Maneuver and fostering student agency.

Theme 3: Engaged, Experiential, and Inquiry Learning

Experiential learning allows students to enter the learning, to engage in the creation and inquiry of knowledge, rather than just receive it. The district Technology Plan stated its commitment to providing "engaging and empowering learning" that prepared students to be "active, creative, knowledgeable, and ethical participants" in society. Ray, the principal, echoed support of this commitment:

> We started moving that thought process [design thinking] into other curriculums. It has started to evolve into less non-engaged time. Students are on task most of the time. It's hard to say 100% of the time 100% of your kids are on task. Even the best lessons sometimes will have distractions. But, for the most part, you can walk into these classes when they are having these great lessons and see engagement happening.

Most of the classroom observations demonstrated that students and teachers immersed themselves in engaged, experiential, and inquiry learning. The excitement of student voices as they worked to solve problems, the active handling of materials and taking some of their learning outdoors to test scientific principals with balls and drone-powered egg drops, and the production of culminating work to demonstrate the depth of their new knowledge evidenced high levels of engagement. Teachers were also energetic, moving and circulating, speaking with individual and groups about their learning and exchanging ideas as well as jokes. The learning community at Granada Middle School presented an environment where many of the students were happy to be there and who worked with interest and purpose.

1:1 Technology as a driver of engagement. Since this type of environment is characteristic of a more democratic, participatory community, the researcher probed for possible connections with the integration of 1:1 technology. Science, STEAM, DI Social Studies, and Newcomers Language Arts teacher participants were unanimous in their assessment that, along with the district and the principal vision as well as professional development, the use of 1:1 technology had contributed to transforming their classrooms into these places of engaged, experiential, and inquiry learning. Science and STEAM teachers described it as helping to build anticipation in learning, giving them more choices, and more power. Luke, a science teacher, who was also one of the District Technology Innovation Team on campus, spoke of the 1:1 effect on student "curiosity":

> Students were investigating something they were interested in and dug as deep as
> they could and still understand it. Like, anything open to them. You know, just

going further, what does that mean? Building curiosity, something we should all

be focusing on.

William, another science teacher, described the difference he had experienced in student

engagement with the introduction of the devices:

I kind of used to have students just kind of stare blankly and just waiting for the answer.

But when I started changing, it changed…With the shift and the devices, I see them more

not just sitting back and waiting for the answer. They are more engaged trying to figure

things out. I think that technology helps with that and can help that even more. It's all

how it's used.

Tanya, the STEAM teacher, believed the connection between 1:1 devices and an increase in

student choices was a significant factor in increasing student engagement and excitement to

inquire into new topics:

Instead of asking me, they can just go and look it up. I'm picturing this kid that I have…I

can see him answering his own odd questions on his device. Learning more about a topic

that they're interested in…Not for everyone, but I can see some kids…just getting

knowledge for themselves…They do gain more power.

Tanya qualified her statement, stating the correlation of 1:1devices and power applies only to

"some kids"; nevertheless, she strongly affirmed the potential effects of the devices.

The principal and teachers credited the availability and use of 1:1 devices with the increase

in engaged, experiential, and inquiry learning. The resulting high activity levels and sustained

focus were evident throughout data gathering.

Energetic activity and focus. Sustained activity in the learning task, mental energy, and social interactions are indicators that measure high levels of student engagement associated with experiential and inquiry learning. One exemplar of the high engagement with these observable characteristics was the eighth-grade STEAM Design class. Previous use of SketchUp as well as the excitement about using the 3-D printers and other tools sustained engagement in the learning. Tanya only needed to redirect the students three times; students responded quickly and positively. At our interview, she confirmed that the uninterrupted attention to task was the standard in the STEAM Design class, "Most of the days they're on it…They're fully engaged."

Student perspectives confirmed this assessment. One student in the eighth-grade STEAM design class explained, "Our brainstorming is gonna' be the real thing once we get the plans— pretty awesome, and, like, we get to create it!" The researcher observed that students were engrossed in the activity, with an intense pace of attending to the details of the making and design. They asked each other a series of questions:

Is that what we want?

How does that look?

So, do you think this is a good solution?

The pace of dialogue was energetic and focused; team members switched off in using their devices to look up information. The entire process demonstrated sustained levels of questioning and inquiry, with the laptops being the research medium in a continuous cycle of brainstorming and design.

Another exemplar involved the roller coaster unit in the three eighth-grade science classes the researcher observed, in which experiencing gravity and force while learning about and

building roller coaster models drew students into a "home" and "expert" group inquiry. Experts in different topics comprised the home group; they broke off into expert groups to jointly research and discuss findings regarding the common aspect of a famous roller coaster. Then, having collaboratively interpreted and evaluated the information in their expert groups, learners returned to their home groups. Students constructed meaning with their home group, taking notes and interacting as needed.

When students asked for instructions or content during any part of the process, teachers reminded them that information was available on their devices. While they circulated, teachers remarked or discussed items of interest. Teams of students engaged in building coasters, talking and joking with one another about the design, checking ideas on their devices, and wondering aloud about the design and discoveries they were making. The dynamics of the team building helped to bring in the students who began to engage in goofy behavior.

The availability of the 1:1 devices enabled teachers to engage in more learning conversations with students as well as encouraged students to be actors in their learning because they did not have to wait for the teacher to make it over to their group. Because examples and instructions were readily available, students maintained continuous mental energy, excitement, purpose, and attention to the task.

By contrast, in the Honors Language Arts classroom, students took roles reading *The Diary of Anne Frank*; students without roles followed along in their book. The teacher sat at her desk, displaying the text on the projection screen and pointing to the text with a pencil projected on the screen. After 10 minutes, about half of the students who did not have roles began looking

around the room; two students lay their heads down on their arms. The reading continued, and the teacher did not attempt refocusing, questions, or discussion.

However, in another observation in this same classroom, students were designing postcards to represent the play's theme. The energy level was low, with minimal student involvement, which increased as the task progressed. As the teacher circulated, most of her remarks redirected students or gave them explicit directions as to how they should revise their postcard, negating the experiential or inquiry nature of learning. The researcher asked one boy sitting next to her why he was not starting to work; he responded with a shrug of the shoulders and a negative headshake, "I just don't like this. I don't like doing this kind of work. It's boring. It's that way in here a lot." As time passed, increasingly more students were off-task, creating their own social dialogues with no real purpose and texting on their phones.

Although most of the classrooms demonstrated characteristics of student-engaged activity and focus, the discrepant example of the eighth-grade Honors Language Arts class was an indicator that some teachers had difficulty creating engaged, experiential, and inquiry learning. In most cases, the use of 1:1 devices provided stimulation to students and acted as a digital assistant, making information available to allow students to sustain activity and focus as well as to exercise a measure of autonomy in their learning.

Individual and collaborative autonomous student learning. Autonomous learning is evident in situations where students, either alone or collaboratively, exercise a large measure of choice over the learning process or product. Because autonomy is strongly connected to student agency, it is an important domain in examining how technology uses and pedagogical practices can open Margins of Maneuver in 1:1 technology integration. Teachers demonstrated

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appreciation for the ways in which the changed dynamics of a 1:1 learning environment supported autonomous learning. Students expressed their satisfaction with the increased autonomy. They enjoyed classes that afforded them those opportunities more than classes with more traditional pedagogy, the "banking model" defined in critical pedagogy. Observational notes affirmed instances of both individual autonomy—in which students exercised individual agency in learning—and of collaborative autonomy—in which students exchanged ideas and power in their learning as a group relatively independently of the teacher.

The example of learning autonomy permeated the science, STEAM, DI Social Studies, and Newcomers Language Arts classes. For example, science expert groups exchanged information on the coasters. Using his iPad to pursue research on coasters, one student told his group, "You don't need to fill that one in; I just got the evidence here for that box." The volume of student talk in the classrooms rose as the students passed the iPads around, sharing details about G-forces and kinetic energy, making building decisions. As the researcher circulated, further student design talk was heard: "Can we build outside of the frame?" "Okay guys, how high do we want to go?" "Is this stable enough?" These student dialogues happened spontaneously without teacher directives.

The Newcomers Language Arts classes exhibited these behaviors. Students switched from English to Spanish, as they deemed appropriate to the tasks and the learning. They looked up facts on their iPads, provided guidance and feedback to one another, and discussed their findings in pairs or groups. They collaboratively wrote paragraphs, assigned topics and roles, and used information from their devices. Independent of their teachers, they gave each other focused feedback, such as: "Do you think this needs more details?" and "Is this a good way to start?" As

learning progressed, students also looked up examples of the work, using templates and each other as support, when appropriate.

In the STEAM class, within the high school design project, student teams made all decisions, researching the various elements of the design and independently allocating responsibility to team members. They flowed in and out of various tasks by mutual consent without any intervention by the teacher. Student dialogue addressed a variety of decisions:

Hey, what's that? Do you think we need a bathroom closer to the classrooms on that side-I mean kids are gonna have to walk a long ways. (Student 1)

I think that's too many flowers, remember we need to think about the environment, and that means the water, too. (Student 2)

What if we use sage or some other plant like that?
Yeah, OK, why doesn't somebody look up some plants that don't take too much water. (Student 3)

I'm a softball player-there's not enough squares between the plates. There's supposed to be 60 feet, and there's only 3 squares, so stuff is gonna bump each other; we won't have enough room 'cause it's wrong. (Student 4)

As these decisions occurred, students were drawing, cutting, erasing, and accessing information sources with their laptops. They spoke confidently and thoughtfully, enjoying banter as well.

Teacher communication and actions affirmed and set the expectation for student autonomous behavior. Several teachers did not hesitate to remind students that they were pivotal in their learning, encouraging student exercise of learning agency:

You guys are on your own for figuring out how to build the funnels. In Google

Classroom, there are directions…if you need more help. (Shelley, science)

Yes, that's how to work! You know how to do this. (Megan, Newcomers)

I don't know. Look it up. Use your devices. They will help you do this.

(Anna, Newcomers)

These teacher statements were evidenced through multiple observations in various classrooms,

and there appeared to be a consistency in the frequency and breadth with which those

expectations occurred—with one exception in the Honors Language Arts class.

Reflecting on the experience of "giving away" control to allow students more autonomy

in learning, teachers expressed a certain struggle with finding the balance that would optimize

the student experience. Anna, one of the Newcomers teachers, explained the tension inherent in

trying to give English-learning students more independence:

It's a balancing act…So just giving a choice…if we're doing a project givin' them

options you can as a group decide how you want to present your final product. Are you

going to create a PowerPoint presentation? Are you going to create a video? Are you

creating some sort of model? So that's one way I think I like to allow for their kind of,

like, choice.

Anna felt that trying to help her students become English-fluent while allowing autonomy in

their learning was a challenge. Committed to giving students choices over their work, she gave

them control over decisions with whom to work and how to demonstrate their learning.

Robert was also concerned about having students challenge themselves as they became

proficient in something, such as using iMovie; nevertheless, he did not mandate work products.

Rather, he resolved to provide intrinsic motivation, encouraging students to make other choices besides iMovie. His perceptions of the impact of 1:1 devices on the nature of the learning process confirmed his commitment to student autonomy and agency:

> So, we have the liberty to try new things. It's not about, "Here's a book; keep to the book." Not for me or the students, and that's OK. It's more, like, everyone is learning along the way…At the end of each unit, students create a project on anything that we studied in the unit. And they have the liberty of choosing their own adventure. I think they like it because it gives them ownership of what they want to do…I can see how creative they are in ways that I might not have noticed in class.

This conversation is a strong exemplar of the finding that 1:1, in conjunction with a teacher who understands students as co-creators and owners of knowledge, has strong potential for fostering student autonomy.

For their part, students did not hesitate to express their high level of satisfaction with the ability to express their individual agency and relative independence within the learning processes. Tyler, for example, described his student experience in the STEAM Design class:

> You get to work in groups and the teacher doesn't really teach you. You have to learn yourself. If you need some help you ask your partners first and then if they don't know or they can't help you then you ask the teacher.

Tyler stated that it was his favorite class because of the "independence" he had in the learning.

Tanya, the STEAM and math teacher, and eighth-graders Tyler and Skylar all described the ALEX application used on student devices in math classes as an opportunity for self-paced

learning. Tyler described that ALEX gives students choices over how quickly they progress

through math and what classes they might want to take:

> If we're in eighth grade, and if you pass, like a class that they give you, then you can,
> like, go up to high school math. It's up to you. If you get it wrong, it takes you back…or
> it just tells you to recheck it and if you don't get it right it gives you an explanation of
> how to do it.

Describing how a student works with ALEX, an adaptive math application, Tyler liked the

ability to make the decisions about when to tackle certain math concepts, how quickly to go

through the materials, and the adaptive help that personalized the learning and gave him a high

degree of autonomous control.

Sam and Lauren, both in DI Social Studies, reflected on similar in-seat experiences and

the self-monitoring of learning resulting from using the 1:1 devices:

> I used to get really impatient sometimes, you know, because we had to slow down to wait
> for guys to write stuff down. Now, I can just go ahead, or look stuff up, you know, like, if
> something the teacher says makes me wonder about something…It's, like, way better. I
> can do my stuff, and like, get going, and no waiting. So, I, like pay more attention and
> talk more (Sam).

> I think, yes, there has been a change because, for example, now, one, we won't be left
> behind or a student won't be left behind, two we could go ahead of the class so now
> we're ready, and then three because it has changed because of what's the third reason; it
> has changed because now when we get research, like, back then in sixth grade when there
> was no technology there would be, like, for homework, blah, blah, blah. Now that we

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have technology, they're like take out your device, you're doing research. So now we

could get started and not wait. Like, we can just work, like, how we want. (Lauren)

Students noted that the ability to go ahead or slow down as needed, was one of the benefits of

learning that resulted from using 1:1 devices.

    Personalized learning. The trend toward student learning autonomy and agency

demonstrated in the data might strengthen with the development of personalized learning

pedagogies. As expressed in the District Technology Plan, LCAP budget allocation, and in the

interviews with Ray, the principal, there had been recent institutional emphasis on personalized

learning. Ray envisioned personalized learning made possible by technology:

> You also have to be flexible to allow different answers and different results so an A could
>
> be different for one kid than it could be for another student…I don't have forty students, I
>
> have forty minds and I have forty people whose needs all need to be planned. Well, in
>
> this corner, I have my kids working on their devices because they are doing some self-
>
> directed study. At this side over here, I have kids working together on a PowerPoint and
>
> practicing presenting it to each other. Then, over here, I have the kids who have missed
>
> some school, and I have to work with them and at the same time I'm just in the middle
>
> observing everything and facilitating when I need to.

Ray said he had been investigating and studying to move in the direction of personalized

learning, and realized that such independent learning could not happen without devices. His

description placed students in the middle of the learning, acting autonomously and exercising

their agency over how they learned, how quickly they learned, and how to demonstrate what

they had learned.

Describing recent personalized learning professional development, Luke, one of the science teachers, described the creation of a capstone style project that would have a framework of expectations defined by teachers. Within this framework, students would design a path of learning, tied to their interests and abilities: "But we're not quite there yet, in terms of it being more personalized, more individualized for the interests of our students."

When probed about whether students would be ready for that type of learning environment, Luke concluded, "Some of the kids will just take off and run with it; some wouldn't; there's going to be some work." Luke's readiness assessment was an indicator that some students had not yet developed their self-efficacy and agency sufficiently to transition. Teachers William, Shelley, and Robert agreed with Luke's assessment as did Ray, the principal.

Tanya, the STEAM teacher, described highly personalized learning already occurring in the STEAM activities, and reflected on the flexibility of the pacing in lass:

> You need an extra week? Ok, you get an extra week. You want to spend an extra 20 minutes learning how to, you know, how to program? Go ahead. You know, so the kids are working at different stages as well…It's easier because I'm not directly teaching. The Design class, they're on their own, somewhat on their own pace…it's great because they get the time to fully understand the concepts.

Ray, Luke, and Tanya expressed a common understanding that student interests, abilities, and preferences drive personalized learning, with students taking a strong role in identifying the paths and pace of learning. As Ray, Luke, and Tanya described, tudent interests, abilities, and preferences drive personalized with students taking a strong role in identifying the paths and pace of learning.

Summary. The levels and incidence of autonomous learning—whether individually or in collaborative teams—demonstrated the midstages of 1:1 implementation. Many students evidenced heightened levels of independence and engagement in learning resulting from device use and pedagogy. Some teachers were still developing the pedagogy that affects the number of students who feel empowered to use their devices to access more control over their learning. While still developing, substantial evidence indicated that 1:1 devices had positive impacts on the level of engaged, experiential, and inquiry learning.

Theme 4: Instances of Higher Order Technology Uses

Higher-order technology uses promote critical thinking, creativity, and communication in users, while lower-order uses typically comprise routine drills, remediation, and a flat or regurgitated use of information. Because the sourcing of information is one of the most common uses of technology, evidence for developing learner ability in critically sourcing and using information was a significant domain related to higher-order technology uses.

Critical use and sourcing of information. The wide availability of information, both real and unreal, affects how students participate in society because some information strives for objectivity while other information seeks to cover truth with manipulated orchestrations and bias. Learning to use technology to critically source information, testing it for reliability and validity, is an essential higher-order skill.

The STEAM Design class checked the validity and reliability of information pertaining to environmental concerns and initiatives applied in the design of a high school. Tanya, the STEAM Design teacher, described how students had collaboratively sourced information,

including how to critically discuss gathered information and make design decisions that might adapt or vary from it.

The science roller coaster learning unit provided a structure in which information was critically sourced. The jigsaw method of home and expert groups was an information and knowledge building structure with built-in balances and multiple perspectives of the various student experts. This was an effective structure for critically sourcing and managing information. Adding 1:1 technology to the home/expert group methodology opened up visual thinking tools such as concept mapping. Additionally, 1:1 devices and associated software, such as the Google Apps for Education and the Google Classroom used at Granada Middle School, provided the organizational capabilities of multiple and shared folders for storing digital information, and the ability to collaborate digitally.

Luke, one of the science teachers, stated that the skills learned with 1:1 technology devices were an important element of learning:

> Well, I think it's mainly teaching them to be good consumers of information…You know, working with them on search parameters so they can do intelligent Google searches. There is just so much information out there, and some of it is faulty and could have negative impacts on them, yet they're able to get on and access it. So, it's important they learn how to be critical in both retrieving and using information.

Luke emphasized the possibility that information might have "negative impacts," and asserted that within a 1:1 context, a student must learn to become "critical" in the approach to information. Luke's words reflected the dominant purpose of 1:1 technology devices as observed in the science classes: to access, evaluate, and communicate information; yet, he was sensitive

that this increased emphasis and access to information required that students adopt a critical stance toward that information.

In identifying ways in which 1:1 devices had strengthened student skills in critically sourcing and using information, William, another science teacher, articulated:

I think we're doing pretty well. You know, I mean I think most of what we are doing is showing students that this information is here and that they have access to it and then they need to determine if it's valid. What they're finding. How it fits. Like, whether it's reliable…I'll use discrepant events to kind of make them get rid of preconceptions and misconceptions. Try to get a clear landing and build on from there.

William's view that student experiences with 1:1 devices helped to develop them as critical users of information was echoed by Shelley, another science teacher. In her experiences, Shelley reported that the first year with the 1:1 devices included guiding students through the informational journey; but that in the second year, they were very comfortable in assessing the reliability of sources and in discussing results. Shelley was surprised in the units on cloning and genetically modified organisms with "the depth and higher order level of questioning and the discussion students had, something I did not expect to happen yet."

When asked about his persistence in stressing critical sourcing of information, Robert replied, "I mean, it's to have them interpret it and kind of see the kind of evidence and then try to weigh in on whether they believe it or not, and why they feel that way." A critical approach to the many sources of information available with the use of 1:1 devices and the Internet was an essential technology use and pedagogical practice. Robert made the explicit connection between

the higher-order technology uses of information and the ability to participate in social justice as a possible change-maker.

In all the observations, Robert was consistent in asking his students to question the reliability and validity of information he shared with them or that they discovered themselves with their devices. Constant questions peppered his classroom discourse:

Is this a reliable source?

Why do you think it is or is not a reliable source?

If it's reliable, what does it tell us?

What is your justification?

Did you find this information in multiple sources?

Students discussed with classmates, investigated information, and generated meaning together.

Students were unanimous in expressing their understanding that not all digital information was valid, and that it was their responsibility as a user of information to determine its reliability and validity. They expressed that they had many opportunities in which to evaluate and discuss information in their STEAM, science, and Social Studies classes.

Katherine, an eighth-grader, stated, "Yeah, it's sort of helped, we have the information available and can get all the directions we need basically…For me, if I want to get stuff faster to keep on working, I use my device." Another student, Skylar, added: "I say it helps me because at school I can, like, search up, like, what this meaning is for all of my school activities and, like, get a better understanding of it." Both girls, while expressing reservations, endorsed the use of 1:1 devices for helping them stay organized and for immediate access to a wide variety of information.

Katherine continued to state that she trusted information from a book or article more than what she found on the computer because it is so easy to change or hide who really provided the information. Skylar said that she found higher reliability with conversations with people who were actually involved in the event or situation. Nevertheless, they both said they use their devices to get, "all the information…so we can learn about things."

Skylar explained:

Like, if you want to search a question and you have your iPad you can just search it up and it will tell you the answer but you won't learn why that's the answer. So you have to look up other stuff.

Katherine added:

We also, like, write down, like, what we understand about the question and what we understand we need to do. Yeah, and then afterwards once we're done with that, we, like, do reflections to make sure we actually understand it. That's part of our grade.

These students understood the process of critically assessing information because of their frequent use of 1:1 devices in science and social studies. They also acknowledged that critically evaluating information was easier and faster with their 1:1 devices. Another eighth-grader, Sam, provided an additional perspective from the DI Social Studies class about the relevance of the information: "Yeah, we use the iPads all the time to look at news and stuff that makes us all think about what's goin' on with us and our families." Students were very aware of the informational capacities of the 1:1 technology.

A stakeholder meeting presentation on the Technology Plan, "A Vision for the Future," defined a clear curriculum goal of "21st century and digital literacy skills" (May 19, 2015). These skills included the critical sourcing and use of information, as the Technology Plan cited the International Society for Technology in Education (ISTE) student standards.

Ray, the principal, valued this informational access aspect 1:1: "I think there's the opportunity to learn how to navigate through devices and have access to all kinds of different information at their fingertips instantaneously. So having the device just gives them the instant access." He continued to state his belief in the need to give students the opportunity to critically evaluate the information, and the learning that accompanies these opportunities:

> I think access to 1:1 technology allows them the opportunity to make decisions: which one was right; which one was wrong, or which one do I want to believe…
>
> A perfect example of the officer in Whittier that just passed…Depending on what you read, you may be biased one way or the other. So it may not be a bad opportunity to research and talk about the media and how it impacts society, to ask questions and frame that discussion.

The principal expressed a vision of students interacting with information at a high level of questioning, probing, and assessing the information through various lenses to arrive at authentic learning.

Subject specific discourse. One of the often-cited democratizing uses of 1:1 technology is the acquisition of subject-specific discourse often reserved for communities of privilege. Acquiring this type of discourse is necessary to empowering students in communities that typically do not operate from a position of privilege to acquire the necessary academic literacy to

engage in subject specific discourse. John, a recent immigrant student, talked about how 1:1 devices helped him stay interested even when he did not understand everything since he was learning English: "Yeah, I did not, like, speak English so I could, you know, look things up, you know what I mean. It's, like, I got interested in robotics."

Critical academic literacy. In STEAM classes, students used SketchUp, a tool for architectural design and engineering applications. The project designing a high school involved learning about measurement, scale, function, vectors, sustainability, and more concepts specific to the design and construction of a building, all of which are engineering skills. In the robotics classes, students engaged concepts of logic, programming, materials selection, function, and more concepts specific to fields that are becoming spaces of privileged knowledge capital.

All students had participated in the annual Hour of Code which introduced the basics of computer programming. Additionally, all students had access to the SWIFT programming application on their iPad devices, under the label "Playground;" this label, with an enticing format, intrigued students to begin playing with coding. To extend the benefits of this critical technology skill literacy to students who were not able to fit the STEAM classes into their schedule, the school invested in offering Saturday Maker Labs and Saturday Robotics to any student desiring to participate. At the time of the study, voluntary student participation was at approximately 100 students and growing. Ensuring that every student knows how to use film as a medium of expression was prioritized with iMovie skills built across the curriculum.

In science classes, students were using their devices to access more interactive and more in-depth knowledge of the concepts than what the curriculum mandated. In doing so, they were developing rich academic language and knowledge of the underlying concepts to address issues

such as global warming, the carbon footprint, the impact of disease and unclean water, food shortages, and more. William, Luke, and Shelley all admitted they were "not quite there yet," in terms of making the leap that involved students in applying the learned subject-specific discourse to real world issues.

The discussion of claim, justification, evidence, reliability, and validity that was the staple of the DI Social Studies curriculum, as observed at the case school site, comprised a significant portion of the disciplinary higher-level academic literacy in social studies as well in the humanities. Robert's warm-ups connecting content knowledge to current events provided access to the implications of the current public narrative. Robert described the impact on student thinking:

> They can actually participate in discussions about things they would not have known anything about before. And, it's pretty available. They can learn more about the state and the country, and even other parts of the world; before, all we knew was what our teacher or the book told us, but now, with the devices, it's pretty open.

In addition to becoming conversant in the issues important in social studies, the social studies teachers reported training and use of the online middle school DBQ (document-based questions website), a staple of higher level and Advanced Placement courses. Robert said he had had good experiences with the way students engaged the discourse and academic vocabulary with this activity using the devices.

English Language Learning and Critical Academic Literacy. The emphasis on developing critical academic language in the Newcomers Language Arts class prioritized subject-specific discourse, providing new English Language Learners access to knowledge that

has been the privilege of the dominant language society. Students used their 1:1 devices to practice reading with the proper pronunciation as well as to increase comprehension by retrieving translation information and doing various exercises on the Lexia application.

Anna also discussed the intentionality of the Newcomers Language Arts classes to focus on developing academic language and expository writing skills, as in the unit on habitats and ecosystems, or on the science of fruits and vegetables:

> That's what I'm hopeful for, right, because it wasn't so much in my kids about them learning about habitats really; it was about the language. It was about using the technology so that when they go to high school they know how to set up a document and that's not going to be the one thing that keeps them from, you know, or puts them off from participating or turning in the assignment.

The use of 1:1 devices helped the Newcomers in their acquisition of the English language, specifically in the area of critical academic literary.

Summary. These were substantive examples of ways in which 1:1 devices supported the development of subject-specific discourse in learners who might otherwise not have had access to it. Developing such discourse is essential in enabling students to engage the discourse of the dominant privilege. The ability to do so is essential to the Margins of Maneuver as well as to critical pedagogy principles. The data justified a finding that the domains of subject specific discourse and of critical academic literacy were strengthened by the use of 1:1 devices in STEAM and science, DI Social Studies, and Newcomers Language Arts classes.

Theme 5: In-Progress Efforts to Strengthen Student Voice and Self Identity

Student voice is an important component of the Margins of Maneuver, through which students are able to participate in the democratic process to address their concerns as well as community issues from the lens of their personal histories and culture. They are empowered to build self-efficacy, or confidence, which advances their identity awareness by investigating topics relevant to the student interests and those of the community. Such awareness is essential, both according to critical theory of technology and critical pedagogy in order for 1:1 learning to have democratizing effects.

Learning relevance to the student and community. Observational and interview data showed the potential of the 1:1 initiative to strengthen the relevance of learning, even though exemplars of this type of learning were limited during data gathering infrequency of occurrence at Granada Middle School. The devices to had the potential to help students find their voice, as they provided a way to investigate and act on issues important to them.

As Robert, the DI Social Studies teacher, noted about the impact of 1:1 on teaching and learning:

> Now, we're using devices constantly—here, science, math. It really helps the creativity and independence of the thinking of the student; and it's relevant, to incorporate what they're learning into social media and add content…Students like it…That's giving them the skills they need and they get to be the creators. The principal and the district are all for it.

Robert's comment explained using the 1:1 devices to help student become creators of their knowledge while accessing personally relevant matters. His DI Social Studies class regularly

used current event warm-ups and discussions to help students explore the social, political, and economic systems in which they participated. Robert affirmed, "It's about taking the past and seeing if there's stuff that related to it now, so they can see how it connects to things that matter to them." When asked about opportunities in a 1:1 environment to connect learning to things that mattered to students, Robert described the experiences of exploring and discussing information regarding the Trail of Tears and the movement of peoples against their will:

So, naturally, that was a good opportunity to talk about immigration and refugees, all the things they are hearing about in the news and that, um, probably affects their family and friends. They had a lot of strong feelings to share and there was a lot of emotion.

This statement further confirmed the opportunity to explore topics situated in student and community issues, with the facility of the 1:1 devices.

Lauren, a student in Robert's class, described an event in which the devices were used to respond to warm-up videos:

Figure out about political issues, you know, I remember one time we did, like, with Donald Trump. Not many people agreed but there was, like, about two people were, like, Trump supporters. And everybody was kinda of surprised, then mad, disappointed…They kinda of took it out on the girls, saying, like, boo, boo, but not for long; nothing personal, just like why. Then, like, we talked about it more.

Within the DI Social Studies class, 1:1 technology devices provided access to information that revealed issues and promoted student awareness of diversity in opinion, even within their own community. Robert, alongside two students, Lauren and John, reported that conversations were

lively and, in some cases, emotional for the participants—an authentic expression of student voice.

The Newcomers Language Arts class attempted to develop academic language within the context of the common immigrant experience of the students. Students regularly switched between Spanish and English, and there were frequent references to cultural artifacts in their learning. According to Anna, the 1:1 devices served as a sort of bridge, connecting the Newcomer students to the rest of the school community in ways that she had not anticipated:

> I remember when we were kind of apart from the rest of the school…Now, with the devices, we are able to do a lot of the same content learning as some of the rest of the school, and our kids are more involved in the school activities which helps them learn English more quickly and feel more accepted as a valuable part of the school.

The researcher had not considered this finding as a possible impact of 1:1 technology. Other data from John, one of the Newcomer students, paralleled Anna's experience. John said that the devices helped him learn about robotics and get interested in it, even though he was not in the class. By coming to the Robotics Club on Saturday, John had the opportunity to develop closer connections with other students. When the researcher asked Anna if this was what she had meant, she replied that the devices helped the Newcomer students, especially when they exited the program, and helped them continue developing the language they needed to participate meaningfully in the school community.

Science and STEAM teachers recognized that they did occasionally have opportunities to explore culturally relevant student and community issues, even though they had not been

actively doing so. They agreed that 1:1 devices could connect student to investigating those

concerns. Tanya, the STEAM teacher, explained her reasoning:

> because when you take an iPad and you look at their other tabs, they're looking at other
>
> things, … so they know these things, they're looking up things. They know how to use it
>
> and look for things that they like or they're interested in.

Her experiences were that students pursued interests with their devices that were not always the

interests being covered in the curriculum.

Luke, another science teacher, initially said science teachers did not have much

opportunity to address social justice issues, but that he thought other subjects could benefit from

using the devices to investigate such issues:

> Researching restorative justice... Building curiosity about their world and community.
>
> They've gotten it beaten out of them…Social studies teachers hitting on civil rights;
>
> English teachers from time to time in discussions of their texts…Using 1:1 to uncover
>
> information and then discussing it maybe gives them a desire to change the world or
>
> stand up for what they think is right.

The researcher probed Luke's comment at the second interview, asking about the opportunity in

STEAM, for instance, to talk about sustainability and "green" issues as the researcher had

witnessed in the high school design project. Student conversation and concerns with the

environmental impact of the design seemed to run counter to Luke's feeling there were not

opportunities to investigate issues relevant to the student and community. Luke said he had been

too quick to make that assertion, referencing discussions that had happened with the units on

cloning and genetically modified organisms. After thinking about the recent experiences, he felt differently:

> I mean, there is space for them to do that and to, like, you know develop an understanding, you know, maybe the understanding of issues and then some ways to act locally to do it. I mean we're not going to be solving the big picture problems here but we are going to be able to contribute to solving them

The researcher asked Luke if he now thought that science with technology integration could help students explore social justice issues relevant to student lives. Shaking his head thoughtfully, Luke replied:

> Yes. I really think so. Everybody's got a platform. You know it does kind of take away the filter of access you know where everybody now can get their voice heard. Everybody can be published. Everybody can be out there. People started social media campaigns you know all of these things are out there. It's just a matter of understanding what we're trying to work on.

Luke's statement about "It's just a matter of understanding what we're trying to work on" has many implications for the intentionality that accompanies a democratizing technology integration initiative.

In another example of relevance and community activity, the principal discussed the experience of the "STEAM kids" taking their robotics to the local elementary school, supporting the opening of horizons for the younger students as a way in which technology could enhance students' ability to talk to issues in their community. Eighth-grader Katherine also referenced

this connection to local schools, "We also have, like, opportunities, to help, like the school down here (*school name*), we get to help them out, like, with STEM, their festivals, and other stuff."

John, a former Newcomer student who had discovered a personal passion through the Saturday STEAM program exploring robotics and design, "I didn't know, like, anything about this stuff before I came. The robotics is, well, like, amazing, to be able to make something that is all mine, like, know that it's for real." John discovered a sense of ownership in technology, expressing strong feelings that 1:1 technology had helped him participate meaningfully in his new society.

An example in which students had learned that one of the district board members thought that charter schools should be the answer to school improvement, reducing the amount of funds that went to their school, eighth-graders Katherine and Skylar spoke about their ongoing discussions in class. Katherine articulated their understanding of the situation:

> She's thinking less about education and more about what the school has. It's like a school may have all these great activities and look great, but yet for what the students put into it and what they're teaching the students …"We have the greatest," you know the attitude, but, okay, what am I learning from that?

Skylar described a similar incident with the board of advocacy, one that had risen above the level of discussion and growing awareness, to advocacy, in which she and other students wrote to someone on the school board about technology. Skylar said:

> We did this project about how, like, how they're taking technology to a different level and stuff and how they might get rid of books and the teacher gave us a decision to send a letter to the head school district…I wanted to do that so and I asked if I could write a

letter and he was like no you have to send her an email; she never picks up her

mail…Okay, so like, I actually made my letter stating my opinion and I just sent it.

In this case, Skylar used technology to write an email letter protesting the possible elimination of

books in favor of digital resources, asserting her voice in the conversation to power.

Summary. The data justified the finding that students had made explicit connections

between their uses of technology and its relevancy to their lives. They did not reveal instances of

direct activism or advocacy, excepting Skylar's example. Already mentioned in the discussion of

the first theme, all students indicated that they would like the opportunity to use their 1:1 devices

to take action but it had not happened, as far as they knew.

Findings were mixed on 1:1 devices helping students engage issues of importance to

them and their community. Conversations did not always allow for the depth of discussion that

might have helped students probe factors that affected their lives. Additionally, the component of

direct activism had not yet been realized in this domain. Findings indicated that agency and

potential for developing skills necessary for democratic participation depended partially on

teacher pedagogical beliefs about the role of the learner that translated into pedagogical

practices.

Academic self-confidence versus self-identity. Self-identity is another critical

characteristic of Margins of Maneuver because it is difficult to assert authority or agency over

oneself, learning, or knowledge with a weak sense of self. In this way, developing authentic self-

confidence from an evolving sense of efficacy is an important, though not exclusive, part of

strengthening self-identity.

Ray, the principal, felt strongly that social media and 1:1 technology allowed students to explore and develop their identities in ways unavailable before:

I think when it comes to their own self-identity, because there are so many different things out there now, kids tend to want to look at different topics and see if they fit into a category…In general, we all want to fit in, but I think at this level they are trying to find that identity that they will be comfortable with for 10-20 years down the line. I think access to social media and technology, as a whole, gives them a pathway for finding themselves, so to speak.

This conviction sustained itself, in evidence again during our second interview:

You know junior high…It's when everything that could potentially go wrong with a body; a human being, ride the perfect storm emotionally, physiologically, physically, psychologically, it just hits that hard. So you know I think what social media does for a lot of our students in that it gives them an out and it gives them a place to express who they are.

Ray understood the importance of identity and believed that social media and 1:1 technology helped students develop and discover identity.

An example in the STEAM class confirmed Ray's thinking. One girl asserted herself as the "expert" based on part of her self-identity as a softball player and asked for a redesign of the field. This interaction caused her to self-reflect, "How come I'm the one who always makes these decisions and is in charge of things? Is it because I'm bossy and mean?"

Another student on the team assured her that she was not mean, just very particular about expressing what she wanted and how she wanted it done. Experiences with technology in the

STEAM class appeared to foster recognition of one's identity through reflective capacity and in the interactions with other students as well as the teacher.

When the researcher mistakenly asked about "wells" on the grid layout, the students laughed, in a tolerant manner, and calmly clarified the mistake, pointing out it was a shortcut for "windmill" which they would be using to help make the school energy sustainable. The direct eye contact, clear articulation, and erect posture indicated the self-confidence of the students in asserting expert designer as part of their self-identity.

Shelley's science class exhibited several instances of an environment that promoted strong self-identities. One conversation between Shelley and a student alternated between the student modeling something he might do and Shelley's suggestion that it was a possibility. Finally, the student used the iPad information to figure it out by himself, concluding, "I'm so smart." Being able to recognize oneself as "smart" was an expression of confidence and also built the student's self-identity as a capable learner.

Another particularly striking example of the potential of 1:1 devices to strengthen student self-confidence occurred in Shelley's science class. After two students had used their iPads to retrieve the information they needed to build a challenging portion of the coaster, they exchanged high-fives:

> Student 1: There, I just did it, just by listening and watching the iPad video. So, I can believe in me.

> Student 2: I can believe in me and I can believe in you, and you can believe in you and believe in me.

These students voiced their affirmation of themselves as co-creative, capable learners, after experience with the iPad enabled independent completion of the learning task.

When Megan, a Newcomers teacher, expressed belief in the students' ability to navigate the fruit and food assignment, one boy used his iPad and was so efficient that he completed one of his assignments, smiled, and proudly displayed his iPad screen to all the other students. The other Newcomers teacher, Anna, commented on her belief that teaching the neighboring elementary school about STEAM and robotics, and using iPads had strengthened student self-confidence: "'Cause if they can help younger students and kind of do the teaching, then they know that they know."

Summary. The observational data found that 1:1 technology access had positive impacts on the formation of student self-confidence that helped them develop self-identities as capable learners. The data supports a finding that 1:1 technology provided opportunities to strengthen self-confidence, which in turn contributed to students' self-identity as capable learners. Additionally, 1:1 technology supported discovery and reflection of various aspects of student personal self-identity, as an athlete, an immigrant, an expert, or designer.

Theme 6. Purposeful Awareness of Economic Disadvantages

As Feenberg's (2002, 2010, 2017) critical theory of technology maintains, purposeful awareness of the historicity and economic context of persons, systems, and technology is necessary to exercise democratizing actions within the Margins of Maneuver. The data demonstrated this purposeful awareness at Granada Middle School—from the principal to individual teachers to students. Recognizing the potential marginalizing impact of economic factors on the student population and surrounding community is a theme that emerged from

conversations with the participants. These same factors cause the second and third digital divides in technology uses, as has been demonstrated in the literature and the NETP (2016, 2017).

Having grown up in the community, Ray, the principal, expressed awareness of potentially oppressive contexts and his experiences provided motivation for his leadership vision and actions. Committed to ensuring that the students had all the same options available to economically advantaged populations, Ray described his transition to school leader and the evolution of his thinking:

> You know, I want to say in my junior high years, there were a lot of conversations about making sure you graduate from high school…but only one person that I can recall in high school to ever encourage me into going to college, my woodshop teacher… So, when I had the opportunity to, you know, take a position like I do now and, you know, inspire and lead kids within the same community… I think that the more we talk to kids about that and the more we tell them the end result can be college, career, and beyond, we open up all the possibilities…They're not locked into anything that someone else boxed them into because of what they think is right.

Convinced of the efficacy of technology and personalized learning to provide equity pathways for students in an economically disadvantaged environment, Ray modeled and promoted its uses both with his own faculty as well as with others.

Further, he asserted his view that families and students gain power through learning with technology and problem-posing, a significant part of the process, communicating to parents that, "it's being used for you and your child is powerful." Ray's statement evidenced a belief not only in technology as a transformative tool but also that using technology afforded parents and

students participation in power. This awareness and purpose resonate with characteristics of the Margins of Maneuver.

Ray's awareness also suggested a concern for the ways that the learning explored the effects and potentially marginalizing factors of economic disadvantage, seeking to avoid a reactionary or fearful response from the learning community. He reflected on the topic of immigration and the need to frame it "without spooking and creating panic amongst students:"

Like, let's look at the history of immigration and not just the U.S. but in other countries and the impact it's had…It could be a great map lesson…sparking other conversations about the impact of immigration in the U.S. right now, or even just in this community.

Ray's concern evidenced awareness that the learning community had less power in the dominant society on matters such as immigration. He acted and thought purposefully about how to use technology-enhanced learning to empower students without placing them at risk.

Robert, the DI Social Studies teacher, also demonstrated an awareness of the need to infuse purpose into technology-enhanced practices, particularly with economically disadvantaged students. His statements corroborated his sense purpose in opening up various contestable issues in class warm-ups: "They are in eighth grade so I feel as if I should facilitate, guide them to digging for information, to thinking about it, evaluate it to make sense of things in their life." Robert provided an example, in describing his intentionality in discussing current immigration issues with students:

Like the issue of the undocumented and what their future will be. A lot of our students might have that connection, or they have family members—they're not sure how but they know it will affect them one way or another.

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Robert's purpose in these activities illustrated the early stages of critical pedagogy's *conscientização*, and he described how this process extended to discussions with families at home. Using an example of asking students to find out if any of their parents had participated in the walk-out to protest Trump's policies, Robert reported that students came back to class, stating that their parents and neighbors had not walked out. Probing for reasons led to a discussion that tried to uncover the impact of economic factors that marginalized the community's participation in protest. Robert then said that students came up with questions of, "Is protesting something that people who should be protesting have a hard time doing because they're afraid of being fired, or because they can't afford to miss work?" Although neither he nor the class pursued definitive answers to the questions, the exchange did engage student thinking in considering their community's history and economic positioning, one of the components of Margins of Maneuver as well as of critical theory.

Luke, a science teacher, indicated an ideological connection to equity and opportunity: "Providing equity and providing opportunity for kids that wouldn't necessarily have it. I mean, I think 1:1 and our other technology gives kids opportunities they might not necessarily have and then gives them an ability to participate." Although connecting "equity" and "opportunity" could be a neoliberal sentiment, Luke's definition of equity as "an ability to participate" was a positive indicator for his purposeful use of 1:1 technology to foster student participation in issues of concern to them and their community. He continued talking about the role of 1:1 and technology-enhanced learning relative to social justice, and its ability to give voice to student concerns, a platform for advocacy:

There's a lot more of the social issues that I feel like our students are really focused on. You'll see it, you know, community issues and dealing with, like, police or, you know,…where it tends to focus more on the social justice issues.

Another science teacher, Shelley, agreed that having devices opened up information more quickly than might otherwise be expected, noting that students uncovered personally relevant implications of a cloning experiment: "They were asking, why is it important that the clone be the same as the other one, or why does it have to be a certain color or size? Why are people making those choices?" Students recognized one factor of their own potential marginalization—color—in asking such questions, demonstrating an awareness that is necessary for Margins of Maneuver. As the teachers reported, intentionality in 1:1 device uses and associated practices led students to a deeper understanding of their own and community situation.

Tyler expressed this growing understanding in his response to what issues he might like to address using technology as a tool; his voice quieted to a whisper as he rasped out, "racism." He then explained his thinking more fully:

I don't really like the racism in the world…I would, you know, like to find out ways to, like, help stop it. Yeah, I would probably make a speech or somethin' and give it out to the world, like on the Internet, so they could see how I feel about racism.

Tyler's feelings about racism as a negative impact in his life and community led him to consider how the Internet could provide him with a platform to voice his concerns, to "give it out to the world" that he might influence others and curb racism.

Another student, John, who was a recent immigrant, assessed his learning using iPads in Social Studies class:

Yeah, we use the iPads all the time to look at news and stuff that makes us all think about

what's goin' on with us and our families. I mean, there's a lot-it's kind of weird, you

know, that we live in the same place but have, like, these different opinions about stuff

like immigration.

Because of its ready access to multiple sources of information on issues directly pertaining to

conditions of their socioeconomic situation, the iPad impacted the ideas that students formulated

about themselves as part of an immigrant community a very personal part of their identity as

individuals and as members of a community.

Lauren talked at length about her research experiences and emphasized the need to verify

information and to think deeply about it. Because of her informational resourcing, which also

extended to her extracurricular participation in debate, Lauren felt that she and her classmates

"could change the world or change, like, the community or do something to help the

community." She said that she wanted to use the critical information skills gained with her

access through use of 1:1 technology in politics and perhaps even run for president.

The data demonstrated a purposeful awareness of the context and impact of economic

disadvantages as well as a developing belief that teachers and students could use 1:1 technology

in democratizing ways. Acting with purpose over technology had become an expression of its

ability to open up more equitable paths for students, that raised student awareness which both

motivated and skilled them for fuller participation in the dominant society.

Instances of micro-resistances. One of the indicators of Margins of Maneuver that can

lead to democratization of technology is the exercise of agency to challenge the dominant society

and white privilege; in other words, instances of micro-resistance. At Granada Middle School,

the data revealed these instances in the actions and attitudes of the principal, the teachers, and the students. Himself a Latino male and person of color, Ray, the principal, resisted any labels during our conversation and challenged the researcher's initial use of "low socioeconomic status" in describing either his students or community population. Reacting to the implicit bias of labels, he said, "You know so many labels are thrown out there that there's a lot of confusion as to what is what." Ray explained that treating people as individuals, beyond labels and categories, is necessary to open up possibilities and curtail the attempts of the dominant group to "box in" groups or individuals with economic disadvantages.

Anna, the Newcomers Language Arts teacher, was also Latina, and expressed a similar disposition and sense of purpose in her actions with students to create open spaces: "and the more confident they are of being able to get the information they need to just, you know, keep growing. That it's all open to them." This openness also translated into ensuring that her students were prepared with appropriate tools for future expectations of an educational system largely controlled by the dominant society: "That was a big part of my goal,…that they have the tools but that they knew how to use them and that's something that they could take with them." Anna's words affirmed her resolve in taking action within her sphere of influence, the students whom she taught, to resist marginalization and assert themselves with democratic participation in the resources and opportunities of the dominant society.

The students also evidenced instances of micro-resistances. When joking with the teacher about being the "professional" in the room, the science student asserted himself in ways that prepared him for encounters with power outside of the supportive classroom environment, a beginning of the realization of his power as a micro-resistor in his self-perception and thinking.

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Likewise, the students in the Honors Language Arts classroom refusing to be "bottled" into passive learning demonstrated their resistance. They reacted to such learning and to highly directive instruction and activities by going off task with their devices or texting with their mobile phones, asserting their agency in resistance to the banking model paradigm that served the interests of the dominant class.

Katherine told of conversations with the school site council that demonstrated an independent and effective advocacy for keeping the computer lab, showing confidence in the discursive sharing of power with the group of dominant, powerful adults. Additionally, she was not shy about expressing her indignance at the district school board member who advocated for charter schools, speaking badly about the education received at noncharter public schools. Katherine felt emboldened enough to assess that the board member was wrong: "We have old stuff here and there but what she's focusing on is our image. That's ridiculous." Katherine felt she had the power to speak out about someone being more concerned with facilities than a school's learning, evidence of the growing empowerment of students at Granada Middle School that expressed itself in observable instance of micro-resistances.

Intentionality of efforts at teacher and institutional levels. Despite the purposeful awareness of economic disadvantages and the growth of micro-resistant behaviors and thinking, the variations in data between teachers and classrooms, in most of the themes and associated domains, suggested that intentionality of teachers and the institutional levels at democratizing 1:1 technology uses and pedagogical practices was an area of growth. The District Technology Plan defined personalized learning and student centeredness in pursuit of 21st-century skills: "Innovation, learner choice and voice, collaboration, and access." The school's vision and

mission clarified this statement by stating that it would pursue the district goals by "building autonomy through mastery and purpose, and creating a positive global school culture and climate."

The purpose of the goals stated in both documents was to prepare students to be college and career ready, which the district plan interpreted as eventual graduate achievement and success "in the workplace." Ray had a larger view of his commitment to College and Career and Beyond. He expressed his belief that the journey is a profound part of being human, and this belief characterized his openness to implement change that helped students grow into adults who could navigate the journey and who could be change-makers. Even with all that in place, an explicit recognition and intention to use 1:1 technology and critical thinking to engage in Freire's "problem-posing" and reveal the world and its complexities, including factors that might oppress students, was not consistently part of the interview, observation, or document data that was analyzed.

The lack of explicit consistency left the implementation of democratizing technology uses and pedagogical practices to the discretion of teachers and their ideological commitment to student agency and participation in the dominant society. William reconsidered his response that he had not had any opportunity to explore student and community issues: "I'm sure they're looking up skateboarding things that we're talking about in class…a little simulation with the skate park but I'm not directly witnessing it." This response evidenced a lack of awareness of the implications of the question, equating student issues with items of interest in student culture. This lack of awareness illustrated the inconsistent intentionality of using 1:1 technology to further the democratizing effects of Margins of Maneuver.

Nevertheless, teacher commitment to promoting equity for their students was a common thread in the interviews, usually defined as opportunity and participation in society. This commitment was a serious one, as demonstrated by the longevity of service at the school by most of the teachers. When asked if the researcher perception that various efforts to help students achieve equity and full participation in society aligned with the personal beliefs of the principal and teachers but lacked purposeful intentionality, Shelley, Luke, Robert, and Anna agreed. Despite the commitment of the principal and the teachers, the intentionality of using 1:1 technology to open up discussions of barriers to equity, to craft opportunities in learning that empowered students to actively resist these barriers, was underdeveloped.

Conclusion

This chapter presented the data, its emergent thematic analysis, and the findings that explored the potential of 1:1 technology uses and associated pedagogical practices to foster Margins of Maneuver to promote agency and democratic participation in the case of an eighth-grade classroom whose population was predominantly economically disadvantaged. The findings and analysis were situated within the six themes: (a) a technology-enhanced learning school culture; (b) teachers as facilitators; (c) engaged, experiential, and inquiry learning; (d) instances of higher order technology uses; (e) in-progress efforts to strengthen student voice and self-identity; and (f) purposeful awareness of economic disadvantages.

Findings identified a strong commitment in vision as well as in administrative support of a technology-enhanced learning school culture; peer support was mostly informal and underdeveloped, and students expressed concerns with technology while affirming the positive effects of 1:1 technology devices on their learning. The data regarding the teacher-student

relationships and communication as well as in engaged, experiential, and inquiry learning justified a finding that 1:1 devices had encouraged teachers to shift their role to activator-facilitators. There was also strong evidence for instances of higher-order technology uses associated with 1:1 devices, including the strengthening of subject-specific discourse, with potential for expansion of uses. Likewise, the efforts to strengthen student voice were in progress supported by 1:1 technology uses and associated pedagogical practices. The purposeful awareness of the economic disadvantages of the school population inconsistently affected the uses of technology and pedagogical practices as well as the attitudes and ideologies of the district, principal, and teachers. The data showed evolving instances of micro-resistances simultaneously with underdeveloped teacher and institutional intentionality in empowering students to use technology as active shapers of their community.

The research found that further development in opening Margins of Maneuver would require development and maturing of intentionality in 1:1 technological uses and practices. The research also found that the 1:1 implementation had had positive impacts on the formation of student agency and participation skills to open Margins of Maneuver that would benefit from further growth in such intentionality. The next chapter provides a summary of the study, answers the research question, and discusses the findings, implications, and recommendations for future research, ending with a reflection and conclusion.

CHAPTER 5

DISCUSSION

> We could say that the form taken by technologies stems not only from experts'
> intervention but also from that of the concerned groups that have been allowed to
> contribute to their shaping. And just as there are good and bad sculptors…so too
> there are good and bad ways of identifying and involving (or not involving)
> concerned groups.
>
> — Callon, 2010

The National Education Technology Plan (NETP, 2016, 2017) reported the—accelerated

growth of one-to-one (1:1) technology integration in United States schools, while at the same

time cautioning that current data on technology uses and pedagogical practices demonstrated a

widening in particular aspects of the digital divide. The report specifically identified the critical

area of concern as the second- and third-level digital divides, in agreement with the research

literature. The second- and third-level digital divides refer to the differential between technology

uses and pedagogical practices along economic lines that have demonstrated marginalizing

versus democratizing effects (Boardman, 2012; Harris, 2010; Hohlfeld et al., 2017; Lee, 2013;

Mouza, 2008; Reinhart et al., 2011).

Critical theorist Andrew Feenberg (2002, 2010, 2012), while acknowledging potential

hegemonic issues associated with technology, proposed the possibility of opening Margins of

Maneuver, spaces to foster agency and democratic participation. Feenberg identified design,

uses, and purpose as the most significant characteristics in evaluating whether a particular

technology implementation was fostering Margins of Maneuver. Okan (2007) supported

Feenberg's theory, stating that Margins of Maneuver result from the exchange of agency

regarding design, uses, and purpose within educational processes:

Thus, technology use is seen as the result of the interaction of several elements,

such as the inherent characteristics of the technology, teacher's pedagogical

beliefs and the kind of pedagogical activities that were designed as a result of

them, students' own understandings of the potentials of the technology and the

negotiations between students and the teacher regarding how the technology

should be pedagogically exploited. (N.P.)

Similar to NETP's diagnosis of the second- and third-level digital divides, Feenberg and Okan

emphasized the importance of technology's uses and practices to democratizing its

implementation.

Despite the importance of understanding the role of technological uses and pedagogical

practices to the critical equity concern expressed by the research on the digital divide, the

literature has few studies exploring this role of technology. Recognizing a need to explore these

relationships to help narrow the second- and third-level digital divides, this study used a critical

theory of technology and key characteristics of critical pedagogy as the theoretical lens for

reflecting and discussing the data. To bridge the gap between theory and practice, the study also

used Teemant and Hausman's (2013) *Six Standards for Effective Pedagogy,* specifically its

distinguishing characteristic of the *Critical Stance* standard derived from Freire's critical

pedagogy. Teemant and Hausman added the standard to the original sociocultural five standards

to provide practical language for critical pedagogy, making it more accessible to teachers and

overcoming McClaren and Kincheloe's (2007) reasoning for critical pedagogy's lack of impact

on schooling.

This chapter begins with a summary of the study to set context for a statement of the main findings, followed by a discussion of the findings; implications and recommendations for theory and practice at the district, school, and teacher level; possibilities for future research; researcher reflection; and conclusion.

Summary of the Study

This phenomenological, qualitative case study explored the potential of 1:1 technology to impact learner agency and democratic participation within the context of a middle school whose population met the state criteria for "economically disadvantaged," as identified in the School Accountability Report Card for the academic year 2015–2016. The study's results contribute to existing critical theory regarding technology-enhanced learning. Further, the study gives voice to the technology and learning experiences of the participants in the selected middle school case, as well as suggests implications for educational policy regarding technology integration.

The research was conducted at Granada Middle School in the San Vincente School District, both of which met the criteria of having a population identified by government criteria as economically disadvantaged. The school and district were in their second year of a 1:1 implementation, and the research focused on the experience of the principal, the eighth-grade teachers, and the eighth-grade students in science and STEAM, Social Studies, and Language Arts classes. Using a case study design, the researcher gathered data through observations, semistructured interviews, and analysis of documents to examine the impact of 1:1 technology. The data were coded to identify common patterns from which themes emerged that helped to reveal the significance of the data through the lens of the theoretical framework to address the research question.

Research Question

To what extent do 1:1 technology integration uses and associated pedagogical practices foster *Margins of Maneuver* in an eighth grade comprised of a student population that is predominantly economically disadvantaged?

Statement of the Findings

The research process spanned four months—from the initial all-day site visit to the subsequent document analysis, observations, and interviews. Through inductive analysis and coding observation notes, interview transcripts, and district as well as school documents, the researcher identified six themes and associated domains as they emerged from the data.

1. *A Technology-Enhanced Learning School Culture for College, Career and Beyond.* The district and school exhibited a strong philosophical and budgetary commitment to 21st-century design learning, problem-based, inquiry learning, and STEAM, grounded in its core value of College and Career Readiness (CCR). The principal cultivated democratic relationships at the school, between all members of the learning community, and had expanded the CCR to College, Career, and Beyond, a vision of growth that would expand throughout a student's lifetime. Students told of their participation in decision-making well as consultative roles in school committees, as well as in engagement with teachers and a wide variety of activities. The 1:1 technology-enhanced environment evidenced a high participatory culture within the school, between principal, teachers, and students, which formed a supportive context for Margins of Maneuver.

2. *Teachers as Facilitators.* The findings were persuasive that 1:1 technology

   integration has accelerated the shift from teacher as information deliverer to teacher

   as facilitator. The nature of teacher-student relationships had become more

   democratic with an easy flow of dialogue and camaraderie between teachers and

   students, and between students themselves. Teachers had established repertoires of

   "activator" behaviors that kept them engaged with students and their learning, which

   included both utilitarian and generative questioning, coaching behaviors, modeling,

   and scaffolding appropriate to the task and the individual needs of students. Because

   1:1 technology allowed students more independence in learning and changes power

   dynamics in the classroom, it acted as a driver for the teacher shift to facilitator. This

   shift opened spaces in which students could assert their agency—voice and choice—

   in the learning, characteristic of Margins of Maneuver.

3. *Engaged, Experiential, and Inquiry Learning.* The findings were that students

   exhibited the characteristics of engagement in terms of energetic learning activity,

   focused attention to the tasks, and lively social interactions. Autonomous student

   learning happened both individually and collaboratively. Students paced their

   learning, looked up more information, challenged one another and the teacher, joked

   and bantered all the while continuing to learn. They appeared to be active creators

   and co-creators of knowledge. Evidence that 1:1 technology uses promoted

   engagement and autonomy appeared in both the observational and multiple interview

   sources, including student assessment of their learning experiences. The resulting

increased student participation and ownership of their learning also supported the evolution of Margins of Maneuver associated with the 1:1 technology initiative.

4. *Instances of Higher Order Technology Uses.* There was evidence of lesson plans and learning activities that challenged students to use their devices for higher order technology uses. Observations and interviews evidenced a pervasive emphasis on the critical use and sourcing of information, as well as being part of the school and district document record. Students were active in acquiring subject-specific discourse to enable them to participate in arenas normally reserved for the dominant society. This critical academic literary was found across the classes, including the Newcomers ELA classes, in which the 1:1 devices had helped to accelerate the acquisition of academic English necessary for future democratic participation in the systems of school.

5. *In-Progress Efforts to Strengthen Learner Voice and Self-Identity.* Voice and self-identity are essential components of fostering agency in students. There was evidence that the use of 1:1 devices had helped students to develop self-confidence as able learners, securing that sense of efficacy as part of their personal identity. Some teachers explored issues that were personally relevant to students, but the discussion did not go beyond an exploratory inquiry. Students unanimously expressed that they would like to be able to take community action, and to use their devices to address more personally relevant issues in the systems of school and in their community.

6. *Purposeful Awareness of Economic Disadvantages.* The principal as well as the majority of teachers and students demonstrated awareness of the economic

disadvantages of poverty or low income accompanied by potentially marginalizing factors of ethnicity and limited English language fluency. Having been a community member throughout his life, the principal was very mindful of the economic disadvantages, and was committed to providing opportunity and skills to enable students to exercise agency and to participate meaningfully in society. Most of the teachers expressed a similar commitment, as seen in their longevity at the school that suggested a conscious desire to educate poor and low-income students. Students were also aware of some factors causing potential marginalization. The data demonstrated instances of micro-resistances in principal, teacher, and student behavior and actions. The intentionality of using 1:1 technology to foster student agency and democratic participation was inconsistent and a growth area for further developing capacity to open Margins of Maneuver.

Themes and domains provided a contextualized picture of the school site that was the unit of analysis for this case study. By fostering student agency over the devices and their learning, helping to strengthen their identities as able learners, and providing effective media for expressing student voice, the data demonstrated Feenberg's (2002, 2010, 2017) and Okan's (2007) contention that technology has an "ambivalence" that can be shaped to democratizing purposes.

Participants mostly acknowledged this reality, making frequent references to the changed classroom dynamics that had resulted from the 1:1 technology. Many of them thought the changed dynamic had transferred more power to the student as an agent who took an active and co-constructive role in learning, as envisioned by Freire's (1970/2000) critical pedagogy.

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Nevertheless, the data exhibited some tension, with evidence for the influence of the global knowledge economy on district and site technology decisions and participant attitudes. The following discussion of these findings examines the 1:1 technology implementation at Granada Middle School in relation to the research question.

<p style="text-align:center">Discussion of Findings</p>

Research Question: To what extent do 1:1 technology integration uses and associated pedagogical practices foster *Margins of Maneuver* in an eighth grade comprised of a student population that is predominantly economically disadvantaged?

Technology Uses and Agency at Granada Middle School

In the STEAM, science, DI Social Studies, and Newcomers Language Arts classes, technology was part of the daily learning experiences. For purposes of the discussion, this study refers to this group of teachers as *teacher-adopters*. The observations showed that students in these classrooms used their 1:1 technology devices to pursue individual research, to pace their learning from teacher presentation, to investigate topics in which they were interested, and to collaborate with other students. These classrooms were noisy places with the "hum" of discovery, reflecting the engaged attention and focus given to the learning process, as well as the student and student-teacher dialogue of questions and advice as they used the devices to look up videos or other materials. Using the devices did not result in student isolation; there was a high level of joking and banter in the room, as well as helpful feedback and negotiation of knowledge in the dialogues.

The learning process demonstrated appropriate levels of student autonomy that emerged from student relationships with each other, with the teacher, and with the use of the devices,

consistent with the aspects of agency that define autonomy according to Greeno (2008), Lewis et al. (2007), and Rainio (2008). This demonstrated autonomy characterized the growth in agency and authentic participation in decisions regarding their learning as well as other facets of their life that typify Feenberg's (2002, 2010) and Okan's (2007) Margins of Maneuver, which can be used to narrow the second and third digital divides.

There were some teachers still struggling with how to incorporate devices into the learning environment of their classroom. Observations in those rooms evidenced a frequency of students as receptive learners as well as disengagement indicators. These teachers, by their own admission, rarely used technology, and the student devices were not in evidence during the observations. The lack of student activity paralleled the nonuse of the devices. The compelling evidence that classrooms using 1:1 devices are lively, creative places of learning, while those not using devices are often passive and disengaged corroborate the proposition by An and Reigeluth (2012), Boardman (2012), Donovan et al. (2007), Harris (2010), Lee (2013), and Pogany (2009) that 1:1 technology implementations resulted in higher student engagement and active co-creation of learning experiences. Findings support the conclusion that when 1:1 integration provides students with the ability to act as co-creators of their learning and engages them in a collegial discovery of knowledge, it fosters the dispositions and environment in which Margins of Maneuver can develop.

Individual expressions of student agency in the use of technology. Students used the devices as tools in their learning, as naturally as they would a book, pen, or paper. The devices blended into student conversations, and sometimes were a source of material for that conversation. Students were very comfortable looking up information, accessing Google

Classroom for instructions or videos to keep them successfully moving through different steps of a learning task, or researching a topic.

Students and teacher-adopters talked frequently about this aspect of technology use, as an immediate source of information that freed students to continue learning when they did not remember something or needed more help to move forward. Students, teacher adopters, and the principal referred to the independence that devices provided to students, as they were less reliant on the teacher to provide them with each step or piece of the information. Students appreciated the feeling that they were in charge of their learning and teacher-adopters liked being able to provide help and an opportunity for deeper discussion and learning, feelings that were also expressed by the students in Pogany's (2009), Harris's (2010), and Mouza's (2008) studies.

Students, teacher adopters, and the principal talked about students using 1:1 devices to self-pace their learning, going slower or faster with the teacher during lecture presentations. Students also mentioned going deeper into a topic by doing a related search when they knew they already understood the presentation slide, or going back a few slides to review something that needed clarification. Devices provided definitions and comprehension helps to guide students in independently navigating academic language in various readings. Students enjoyed the options for communicating their learning, creating iMovies or making other technology-enhanced products that displayed their knowledge. The researcher observations confirmed that the devices functioned as a personal learning assistant for students.

The high level of activity with their devices was the product of student choice in the classrooms of teacher adopters, mediated by the teacher as a facilitator of the learning. Students asserted control over the devices, using them to serve student learning purposes and putting them

aside to use other tools when they decided those tools were more appropriate for a particular task. There was no evidence of the devices monopolizing student attention, nor of students slavishly using the technology; rather, students exhibited a high degree of agency in the technical spaces in terms of choice and purpose for the uses of 1:1 technology.

These findings lead to the conclusion that, in a complex interaction, 1:1 technology opens up more power to students who then feel emboldened to exercise agency over their use of technology, developing yet more student autonomy, creativity, and self-confidence, essential to fostering student voice according to Cook-Sather (2006) and Kinzie (1990). These behaviors are often privileged power characteristics of the dominant society, a finding that agrees with Boardman (2012), Felderman (2010), Harris (2010), and Mouza (2008). In fostering these behaviors, 1:1 technology has the potential to increase democratization as well as participation in the dominant society, working from within the Margins of Maneuver.

In teacher-adopter classrooms, student accessed cognitively challenging activities while acquiring, constructing, and using knowledge in subject-specific critical academic literacy. The devices were omnipresent, providing support for student integration of self-identity as being competent and able individuals, a feeling expressed in their talk of hope-filled anticipation of future learning. Many times, students would smile with delight or express their satisfaction with having successfully met a learning challenge with the help of their device as well as teacher facilitation.

This incorporation of being able learners into student self-identity was empowering and liberating. As communicated by some of the eighth-grade students, they felt comfortable standing up to adults to "fight" for the continuity of the computer lab instead of freeing up the

money for more iPads or to make another maker space; or, challenging the information provided by a teacher with other knowledge they find on the Internet. They even felt comfortable going into the principal's office or a teacher's classroom to leave their skateboard in a cabinet for retrieval at the end of the day, which the researcher observed a few times.

These assertive uses of 1:1 device integration and the shift in pedagogy demonstrate the strengthened empowerment that has already been discussed to create an environment positively associated with student self-identity and sense of efficacy, as found in previous studies (An & Reigeluth, 2012; Boardman, 2012; Boylan, 2010; Harris, 2010; Loyens & Gijbels, 2008; Mouza, 2008; Pogany, 2009; Rosen & Beck-Hill, 2013).

Collective expressions of student agency in the use of technology. Access to the devices appeared to close distances between the students as well as between student and teacher, placing them all in the same technical space that has the "leveling" effect described by Feenberg (2002, 2010, 2017). Examples included the DI Social Studies student dialogue around the Trail of Tears, connected to the issues of misplaced peoples that connected on a personal level to the current immigration policy, or science class questioning of the reasons behind certain cloning choices relative to current race and ethnicity concerns in their lives. In other examples of collective learner agency, students used information available through the devices to negotiate design decisions in the STEAM and science classes, and provide meaningful writing feedback to one another when producing a group report in the Newcomers Language Arts class.

The learning community collaboratively used and sourced information enabled by the technological immediacy of varied perspectives to go beyond information recall and regurgitation to a more cognitively demanding and democratizing unpacking of the information.

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This finding replicated findings in previous 1:1 studies that technology use, appropriately situated, beneficially impacts student self-efficacy and, therefore, the development of student agency and voice, as would be expected in environments experiencing Margins of Maneuver (Boardman, 2012; Boylan, 2010; Harris, 2010; Kemker et al., 2007; Lewis et al., 2007; Mouza, 2008; Pogany, 2009; Shapley et al., 2010).

In the teacher-adopter classes, groups of students used the technology to access a variety of informational sources, as well as to question the reliability of the sources and discuss possible biases or impacts of the information. The principal and teachers focused attention on this type of use in their interviews, expressing the belief of the urgency to help students manage all the information available to them through the interconnected Web. Students also expressed how important it was for users to question the viewpoints and the accuracy of information sources to be able to get a more reliable picture of an event or situation. The researcher observed students challenging each other about the information and its implications. This observed type of collective inquiry and dialogue that accompanied 1:1 integration helps students develop their conscious awareness of the systems in which they participate, as Freire (1970/2000), Freire and Macedo (1987), Giroux (1988), and Teemant and Hausman (2013) have maintained. This finding aligns with increasing student participation in speaking to the events and historicity of their lives, correlated with critical pedagogy and necessary for opening Margins of Maneuver (Feenberg, 2002, 2010; Freire, 1970/2000; Okan, 2007).

In addition to using devices in collective problematizing, students in teacher-adopter classes actively enlisted the 1:1 devices in their development of critical literacy in subject-specific discourse across the content areas. Subject knowledge in the sciences, mathematics,

technology, and engineering, as well as in sophisticated academic language, have become the guardians of the privilege tower, as evidenced by the underrepresentation of certain ethnicities, races, and economic classes in fields requiring this type of knowledge.

With access to 1:1 devices, Internet access, technology-enhanced learning, and selected application software, students at Granada Middle School were strengthening their abilities to engage in these discourses that are often the privileged domain of the dominant society, as argued by Freire (1970/2000), Freire and Macedo (1970), Harris (2010), Lewis et al. (2007), and Lewison et al. (2015). The finding supports that critical use of 1:1 technology helps develop the discursive skills of students who are economically disadvantaged to empower them to participate authentically in the dominant society, as found in Harris (2010), and demonstrating the democratizing potential of technology asserted by Feeberg (2002, 2010, 2017) and Okan (2007).

Inconsistent or discrepant uses. The uses of 1:1 devices were still in the emergent stage in selected situations and teacher-adopter classrooms, but in some cases, teachers rarely used the devices, if at all. Confirming the finding that the 1:1 implementation was still evolving, students acknowledged that they did not experience the engagement of the devices in as many classes as they would have liked, pointing out that some teachers are just "annoyed" or "stressed" by having to figure out how and when to use the technology. Teacher-adopters and the principal were aware of the situation as well, making frequent remarks such as "We're not there yet," "We're working on it," "We're trying to figure out best practices." Several teachers even cited the lack of wholehearted teacher support as a factor mitigating growth of the uses of 1:1 technology to positively impact students.

These factors echo the findings of former studies (Amankwatia, 2008; Boardman, 2012; Inan & Lowther, 2010; Jones, 2013; Pack, 2013; Pogany, 2009; Polly & Hannafin, 2010; Warschauer et al., 2010). Relatively immature 1:1 technology implementations often demonstrate this type of evolutionary and developing use. Nevertheless, efforts to sustain and extend existing uses to strengthen the agency, identity affirmation, subject-specific discourse, and skill in negotiations with others to expand the democratic participation of students are important in making full use of the potential in the Margins of Maneuver that the current 1:1 technology uses and associated pedagogical practices at Granada Middle School have already demonstrated.

Likewise, student use of 1:1 devices to explore the power relations and systems of the world and community was exclusive to certain classrooms and learning events. However, as the literature points out, this piece of critical consciousness is essential to designing uses of technology that serve the interests of the economically disadvantaged members of a community versus the interests of the dominant members (Feenberg, 2002, 2010, 2017; Freire 1970/2000; Giroux, 1988; Lewis et al., 2007; Teemant & Hausman, 2013).

Although teachers and students probed information for issues of reliability and validity, the application of inquiry to pose open-ended questions to possible factors of inequity or injustice were not frequent. Students used information to solve problems within the knowledge base, learning procedural, utilitarian approaches to applying knowledge. The next step of co-learning with students to inquire, plan, advocate, and act to promote equity and justice had not permeated the character of 1:1 uses at the school.

The currently selected technological uses and practices had sown the seeds of moving to this next step in developing the democratizing potential of 1:1 technology. Further development remains essential in the narrowing the third digital divide as well as moving toward a mature Margins of Maneuver. Engaging technology as a partner in inquiry provides a potential edge to the use of the devices as tools with which to interrogate power and systemic factors of oppression or inequity. More frequent uses of 1:1 devices to connect learning to student and community issues and interests would strengthen the scale of the 1:1 uses on fostering Margins of Maneuver as envisioned by Feenberg (2002, 2010, 2017), Friesen (2012), and Okan (2007), and aligned with critical pedagogy's praxis (Freire, 1970/2000; Giroux, 1988; Lewis et al., Teemant, 2014; Teemant & Hausman, 2013).

Technology-Associated Pedagogical Practices at Granada Middle School

"I think everyone understands what we're trying to do—making sure the kids have a level field." These words from one of the science teachers describe the collective will of many of the teachers to be actors for equity, as demonstrated in the longevity of the faculty, many of whom could have elected to work at schools with more affluent populations.

That teachers had chosen Granada Middle School evidenced their common purpose, which the science teacher articulated and which all teacher participants as well as the principal voiced. This view affected the adoption of 1:1 pedagogical practices that were beneficial to student learning as well as to strengthening student agency and democratic participation.

Most of the teachers appropriated this teacher identity—teachers who teach to level the playing field for students. Their actions expressed this identity: posting roller coaster models and videos on Google Classroom; selecting iMovie and other presentation media as the ways that

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students could demonstrate knowledge and understanding; asking students to research information on contestable issues that affected the students and their community. By making pedagogical choices that encouraged these types of student uses, teachers asserted their own agency in support of student agency, identity, and voice. Teachers referenced trying out new ideas, figuring out how to best use the 1:1 technology, showing that they were aware of their freedom in designing learning as well as the importance of their pedagogical decisions—an importance affirmed by empirical studies (An & Reigeluth, 2012; Boardman, 2012; Inan & Lowther, 2010; Pogany, 2009).

 Classroom observations found that most teachers were comfortable releasing control of the devices to the students. The majority of teachers observed or interviewed (about 75%) planned units or lessons in which students were encouraged to use their devices autonomously, as well as ensured the learning was engaging and experiential to help keep the students on task as they worked with the devices.

Facilitative pedagogical practices associated with 1:1 technology. The pedagogical practices data justified the finding that the majority of teachers had adopted the shift in their role from information dispenser to expert facilitator. This shift to teacher as facilitator shaped spaces where students became co-agents in the learning, contributing and constructing individual and shared knowledge through active learning. Teachers provided students with many opportunities to cooperatively source information using their devices to become expert at a skill or knowledge topic and then teach others in their groups.

At the same time, teachers could be seen and heard engaging in coaching conversations, assuring students they had the necessary tools to accomplish a task; reminding them to use their

tablets first to get answers before asking the teacher; and modeling different skills, design, and thinking approaches in their use of technology as a part of their teaching practices. Teachers had not only shifted their roles to facilitators but also stayed actively involved with their students using selective activating behaviors such as leveled questioningto avoid the pitfalls of being too passive of a facilitator, as articulated by Fullan (2013) and Gregory (2016), both of them citing Hattie's 2009 meta-analysis.

Teachers were aware of this shift in their pedagogical practices, referencing themselves as "facilitators," and defining that role as awakening student curiosity about certain topics or themes; then, helping them discover both the state-mandated curricular aspects as well as the student's own findings and thinking about the topics. Some of the teachers talked about the difficulties in balancing curriculum requirements with increased student ownership of the learning, a finding that was also evident in observations and cited in previous studies (Boardman, 2012; Harris, 2010; Pack, 2013; Shapley et al., 2010). Regardless of those challenges, teachers who had adopted 1:1 devices as an everyday part of their pedagogical tool set also attributed 1:1 technology as a driver of the shift to student-centered pedagogy and the role of facilitator, as suggested by Donovan et al. (2007) and NETP (2016, 2017).

These findings suggest that 1:1 technology implementations elicit environmental conditions and classroom dynamics that help teachers to also evolve their role as facilitators of learning, which some of the literature suggests is an effect of 1:1 technology (An & Reigeluth, 2012; Boardman, 2012; Donovan et al., 2007; Lee, 2013; Mouza, 2007; Rosen & Beck-Hill, 2012). The 1:1-enhanced shifts create a collegial, democratic learning environment often found

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in spaces of Margins of Maneuver (Okan, 2007) and aligned with the expectations of critical pedagogy (Freire 1970/2000; Giroux, 1988; Teemant & Hausman, 2013).

Redefined, more democratic teacher-student pedagogical relationships. By working more in the manner of a teacher colleague, providing developmentally or linguistically appropriate support in their role as facilitator, teachers' pedagogy also shifted the power exchanges. Observations revealed the more democratic, less teacher-centered classrooms that exhibited the shift. Both teachers and students redefined their roles vis-à-vis each other's expressions of agency, illustrative of the paradox of balancing agency among various actors, articulated by Rainio (2008). The facilitative, student-centered pedagogy encouraged students to use their devices and each other's expertise to create their own locus of control and decision-making while also submitting themselves to the expectations of others. As seen at Granada Middle School, technology-enhanced 1:1 learning cultures demonstrated high levels of teacher input, student-driven projects such as designing a model high school, collaborative writing and thinking, and multiple ways to demonstrate mastery such as iMovie. Through these experiences, students gained the necessary skills to mediate their identities and exchanges with the dominant society characteristic of democratic participation in the trial runs of their classroom interactions (An & Reigeluth, 2012; Boardman, 2012; Freire, 1971/2000; Lewis et al., 2007; McCombs & Miller, 2009; Rainio, 2008; Teemant, 2014; Teemant & Hausman, 2013).

Characteristic of these redefined teacher and student roles, the principal, teachers, and students reported the frequent access each member of the learning community had to one another and the easy communication flow. Students viewed this access to dialogue with those who were authorities as potential avenues of participation in the life and activities of the school. They

spoke with efficacy, an erect body posture, and almost no mumbling in describing their various interactions with adults on school committees and in outside organizations. The 1:1 devices and other digital media reduced the distance between power and authority and the students. In doing so, technology uses created ways in which students could influence and change the school and social systems, a significant outcome of Margins of Maneuver and the "action to power" principle of critical pedagogy (Feenberg, 2002, 2010; Freire 1970/2000; Teemant & Hausman, 2013). One example was sharing their STEAM experiences with neighboring elementary schools. These expressions of democratic participation and student voice emerged from the 1:1 learning environment, demonstrating a stronger sense of agency as well as continuing to develop and affirm identity, as found in the literature (Cook & Sather, 2006; Freire, 1971/2000; Harris, 2010; Lee, 2013; Lewis et al., 2007; Mouza, 2008; Rainio, 2008; Selwyn, 2010; Teemant, 2014; Teemant & Hausman, 2013).

Inconsistent or discrepant pedagogical practices. Nevertheless, the shift to teacher as facilitator and its accompanying student-centered pedagogical practices, as demonstrated in STEAM and science, the DI Social Studies, and the Newcomers Language Arts classes, had very little evidence in the regular Social Studies and Honor Language Arts classes. The first group of classes integrated the 1:1 devices into the everyday, ordinary experience of the students. Teachers had not only shifted into the facilitator role, but also used student-centered pedagogy, planned learning in which students strengthened their agency and identified as self-efficacious learners, and had easy communication as well access with students. By contrast, the second group had infrequent or no use of 1:1 technology and exhibited teacher-centered pedagogy as

well as a highly directive relationship between teachers and students in which student agency and voice was minimally present.

These contrasting pedagogies and observed behaviors between adopters and nonadopters of 1:1 technology argue that participants who had integrated 1:1 technology experienced a direct relationship between device integration, teacher facilitative practices, and active student-centered learning. Further, learning experiences within the 1:1 technology integration environments demonstrated a greater exercise of student agency, the development of a stronger identity as an able learner, and expressions of student voice, consistent with Margins of Maneuver and essential elements of critical pedagogy (Feenberg, 2002, 2010; Freire 1970/2000; Okan, 2007; Selwyn, 2010; Teemant & Hausman, 2013). These findings confirm previous findings of the impact of 1:1 on pedagogical practices and the resulting student learning impacts (An & Reigeluth, 2012; Bebell & Kay, 2010; Boardman, 2012; Chandrasekhar, 2009; Harris, 2010; Inan & Lowther, 2010; Kirkscey, 2012; Kopcha, 2010; Matzen & Edmunds, 2007; Mundy et al., 2012; Pogany, 2009; Zucker, 2004; Warschauer et al. 2014).

A certain amount of deficit thinking expressed in personal communications during observations—that students were significantly below grade level and that no teacher practices had successfully changed that enduring reality—is one possible explanation for resistance to planning lessons that allowed students to use their 1:1 device. Another possible explanation is that some teachers did not believe that using the device would produce a measurable impact on student learning. Lastly, some teachers might not have considered students as knowledge agents or creators, choosing the traditional knowledge delivery model which allowed them to hold on to

their identity as the expert and power in the room; they might have been reluctant to share that role with students or to nurture the increased freedom that devices provide to students.

Given the other finding of a positive association between 1:1 technology integration and the shifts in pedagogical practices, one might argue that if these teachers had shifted to providing students with technology use opportunities, the dynamics of their class would change. Consequently, students might be more willing to participate in learning and in purposeful exchanges with their teachers and one another, as proposed in critical pedagogy theory (Freire 1970/2000; Giroux, 1988; Lewis et al., 2007; Teemant, 2014; Teemant & Hausman, 2013).

Impact of Leadership on 1:1 Technology Uses and Associated Pedagogical Practices

The principal made a conscious choice to return to his neighborhood, even though his skills and credentials would qualify him to work in more affluent districts and schools. He unabashedly talked about it being a highly personal decision, as was his support of the expansion of the curriculum to emphasize the use of technology to empower the students and teachers. As a result, the principal provided the professional, budgetary, and interpersonal support to help the learning community in their choices to use technology to enhance learning.

The availability of many technology options—iPads, Chromebooks, laptops, smart phones—left the device selection up to the teacher and student, based on their assessment of the best match to their desired purpose or need. His policies provided all students, including those who want to make an extra-curricular commitment, access to a Saturday Robotics Club and Maker Space design labs and experiences, iMovie and digital media competencies, participation in the Hour of Code, and the availability of Swift on the devices, a programming language in a play environment. Shaping these technical literacies gave students many options that are often

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privileged prerogatives of members of the dominant society, helping to close the second and third digital divides (Feenberg, 2010; Felderman, 2010; Mouza, 2008; NETP, 2016, 2017).

Previous research has identified this multipronged leadership as a significant factor in sustained transformative uses of technology that can evolve to help close the second- and third-level digital divides (An & Reigeluth, 2012; Bebell & Kay, 2010; Boardman, 2012; Jones, 2013; Kengwe et al., 2012; Mundy et al., 2012; Shapley et al., 2010; Warschauer et al., 2010).

Other choices modeled by the principal's shared leadership style also had positive impacts on the potential for democratic participation. He dialogued with teachers regarding their perceived needs and concerns in the area of technology as well as encouraging them to go ahead and risk "failure." Through email, the school website, and personal communication, he shared his ideas about how to use technology to improve learning and invited teams to work together to plan innovation and to join him in presenting their results. Rather than mandating 1:1 usage compliance, the principal cheered teachers in making the shift to teaching and learning with technology, relying on growth of the critical mass of support within his faculty to help him diffuse the shift in "how we do things around here."

By opening up these spaces for teachers, he modeled the respect for the agency of others. Many of the teachers translated that modeling into their own democratic practices in their classrooms and the emotional tone they set in their interactions with students. Overall, the principal established a participatory culture as expectation, and he consistently acted from that belief system. The result has been a transfer from his official capacity as decision-maker and vision holder to promote a "pay it forward" democratic orientation among the teachers and the rest of the learning community, as described by Bolman and Deal (2002) and Shields (2012).

The underbelly of this leadership style is that it allows for a slower development, with multiple tweaks and turns in response to varied ideas. Sometimes, there might be some perceived inefficiencies by those who take more of a highly directive approach. Nonetheless, the principal was adept at disseminating news about the school to the public as well as at interpersonal skills to compensate for these factors.

Potential for Margins of Maneuver at Granada Middle School

Feenberg (2002, 2010, 2017) characterized technology as ambivalent because, despite its strong historical affinity to the dominant class, the very nature of technology creates opportunities for actors to create, foster, or use spaces known as Margins of Maneuver. Within these spaces, users' agency and voice, strengthened by their identity and democratic participation, can resist technology's potentially hegemonizing effect resulting in a democratic rationale. Examples of such micro-resistances using 1:1 technology to further development of agency were found in the principal and several teachers as well as in students' behaviors, actions, and thinking.

Findings concerning the effects of 1:1 technology uses and pedagogical practices in the eighth grade at Granada Middle School affirmed that 1:1 does have the potential to foster Margins of Maneuver, in instances where the teachers have adopted the integration and sought a thoughtful device implementation. Most of the teachers in the study demonstrated planning and attitudes that considered how students would use the devices in ways that leveled the playing field. The resultant learning environments evidenced students who (a) exercised agency, to varying degrees, in experiential learning; (b) strengthened their identity, including self-efficacy as an able learner; (c) developed abilities in subject-specific discourse as well as in negotiating

exchanges of power in their relationships with one another, the teachers, and the principals. Observations noted the frequency of higher-order, more cognitively demanding uses of sourced information. Given this data, the study found that concerns with validity, reliability, and bias in potential sources of information as well as in interpretation of information strengthens the socially constructed spaces of Margins of Maneuver associated with democratizing 1:1 implementations.

Active teacher adopters of 1:1 technology collaborated with one another and thought about new ways to use the technology, how to best keep students engaged, and ways in which they could grow as teacher facilitators. They demonstrated student-centered pedagogical practices, democratic relationships in the classrooms, and an openness to reflective re-imagining of the classroom and their teacher-student relationships. Technology-enhanced learning spaces would exhibit these behaviors when fostering Margins of Maneuver (Feenberg, 2002, 2010, 2017; Friesen, 2012; Okan, 2007; Teemant & Hausman, 2013), opening those spaces to all system participants, including students.

Despite these positive findings, Granada Middle School was in the incipient stage of 1:1 device integration. The school had the advantages of a committed principal and teachers, who, for the most part, had adopted the multiple changes of the integration, the shifted pedagogy, their changed roles as facilitators, and curricular shifts. These multiple demands can create a stressed system that the school tried to alleviate with weekly early release time and accommodating common planning times for similar grade and content teachers whenever possible. The stress had been showing, resulting in inconsistency of fidelity to the 1:1 integration and its potential for democratizing the learning experience. Continuing to promote fidelity to mission is primary to

the fostering of the Margins of Maneuver, with its associated effects on student agency and democratic participation, which are needed to help close the second- and third-level digital divides, as contextualized within a 1:1 learning environment.

Critical Stance: Purpose for action within the Margins of Maneuver. The imperative for the critical stance, the revealing, reflection, and action/advocacy step of critical pedagogy's praxis (Freire 1970/2000; Teemant & Hausman, 2013), is significant when discussing the potential of Feenberg's (2002, 2010, 2017) Margins of Maneuver within an educational setting. Adopting strategic 1:1 technology uses and practices to act from the margins develops student efficacy and agency in interrogating large amounts of accessible information and in speaking to the dominant society.

Either this information can be used in a utilitarian fashion to solve problems or explain procedures, or it can be used critically to pose problems and evaluate alternative actions emerging from a thoughtful evaluation about potential injustices. Some classes were asking these types of questions, yet none of the observed classes deepened inquiry with a critical stance, as Felderman (2010) had with the students creating podcasts that opened discussion about local social justice issues. Freire's critical stance praxis cycle is represented below.
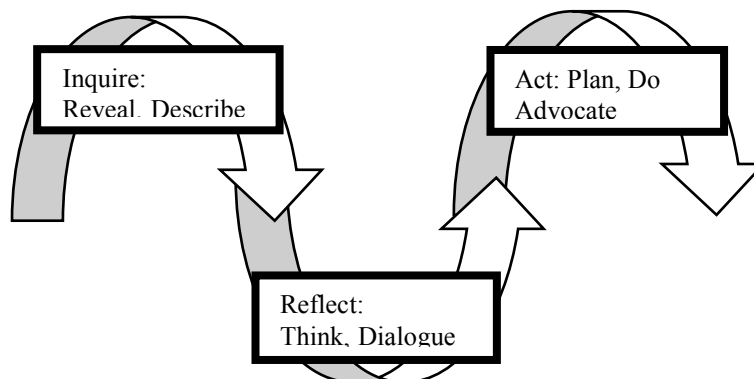

Figure 7. Critical pedagogy's praxis cycle. (Freire 1970/2000)

Without this critical stance praxis cycle, also found in Teemant and Hausman's (2013) *Sixth Standard,* uses and pedagogical practices related to the 1:1 devices lack consistent, deliberate, and consciously aware purpose. Nevertheless, 1:1 technological uses and associated pedagogical practices that foster Margins of Maneuver without the critical stance still have the capacity to promote student agency and strategic skills that lessen the second-level digital divide. Feenberg's (2002, 2010) and Okan's (2007) Margins of Maneuver can precipitate instances of micro-resistances as was evidenced in the data, which can lay groundwork for closing the third-level digital divide. The third-level digital divide, however, requires a full expression of agency and democratic participation originating within the Margins of Maneuver created with 1:1 technology, and this expression needs intentionality.

When asked by the researcher whether 1:1 increased the opportunity to plan learning that connected to issues that matter to students, many teachers had to stop before answering, and appeared slightly confused or asked for clarification. This behavior could be an indicator that teachers' concern with preparing students to be college and career ready, aligned with the dominant narrative, overshadowed their conscious intentionality directed at opening Margins of Maneuver. Further, when students were asked if they experienced those types of learning opportunities with 1:1, most of them could only come up with one example, if any at all. Still, all the students indicated they would be interested in having those learning experiences.

This finding suggests that being actively engaged in learning with 1:1 devices and the resulting immediate access to information can have an effect on student awareness and lay the groundwork for further opening of the Margins of Maneuver in support of democratic participation. Further exposure to 1:1 technology and maturing of the pedagogical practices,

given the initial findings of a critical mass of leadership and teacher attitudes as well as the instances of micro-resistances, would further actualize the strong democratizing potential at Granada Middle School.

At their stage of development, students are not ready to organize around activities and learn to serve their interests without a platform initially facilitated by a more knowledgeable adult, such as the teacher. Tension exists between the evidence for 1:1 technology giving rise to Feenberg's (2002, 2010) and Okan's (2007) Margins of Maneuver that support agency and democratic participation with the inconsistent intentionality that might have resulted from the dominant values of the knowledge economy.

Potential barrier to Margins of Maneuver: The Knowledge Economy. Since the data exhibited tension in its findings regarding the lack of critical stance in the Margins of Maneuver, examining alternative explanations helps to evaluate the implications of the research question. One cause of the disconnect between a critical, intentional stance and a more mature Margins of Maneuver might be the district commitment to college and career readiness that contains language that resonates with the knowledge economy.

College and career readiness does not demand problem-posing, interrogation of inequity, and advocacy to action, as expected by Feenberg's (2002, 2010) and Okan's (2007) Margins of Maneuver or Freire's (1970/2000) critical pedagogy; nor does readiness expect learning that opens opportunities to speak to inequities as Teemant and Hausman (2013) espoused. Rather, such readiness often aligns with utilitarian skills, applied to a specific problem or procedural task, and the proposition that knowledge and technology are value neutral so that a person should acquire skills without needing to adopt a critical stance.

As Feenberg (2002, 2010, 2017), Friesen (2012), and Selwyn (2010) have articulated, technology has a contestable disposition and, given the profit motives inherent in its construction and deployment, is easily swayed toward social replication uses. When Feenberg refers to technical spaces as contestable and potential fields of resistance in the Margins of Maneuver, he identifies a utilitarian use of information as one of the myths used as a co-opting tactic to shape technology to the uses of the dominant society.

Friesen (2012) and Selwyn (2010) go further, proposing that the utilitarian expectations of technology have actualized in the knowledge economy as an attempt to distract economically disadvantaged peoples from the realities of systemic oppression. The knowledge economy presents the "self-evident" truth that advances in technology will end inequalities, although the history of technological breakthroughs has yet to demonstrate that effect. Therefore, the values of the knowledge economy, well diffused into organizational and policy thinking, would not require critical intentionality but might produce a perceived leveling effect by virtue of the use and existence of "neutral" technology. Even if there is realization of the need for a critical stance in 1:1 technology uses to serve democratizing interests of economically disadvantaged populations, the pervasive messaging of the knowledge economy may present a confounding element and barrier to developing intentionality of purpose. Deflecting critical examination of the reasons for social stratification might be a factor that obscures participant efforts to take a critical stance within the Margins of Maneuver, inhibiting the development of agency and the closing of inequities.

Summary

Critical stance's intentionality fuels agency and democratic participation in the choices and decisions of the community, as Feenberg (2002, 2010, 2017), Okan (2007), Freire (1970/2000), Giroux (1988), and Teemant and Hausman (2013) asserted. Since sustained, consistent intentionality of critical stance is absent from the findings, the researcher concludes with a qualified statement. One-to-one technology uses and associated pedagogical practices foster Margins of Maneuver, as exemplified in the findings of the Granada Middle School case study. Data demonstrated exemplars of the characteristic environmental shifts in pedagogy as well as uses of 1:1 that strengthened student identity and confidence as able learners. These shifts provided pathways to skills and discourses that economically disadvantaged people need to participate in exchanges of power with the dominant society. There were instances of micro-resistances found at all levels in the learning community—principal, teachers, and students— evidencing the potential for further growth in intentionality of purpose in developing a critical stance.

Therefore, the study affirms Feenberg's (2002, 2010, 2017) and Okan's (2007) critical theory of technology that use and design can democratize its implementations, including technology uses in education. The case study also concludes that the lack of an intentional critical stance, articulated by Freire (1970/2000), at Granada Middle School hinders the full maturity of Margins of Maneuver, in which student agency and democratic participation may be further developed. The qualification in the conclusion arises from applying the lens of Freire's (1970/2000) conscious awareness that develops into action and speaking to power, as operationalized in Teemant and Hausman's (2013) Sixth Standard.

This qualified affirmation of Feenberg affects the ways in which the development of the Margins of Maneuver enables the 1:1 uses and associated pedagogical practices to close the third-level digital divide. By missing the piece in which students devise an advocacy and action plan within the uses of 1:1 devices, problematizing their lives, historicity, and communities, the existing Margins of Maneuver have not been applied to the third-level digital divide in which such activity takes place (Freire, 1971/2000; Kemker, 2007; Reinhart et al., 2011; Teemant & Hausman, 2013).

Although knowledge economy concepts presented an external barrier, they were not insurmountable at Granada Middle School. The principal, teachers, and students could more fully assert themselves into the uses and pedagogical practices of 1:1 technology; it will require clarity of purpose. The research and the data suggest that 1:1 technological uses and associated pedagogical practices in classrooms of adopter participants can resist the external discourse of the knowledge economy. This resistance takes shape in the evidence of students as actors and collaborators in their knowledge construction, in the strengthened identities of students and the facilitator roles of teachers, to move toward rationalized, participatory democratic processes.

Implications and Recommendations

Theoretical Implications

Despite technology's important role in postmodern society, and its ability to be co-opted for profit motives and social replication purposes, the lack of practical research on a critical theory of technology is a careless disregard of technology's import, as Feenberg (2010, 2017) has said. People do not want to live without the advances in biomedical technology and other

developments, making it is necessary to contribute to existing theory to gain a better understanding of how to democratize technology.

As practical research, this study contributes to previous research regarding Feenberg's (2002, 2010) critical theory of technology. The findings and conclusions provide empirical support to Feenberg's theory, demonstrating that 1:1 technological uses in educational settings can democratize technology's purpose with the associated pedagogical choices. Feenberg (2010, 2017) has explored the democratizing potential of the Internet and of blended learning, but has not explored his theory in the contemporary phenomenon of 1:1 technology integration in educational settings. This study suggests that within an educational setting of a predominantly economically disadvantaged population, 1:1 technology in teacher-adopter situations encourages pedagogical shifts with changes of power dynamics in the classroom. These shifts create a more democratized learning environment in which students can practice and acquire skills in discourse and participation in the dominant society. Additionally, the study has shown that the acquisition of such skills strengthens the identity and self-efficacy of student technology users in the 1:1 setting, providing many opportunities for personal inquiry and autonomous learning. These findings are consistent with the Margins of Maneuver in Feenberg's work at a very practical level. Further, the findings suggest that the application of Margins of Maneuver to 1:1 technology within an economically disadvantaged environment create a contestable space, thereby requiring sustained, conscious intentionality in purpose for the technology to foster student agency and democratic participation. While Feenberg stresses user intention, this finding is a new contribution, revealing the importance of an intentional critical stance to realize the democratization potential of Margins of Maneuver.

This contribution to critical theory of technology within educational settings relies on applying Freire's (1970/2000) critical pedagogy principal of *conscientização*, consisting of mindful awareness of one's history and systemic conditions. The nexus of the two theories did not exist in other studies or dissertations consulted in the literature review, and it is significant for realizing the full potential of Margins of Maneuver by applying critical pedagogical practices to the pedagogies of 1:1 integration. By using this nexus as the theoretical framework, this study contemporizes critical pedagogy to the growing new literacies required in using 1:1 devices in liberating ways: critically using and sourcing information, using information to problem-pose as well as to advocate and plan action, developing the subject-specific discourse to join the conversation of privileged spaces and to interrogate social injustice. In developing mature democratizing efficacy, 1:1 technological uses and associated pedagogical practices benefit from the intentionality of critical pedagogy's critical stance in taking action within Margins of Maneuver. A final contribution of this study to critical theory is to provide a conceptual and operational road map specific to implementing 1:1 technology that applies principles of critical theory of technology and critical pedagogy to effect democratizing rather than further marginalizing uses of technology within an educational setting.

Practice Implications: Recommendations

The study's findings reveal possibilities for changes in practice at the district, school, and teacher levels, to advance the transformative potential of 1:1 technology in an educational setting.

District recommendations. There are six main district recommendations, based on the case study findings and thematic analysis:

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1. Use clear policy language with commitment to social justice and equity;

2. Increase the frequency of Technology Plan monitoring, especially in areas related to professional development (PD) offerings and formalized peer support systems;

3. Develop a three-year PD plan that matches the stated teacher need for PD in the intersection of technology, pedagogy, and content area;

4. Investigate and budget for job-embedded PD to close the gap of voluntary PD;

5. Develop school leader evaluations that include a domain for distributed leadership; and

6. Develop teacher evaluations that include domains for student-centered and personalized learning practices.

District policies would benefit from clear rhetoric that articulates social justice within its vision and philosophy statements. Mixed ideological messages dilute the potential for policies to be authentically transformative. Even if the mixed message is unintended, its existence mitigates the potential for change as constituencies aligning with one or more messages can find justification for their action or inaction. Clarity of message would create intention and frame policy.

Districts should monitor fidelity to the Technology Plan with sufficient frequency to create accountability awareness at the school level as well as evaluating alignment of its budgetary, infrastructure, and professional development decisions with its vision and plan. For example, despite the San Vincente District Technology Plan having a plank related to frequent peer supports and peer classroom observations, teachers reported low levels of that activity. Additionally, a majority of teachers surveyed in the development of the plan indicated reasonable knowledge of technology but little knowledge in how to incorporate 1:1 technology

into the everyday experiences of learning. Yet, a look at the San Vincente district professional

development (PD) offerings demonstrated that the PD schedule is heavily oriented toward

technology procedural knowledge and pedagogical approaches rather than on PD at the

intersection of both technology and pedagogy. To minimalize this misalignment evidenced in the

subject study, districts would benefit from frequent monitoring of a Technology Plan

implementation.

As allowable within legal constraints, the researcher recommends that district PD funds

should allocate a generous percentage to school control, making it available to the school leader

to personalize PD to teacher needs as aligned with teacher personal goals and fidelity to plan. In

this way, the district could match the methodical three-year sequence in the Technology Plan

with a PD three-year plan that addresses how to use 1:1 technology to foster student

centeredness, to personalize learning, to release control to students with greater student voice

and agency, and to develop subject-specific discourse especially as it pertains to English

Language Learners. Since many collective bargaining agreements characterizes PD as voluntary,

the researcher recommends incentives tied to the desired PD sequence as well as consideration of

new models of PD that teachers find enticing, such as using formats tied to culture—"breakout"

escape room simulations—for example.

Leader and teacher evaluation procedures, insofar as possible within collective

bargaining agreements, should consider connecting personalized, job-embedded PD to teacher

and leader reflection on goals and the evaluation. Leader evaluations would then include

domains in distributed leadership as well as existing other domains, ensuring that the leader is a

model of democratic participation. Since the study identified the importance of student-centered

and situated personalized learning practices as well as intentionality as critical to democratizing

1:1 technology integration, the district should consider including domains in these categories in

teacher evaluations, again subject to collective bargaining agreements.

 School recommendations. Recommendations for school sites include:

1. Set aside budget and calendar time to support professional learning communities

(PLCs), and/or communities of practice;

2. Set aside budget and calendar time for peer mentoring systems, with peer coaching and

job-embedded PD; and

3. Set aside times for best practices sharing featuring only school faculty.

The literature and findings have demonstrated the power of peer-to-peer collaboration and

mentoring as the most highly effective method of transferring theory and skills into teacher

practice. Since multiple initiatives place a strain on teacher time and planning efficacy, school

leaders should look into common collaboration time, structures and norms—such as PLCs or

communities of practice—to provide accountability for the work of the common time.

 The school leader would begin by investigating change diffusion theory, identifying

teachers whose goals, competencies, and beliefs characterize them as potential candidates to

form a peer coaching/mentoring group. Peer coaches/mentors would not have evaluative

responsibilities so they can build trust with their peers with the judgement factor removed. They

would also not be instructional coaches who are often associated with administrative agendas.

School leaders would be best able judge their own school's readiness for peer

coaching/mentoring and for which type to use, trying out various models in departments before

large-scale deployment.

Another benefit of this recommendation is that a formalized plan of peer mentoring and support would provide job-embedded professional development (PD), potentially filling the current gap between the technology plan and reported levels of PD, created by voluntary professional development. If provided as "just in time" PD, a peer program would not require teachers to allocate their own time but rather they could participate in PD as part of their ongoing teacher day. The literature has advocated for such measures in citing their efficacy as change accelerators with high rates of transfer to classroom practice (Boardman, 2012; Chandrasekhar, 2009; Inan & Lowther, 2010; Jones, 2013; Polly & Hannafin, 2010; Reinhart et al., 2011).

The school community would benefit from a platform for sharing 1:1 best practices, for example, Tech Wednesdays, 15–20 minute presentations at faculty meetings, presenting sessions at school in-services, and EdCamp facilitators. Opportunities for less-structured, more interactive PD that is highly personalized and job-embedded overcomes the lack of ongoing PD due to the voluntary nature resulting from collective bargaining agreements. Additionally, this practice harnesses the gifts of the group, providing easy accessibility between teachers as they try to use the potential of 1:1 technology to empower shifts necessary to democratization: teachers as facilitators, student-centered and situated personalized learning, and strengthening subject-specific discourse, especially with English Language Learners.

Teacher recommendations. Recommendations in this area include:

1. Develop and participate in formalized peer accountability and support structures for brainstorming and job-embedded PD; and

2. Make frequent use of formative and summative data to personalize learning.

Teachers could then take advantage of common time to work together with one or more teachers, to brainstorm ways in which 1:1 technology can best serve the shift to teacher facilitator, to student-centered and situated personalized learning, to learning that is responsive to issues in student and community lives, to methods for discovery and problem posing. Teachers would work with other teachers in observing peers as well as being observed by peers, using the Critical Friends protocol to discuss their observations and responding to peer feedback with lesson revision as appropriate.

Teachers should regularly collect formative data to inform learning paths, using the immediate access of 1:1 devices and technology to collect, manage, and disaggregate the data, reflecting on the impact of 1:1 technology uses and pedagogical practices in fostering student agency and participation. Rubrics that assess creativity, quality of questioning and research, and multiple perspectives should be developed and used, ensuring the intentionality of expectations that are transparent to students.

Policy Implications

Two National Educational Technology Plans have identified the disconnect between stated teacher beliefs in pedagogical practices found to support democratizing 1:1 technology uses and the practical reality emerging from various empirical studies. These same plans have also named the second- and third-level digital divides a critical concern that threatens to exacerbate the gap between the various socioeconomic classes in critical uses of technology, even as technology's influence grows.

As such, state and federal agencies should investigate the establishment of an incentive-based, comprehensive PD plan focused on developing and mastering a set of student-centered

and personalized learning practices within the context of educational technology uses and various content areas. Making this type of budget allocation a priority item directly tied to democratizing design and uses of educational technology applies resources at the heart of technology integration—the intersection of the unity of teacher beliefs and practices that translates into the learning experiences of students.

Because of the critical nature of ensuring narrowing rather than widening of the second- and third-level digital divides, a best practices grant fund should be developed and allocated to support the application of practices that support democratized 1:1 technology uses and practices. Instead of funding empirical studies that demonstrate over a period of 20 years the inability of 1:1 technology to realize its potential to strengthen equity rather than social stratification, this study challenges policy makers to appropriate resources to support research and training directed at transforming 1:1 technology implementations into its democratizing possibilities.

Future Research Possibilities

This exploratory phenomenological case study used qualitative methodology in an eighth-grade setting school site comprised of a majority of economically disadvantaged and English Language Learning students. The researcher proposes that some of its findings are due to the immaturity of the 1:1 technology implementation. Therefore, revisiting the site and replicating the study at later stages would confirm that either the immaturity of the implementation or other factors were responsible for incomplete actualization of a practice, such as incorporating critical stance into its uses and pedagogical approaches. Further, to increase the reliability of the findings, the researcher welcomes and suggests replication of the study in various settings, locations, and grade levels to increase the reliability of findings. Analytical

generalization applied to a wide variety of cases would increase the analytic generalizability of findings. Both of these areas of study would be valuable in advancing the thinking and practice of critical uses and practices of 1:1 technology.

Contributions of Fieldwork to the Case Study School

By having a wide view of the eighth grade at the school, and gaining the trust of participants, the researcher was able to identify certain factors to share with the principal and teachers. When asked if the researcher perception that the shift of teacher to facilitator and to increased student autonomy as enhanced by the 1:1 initiative lacked intentionality, teachers became thoughtful, confirming this was probably the case. The principal was receptive to discussions regarding potential but untried 1:1 uses and practices. As a result, the researcher will potentially be working with several teachers as a pilot to determine whether some of these practices have significant impact on fostering student agency and participation, including the movement from questioning to advocacy and action. Additionally, the researcher has volunteered to do an in-service, translating the findings into suggestions for practice with interactive demonstrations of the suggested technology uses and take-away strategies for the teachers.

Significance of Social Justice Vision to the Educational Leader

With the commitment to social justice, an educational leader has the capacity to craft collaborative and just learning communities. This vision demands an ongoing reflective cycle to examine the intersection of beliefs and practice, to be able to hold the mirror to oneself and one's practices concurrent with identifying inequities that the collaboration of the leader and learning community could address. As the vision holder, the educational leader engages others into the

mission with modeling and attention to infusing justice into the lived experiences of the members of the learning community.

Self-reflection can sometimes be challenging to long-standing beliefs or concepts. In doing this research, for example, conversations with the principal and his rejection of the label of "low socioeconomic status" caused the researcher to examine the use of that term and other possibilities in this study. By changing to "economically disadvantaged," the study more closely represented the reality without bias of dominant society values. The examination resulted in the researcher asking whose judgment determined that students or families of low income had "low" status. The realization that the label reflected values of the dominant narrative was a surprising one, and caused the researcher to rethink her rhetoric. This openness to revisiting one's ideologies and epistemologies is critical to an authentic social justice stance.

The socially just educational leader values and respects the dignity of all persons in the learning community, encountering persons in their situated position and inviting all of them—teachers, staff, students, other leaders, parents—into the conversation of how education can best serve the needs of justice. This might mean challenging others and systems, but always with a consideration of various sensibilities. The intentionality of the social justice vision permeates leadership activity, whether at the personal level or at the systemic level. This permeation brings the vision into practice, as in the subject of this study: to bring light to the potential of 1:1 technology uses and pedagogical practices to open Margins of Maneuver, democratizing technology with increased student agency and democratic participation.

Conclusion

Technology initiatives are proliferating in education, particularly 1:1 technology initiatives. Critical theory and empirical studies, as well as the National Education Technology Plan, have identified the critical nature of the second- and third-level digital divides as well as the possibly hegemonic, socially replicating tendency of technology. These divides accompany the widening gap between the poor and all others in society, creating an urgent imperative to investigate the types of 1:1 technology uses and practices that foster Margins of Maneuver in which students and teachers assert their agency to democratize technology within learning.

Within the context of a public school eighth grade classified as economically disadvantaged in its second full year of a technology initiative, certain uses and practices do have potential to democratize 1:1 technology:

1. Shifting the role of teacher to facilitator, which reshapes the teacher-student relationship;

2. More cognitively demanding higher order uses of technology with student-centered processes and a critical stance towards information;

3. Personalized learning situated within student and community issues to strengthen student voice, autonomy, and self-identity;

4. Developing subject-specific discourse with critical academic literacy; and

5. Strengthening and fostering purposeful awareness of economic disadvantages and its potential marginalizing factors, and the accompanying micro-resistances.

Given the relatively long history of the digital divide and its potential to increase social stratification, this study's findings present possibilities for closing the second and third digital

divides and realizing the full potential of each student with critical uses and practices related to

1:1 technology.

Appendix A
Semistructured Interview Questions, First Interview, Principal

A. Background

    1. How long have you been a principal? At Granada Middle School? How long were you a teacher before being either an assistant principal or principal?

    2. Describe how you see your role as educational leader, especially in connection with 1:1 technology here at the school?

    a. How do you think it's going? How do you know?

    b. Tell me about a particular experience that comes to mind.

    3. What does "social justice," in the context of 1:1, mean to you in terms of teaching and learning?

B. The 1:1 Experience to Date

    1. Tell me if or how teaching and learning have changed here as a result of 1:1, and other technology?

    2. Describe some ways in which students might use 1:1 and tech to explore their personal concerns? To address issues in their community?

    3. In what ways has 1:1 helped students explore their identities and voice?

    4. How are teachers, students, and families supported in connection with 1:1 and tech, if at all?

    5. Is there anything more you would like to tell me about 1:1 and tech at the school?

Appendix B
Semistructured Interview Questions, First Interview, Teachers

A. Background / Context

    1. How long have you been a teacher? At Granada Middle School?

    2. Describe how you see your role as a teacher? As a teacher in a 1:1 environment?

    a. How do you think it's going? How do you know?

    b. Tell me about a particular experience that comes to mind.

    3. What does "social justice," in the context of 1:1, mean to you in terms of teaching and

       learning?

B. The 1:1 Experience to Date

    1. Tell me if or how teaching and learning have changed here as a result of 1:1, and other

    technology? Can you describe some experiences?

    2. Describe some ways in which students might use 1:1 and tech to explore their personal

    concerns? To address issues in their community?

    3. In what ways has 1:1 helped students explore their identities and voice?

    4. How are teachers, students, and families supported in connection with 1:1 and tech, if at all?

    5. Is there anything more you would like to tell me about 1:1 and tech at the school?

Appendix C
Semistructured Interview Questions, First Interview, Students

1. Have your learning experiences changed since 1:1? How?

2. How have your experiences with 1:1 made you feel as if learning were fairer or had more meaning?

3. How do you think your teachers and principals feel about 1:1 computing?

4. In what ways has 1:1 helped you learn about or take action on things that are important to you?

5. Tell me about some time when you used it to speak out or take action.

6. How have you been supported by the teacher or school to make the most of your 1:1 computer?

Appendix D
Example of Follow-Up Interview, Questions from Ongoing Analysis (Principal)

1. "I think the equity among all students is important…finding those innovative ways to make sure they are exposed to the same curriculum as everyone else." How else is this goal of equity being met within the teaching and learning activities here at the school?

    --Tell me about an activity or learning experience that exemplifies that.

2. "Curiosity sparks and they start learning." Tell me if there have been experiences where students expressed curiosity about situations or concerns that directly affected their lives?

3. One of the hallmarks of student agency and participation is that they learn the specific subjects they might have been excluded from in the past. I've seen some examples of that here--can you talk about what that looks like in terms of a 1:1 learning?

4. Individualized and personalized learning--tell me about how you think it might evolve at the school.

5. There's a phrase you've used frequently, in all of our conversations, and that's "college and career ready and beyond." Tell me more about that.

6. At our first meeting, you mentioned that "social media and technology gives them (the students) a pathway for finding themselves." Tell me more about what you meant by that.

7. If everything was in play with 1:1, describe for me the ways kids would be discovering themselves, their concerns, their place in the community and the globe through implementing tech in their learning?

Appendix E
Summary of Observation, Coding, and Analysis Process

First Classroom Observation: Exploratory and Descriptive

| Field notes: actions, words, activities, and technology uses of teacher and students | Field notes are open-coded in the OneNote research notebook |

Prepare Analytical Memos of First Observation

| Organize field notes by codes; look for patterns; commentary in OneNote | Prepare analytical memo for each pattern, identify areas needing deeper inquiry |

Second Classroom Observation: Focused on Inquiry Areas, Selective Probing

| Filed notes: actions, words, activities, and technology uses, particularly as related to inquiry areas identified in memos | Field notes are axial-coded in the OneNote research notebook, to uncover relationships between patterns and identity outliers |

Prepare Analytical Memos of Second Observations

| Organize field notes; look for relationships between patterns; commentary in OneNote | Prepare analytical memos for identified relationships; consult literature; negative or outlier cases consider |

Weed through coding, narrow for themes and evaluation, consult literature to support analysis

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