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Los Angeles

Infrastructuring for Participatory Design:

Supporting Student Agency in School Technology Use

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of

Philosophy in Education

by

Ung-Sang Albert Lee

2019

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ABSTRACT OF THE DISSERTATION

Infrastructuring for Participatory Design:
Supporting Student Agency in School Technology Use

by

Ung-Sang Albert Lee

Doctor of Philosophy in Education

University of California, Los Angeles, 2019

Professor Kimberly Gomez, Chair

This dissertation examines how infrastructures for more agentic participation of students in the design and implementation of school technology practices were developed in a participatory design-based research-practice partnership (Bang & Vossoughi, 2016) between a university and high school students a university-affiliated community school. The four-year partnership, primarily between a group of high school students and I as the university researcher that aimed to position students as key stakeholders in the school's design of technology practices led to a number of design outcomes, which included a site-specific school e-portfolio system (Lorenzo & Ittelson, 2005). This study, as a design ethnography (Barab et al., 2004) focuses on the relationships between the school e-portfolio system as a design outcome, the processes of

building participatory design infrastructures (Le Dantec & DiSalvo, 2013) with high school students, and the characteristics of student participation and development in the context of the collaborative design processes. Results will show the ways in which existing school culture and practices provided a fertile ground for the participating students and I to co-construct a collaborative design infrastructure that was continuously refined and re-organized to address newly visible, context-specific needs in the design domain as well as the design processes. Students participating in these processes were increasingly positioned and viewed themselves as authoritative and agentic participants in the collaboration. In this context, a constellation of assets they brought to bear to the design processes and embodied in the design outcomes informed their engagement with the design processes, their critique and conceptualization of school technology practices, and further development of individual and organizational equity. While this study focuses on the processes of developing school technology practices and will have much to offer in this domain, especially for those looking to critically examine equity in the design of school technology practices, the findings speak to broader implications on how to construct context-specific processes that view students and local stakeholders from an asset perspective and conceptualize, design and implement educational practices based on local theories of equity.

The dissertation of Ung-Sang Albert Lee is approved.

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Though I will never be able to repay the debt that I owe you, I will always honor your mentorship in thought, strength, voice, and love.

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Fall 2008 – Winter 2008

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Programming as a Context for Making Problem Solving Visible: An Equity Focused K-5 Research-Practice Partnership

UCLA Graduate School of Education & Information Studies

Co-Investigator, January 2018 – Present

Project Lead: Dr. Kimberly Gomez

Project Supported by: National Science Foundation

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UCLA Center for Community Schooling

UCLA Graduate School of Education & Information Studies

Graduate Student Researcher, January 2018 – Present

Project Leads: Dr. Karen Hunter-Quartz

Assisted the development of research and program agendas as one of founding graduate students of the research center dedicated to developing and improving equity-focused research-practice partnerships through community school models. Facilitated community-building exercises for academic and practitioner audiences, and mentored new graduate students in developing authentic research-practice partnerships.

Building a Local Community School Data and Learning Infrastructure for Community Schooling

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Project Supported by: W.M. Keck Foundation

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Technology in Learning and Teaching (TiLT): Supporting School Organizational Learning for Technology Integration

UCLA Graduate School of Education & Information Studies

Graduate Student Researcher, April 2016 – December 2018

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Utilized participatory design methods to facilitate organizational learning on technology integration and curriculum design in the context of a research-practice partnership with two university-partnership schools. Collaborated with students, teachers, parents, and school administrators to

design school technology practices aimed at equity outcomes. Coached locally designed curriculum implementation in classroom. Collected qualitative data to inform research and design.

Utilizing Student Expertise to Support School Technology Infusion

UCLA Graduate School of Education & Information Studies

Graduate Student Researcher, September 2014 – September 2017

Project Leads: Dr. Kimberley Gomez and Ung-Sang Lee

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Project funded by the Spencer Foundation

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PUBLICATIONS

Refereed Journal Articles/Book Chapters

Lee, U.S.* (2018) Infrastructuring for Participatory Design of School Technology Practices: How Students Refined Design Practices. Proceedings from the International Conference of the Learning Sciences. London, UK.

Lee, U.S.* & Gomez, K. (2017) Participatory Design with Students for Technology Integration: Shifting Power and Facilitating Learning in an Urban School. Proceedings from the International Conference of Computer Supported Collaborative Learning. Philadelphia, PA.

Gomez, K., & **Lee, U. S.*** (2015). Situated cognition and learning environments: Implications for teachers on-and offline in the new digital media age. *Interactive Learning Environments*, 23(5), 634-652.

Chapter 1: Introduction

Chapter 1 Overview: How Do We Build Design Infrastructures for Student Agency?

This dissertation examines how infrastructures for more agentic participation of students in the design and implementation of school technology practices were developed in a participatory design-based research-practice partnership (Bang & Vossoughi, 2016) between a university and high school students at a university-affiliated community school. The four-year partnership, primarily between a group of high school students and I as the university researcher that aimed to position students as key stakeholders in the school's design of technology practices led to a number of design outcomes, which included a site-specific school e-portfolio system (Lorenzo & Ittelson, 2005). This study, as a design ethnography (Barab et al., 2004) focuses on the relationships between the school e-portfolio system as a design outcome, the processes of building participatory design infrastructures (Le Dantec & DiSalvo, 2013) with high school students, and the characteristics of student participation and development in the context of the collaborative design processes. Results will show the ways in which existing school culture and practices provided a fertile ground for the participating students and I to co-construct a collaborative design infrastructure that was continuously refined and re-organized to address newly visible, context-specific needs in the design domain as well as the design processes. Students participating in these processes were increasingly positioned and viewed themselves as authoritative and agentic participants in the collaboration. In this context, a constellation of assets they brought to bear to the design processes and embodied in the design outcomes

informed their engagement with the design processes, their critique and conceptualization of school technology practices, and further development of individual and organizational equity. While this study focuses on the processes of developing school technology practices and will have much to offer in this domain, especially for those looking to critically examine equity in the design of school technology practices, the findings speak to broader implications on how to construct context-specific processes that view students and local stakeholders from an asset perspective and conceptualize, design and implement educational practices based on local theories of equity.

This chapter will first present three vignettes that illustrate the extent to which the design and implementation of technology practices at schools are a social process, and how this makes school technology use a particularly complex issue of equity. I will then summarize broader imperatives to localize and democratize educational design and implementation processes in schools, including participatory design (Bang & Vossoughi, 2016), and how these approaches offer useful insights into what types of processes might facilitate the equitable use of technology in schools. This will be followed by a discussion of the role of traditionally marginalized students in these broader imperatives, and argue that this had not been examined enough. In particular, greater insights are needed into how participatory design processes may be developed so that traditionally marginalized students are empowered in the design and implementation process so their assets are privileged, and the design outcomes embody the assets of these students. While there are an abundance of voices calling for marginalized voices and epistemologies to be meaningfully present in the design and implementation of school practices, the field has had lesser insights into how design infrastructures can be constructed in ways that pragmatically respond to global and local issues of equity, school community and organizational

contexts, student assets, and instructional imperatives. Even less has been done to examine how this may be done with students to address school technology practices. Therefore, the rest of the chapter will articulate this study's approach to examining how infrastructures to support the participation of students in developing local participatory design processes may be developed.

Problem Background

Three Cities

Hong Kong

When I was a 15-year-old high schooler in Hong Kong, I decided to form a punk rock band. It was around 2002, and I had been introduced to Napster by my father, which led me to spend hours a day following the musical genealogy of my favorite artists and downloading every album I could get my digital hands on (I hope the statute of limitation has expired). Having had access to a personal computer since a relatively young age and a father who would periodically introduce me to new gadgets, it was not difficult to figure out how to search for punk rock's latest and classics, and download for free to build a personally curated library. I would then search the corresponding sheet music online, and replicate the songs as best as I could with my guitar. My parents had purchased a guitar for me a few years earlier after I was instantly enamored after a music class. Eventually growing bored of playing by myself, and inspired by the various live performance videos of my favorite bands I had also downloaded, I reached out to some friends from school to see if they were interested in joining my quest for stardom.

In a well-resourced private school in Hong Kong, it was not difficult to get the endeavor off the ground. The school had guitar amps, drum sets, and audio systems in abundance, and we went to work during our lunch breaks and after school to find our sound. Once we grew in

confidence and after a few performances in school, we recruited a friend who we knew had continued to take advanced music classes, and asked him to help us record some of our songs because he had knowledge and tools for digital recording that we did not have. We then uploaded the recordings on music-based social networking sites, scoured performance opportunities on online discussion boards for local musicians, and advertised our shows to our peers by creating posters and sharing them on the band's own blog. While my dream of becoming a punk rock star never quite materialized, the skills I developed from those days continue to serve me today. I learned to develop social networks on and offline to pursue a particular goal, and to extract, synthesize, and produce digital media such as music, visuals, and blogs to serve my goals.

Detroit

Ten years later in 2012, I was a teacher in a 5th grade classroom in Detroit, Michigan, starting my new position at a school that had just experienced a management overhaul after being taken over by a state charter district conceptualized by a Republican-controlled state government due to low performance in standardized test scores. While the school had been part of the local public school district and a cornerstone of the community of working class White families and recent immigrants from Central and South America, with teachers who had worked there for decades, none of the old teachers remained after the State takeover. Most of the teachers who now worked there were first-year teachers recruited by a national non-profit, who had no student-teaching experience or traditional credentialing. I was in my third year of teaching, and though I knew I would no longer be supported by my union, I had applied for a job at the school with the promise of higher pay, teacher autonomy, and abundant digital resources. The district was rolling out a 1-

to-1 laptop program, and I was curious to see how I might be able to leverage such technologies for equity in education informed by theories of critical pedagogy.

Towards the end of the previous school year, I had been introduced to Pedagogy of the Oppressed by Paulo Freire and was beginning to shift my foundational beliefs and identity as an educational practitioner. Most of my training prior to that had come from a national non-profit's alternate credentialing program, which from the beginning struck me as ineffective due to the fact that they never addressed issues of culture or power. But I had no training in alternate theories, frameworks, or practices to draw from, and was struggling to implement the type of practices that I could feel proud of as a teacher. Around the same time, by chance, I had attended a presentation at the Allied Media Conference by Detroit Future Schools, a nonprofit that sought to introduce Freirean critical pedagogy into classrooms through professional development that paired digital media artists with teachers to co-design a critical digital media literacy curriculum. I immediately applied to be a participating teacher for the upcoming school year, and over the summer, began planning to operationalize critical pedagogy with a community of teachers and artists that thought deeply, and discussed passionately about the kind of practices that may be more empowering to students. By the beginning of the school year, armed with a literacy curriculum that reflected both Common Core State Standards and theories of critical media literacy, I felt for the first time that I was prepared to teach in a way that could concretely transform the lives of my students, and marched into my new school ready to make use of my new learning.

I soon found out the 1-to-1 laptop program and transition to a "blended curriculum" that the school district had championed in recruiting materials, was poorly planned. The administrators had dumped all of the physical books it possessed under previous management,

only to find out that the combined online curriculum and learning management system the district had purchased was not in a usable state. These issues were compounded by the fact that the school lacked clear procedures and practices even for basic routines like assigning students classes, and led to a generally chaotic school environment. The loss of curriculum did not affect me as heavily, as I had already planned a literacy curriculum and related practices that I could apply to other subject matters. We were having debates about systemic racism, analyzing quantitative data on poverty, and blogging our critiques of the latest movies. Unfortunately, when the online curriculum did arrive, instead of acting as an additional resource to inform my pedagogy, the curriculum itself and the school practices that followed clashed heavily with my vision as a teacher to detrimental outcomes. The product provided students with an undifferentiated trajectory of activities and tests that moved linearly through the State standards of each subject area. Students were expected to learn content from the tutorials provided online and pass their tests independently, while the teacher was positioned as a “facilitator” that simply monitored student progress. Teachers were expected to follow this model at all times, and teacher performance was measured by the extent to which students progressed through the tutorials and tests. Students who did not engage with this single-track curriculum were labeled as “low achieving”. While these tools could very well have complemented my existing curriculum and open up new possibilities for equity, it felt unethical to rely solely on such tools given their significant limitations. Teachers who objected to these methods and continued to exercise agency in curriculum design were heavily reprimanded, and no longer feeling like I would be able to operate ethically as a teacher any longer, I left the profession at the end of the school year.

Los Angeles

In 2013, Los Angeles Unified School District's (LAUSD) was in the midst of a well-publicized struggle in rolling out its 1-to-1 iPad program. An evaluation of the iPad rollout found that most schools that received the hardware along with instructional software did not have the adequate infrastructure, organization, and training to shift teaching practices through the newly acquired tools (Margolin et al., 2014). This was particularly unfortunate, considering the many affordances of educational technologies such as the iPads and related software, which allow students and teachers to interact across physical learning ecologies, pursue self-driven learning, and experience learning in multimodal texts (e.g. Peppler & Kafai, 2007; Barron, Gomez, Pinkard & Martin, 2014). More concerning was the fact that in spite of evident systemic constraints to shifting school technology practices, the discourse surrounding these challenges often placed the blame on LAUSD students, majority of whom come from traditionally marginalized backgrounds, as deviant “hackers” that were unprepared to utilize these tools (Blume, 2013).

Technology Integration as a Sociocultural Process

The illustrations above touch on several critical factors that inform this dissertation study. First, I they highlight the complex social ecologies in which digital technologies are introduced to, and the way these complex ecologies mediate the process in which schools adopt technologies (Selwyn, 2010). Emerging technologies always enter contexts which are constructed through sociocultural factors such as structural inequity and policy, interactions in school and out of school, and the experience and epistemologies of stakeholders, such as their individual identities, affective preferences, and knowledge (e.g. Kaptelinin & Nardi, 2012). They also point to the potential affordances of leveraging emerging technologies to develop pedagogical practices that

can inform educational equity goals. They allow new modes of educational designs, interactions, and modes of participation that would not be accessible otherwise (e.g. Ito et al., 2013). Yet, as one might expect, as digital technologies enter educational contexts saturated with issues of equity, it appears at times, introducing digital technologies into educational settings reproduce or even worsen existing inequities in education. For example students who attend schools that serve traditionally marginalized communities have been found to have lesser access to pedagogies that leverage technologies for collaboration, production and design, and inquiry (Warschauer & Matuchniak, 2010), potentially excluding them from opportunities to obtain economic, social, and political capital (Ito et al., 2013; Jenkins, 2009). This is only one, broad way in which broader patterns of inequity in education manifest themselves in the role of digital technologies in education. Other concerns for equity may center around issues of privacy and data use, representation and identity, and media literacy, among others (Garcia & Philip, 2018). Furthermore, the narratives from Detroit and Los Angeles hint at the ways in which, students of color are always at risk of being viewed through a deficit lens (Solorzano & Yosso, 2001) that prevents them for accessing equitable technology practices in schools.

Viewing technology use through the lens of sociocultural processes encourage us to consider how digital technologies and their use may mirror broader sociocultural practices and ideologies, how the introduction of digital technologies in specific contexts may impact the sociocultural fabric of the context, and how communities can design technology practices to impact larger sociological issues of equity. In this view, the interaction between technology and communities are mediated processes in which multiple levels of human activity, such as ideology, identity, systems and organizations inform each other simultaneously to mediate people's interactions with technology. The extension of this view is that our agency as

technology users is rooted in our ability to design the way technologies mediate our activity. In other words, while sociocultural contexts influence the way we interact with technology, we can (and do) also design the way we interact with technologies to influence our sociocultural contexts. In this way, micro-level interactions at the individual, classroom, and school levels can profoundly affect our interactions with broader contexts and necessitates a careful examination of the relationship between locally situated interactions with technology and broader systemic contexts.

The Multiple Frontiers of Equity in School Technology Practices

Then, how emerging digital technologies intersect with issues of equity in education become a matter of great concern, especially for schools. Given the complexity of issues of equity in education, it is somewhat expected that the proliferation of digital technologies in school settings can generate tensions across educational ideologies, organizational practices, and pedagogy that need to be addressed to leverage their affordances for equity (e.g. Philip & Garcia, 2013).

North's (2006) review of the theoretical tensions across notions of "social justice" in education provides a possible window into how multi-layered these tensions are. North identified tensions in social justice goals that exist along three related categories: redistribution and/or recognition (tensions between emphasizing the ability of marginalized communities to access capital versus building practices that recognize the capital that marginalized communities possess, but are unrecognized from centers of power), sameness and/or difference (tensions between emphasizing the sameness and differences within and across communities and its implications for social justice), and micro and/or macro processes (how macro, sociological processes for social justice are linked to micro-level interactions).

These tensions are present in the broader literature of digital technologies in education and underlie the challenges in using digital technologies for equitable outcomes in schools, some of which are visible in the reflections on the three narratives above, and which will be discussed in more detail in Chapter 2. While these useful frameworks around equity in education and technology use can guide the work of designing school technology practices, it is no surprise that schools have struggled to develop organizational practices that fully grasp and address the many dimensions of equity as it relates to technology use. Given unique political, community, and organizational contexts that each school operates in (Livingstone & Sefton-Green, 2016; Selwyn, 2010), finding ways to critically examine and design for digital technologies to inform and productively negotiate these tensions for social justice at the local level are of paramount importance. Therefore, rather than prescribe a particular approach to equity in school technology use, the goal of this study was to develop insights into how educators and schools may navigate and operationalize practices through, and with, these tensions. To do so, the quality of participation by local stakeholders, and in particular students, in the design of school technology practices was targeted for intervention and inquiry in this study.

Participatory Design for Technology Practices that Reflect Local Assets and Theories of Equity

Core Problem: Traditional Power Dynamics in Schools and Student Assets

Responding to the need to build processes that helps operationalize local technology practices geared for equity, this study viewed traditional school power relations, and the lack of student agency within them, as the core problem that needed to be addressed. In particular, school practices that exclude local stakeholders, especially students, from having meaningful roles in

the design of their educational practices was viewed as the primary impediment to developing equitable technology practices that are aligned with the assets and needs of local school contexts. Like many others (e.g. Bryk & Gomez, 2008; Gutiérrez & Jurow, 2016), this view was built on the core assumption that the field must move on from the notion that the design of educational practices should derive from expert researchers or developers, while educational practitioners, including school administrators, teachers, and students, should be consumers of such innovations. While access to high quality educational practices with technology is important, the needs and assets of local stakeholders must be accounted for in order to design school technology practices that are locally, and more broadly equitable. As Ladson-Billings (2006) argues that purely access-based school practices are unlikely to fundamentally transform the deep roots of inequities in education, as historical, educational debts that are owed to marginalized students that resulted from their continued exclusion from productive educational domains kept marginalized students subservient to their more privileged peers. If educational practices represent the ideologies of those who create them (Apple, 2004), then technology practices will never fully serve the ideologies of local stakeholders if they do not meaningfully participate in the design process.

One of the sociological phenomena that underlie this exclusion are deficit discourses on traditionally marginalized students and their communities (Solorzano & Yosso, 2001). Deficit discourses on students and their communities are a collection of negative stereotypes that serve to assign blame of systemic inequities on individuals and communities most harmed by such inequities. These discourses are reinforced both through broad social discourses such as those perpetuated by the media that, for example, often portray marginalized communities through the lens of “blight”, as well as at the organizational and interactional levels, such as those practiced

by schools through draconian disciplinary actions or tracking based on test scores that assign students with semi-permanent labels of intellectual ability. These deficit-based practices harm students directly through psychological processes (e.g. Steele & Aronson, 1995) as well as by mediating the development of organizational cultures and practices that reinforce the exclusion of marginalized students and families from the construction of their own educational environments and practices (Delpit, 2006). While it is usually not the intent of educational researchers to reinforce these deficit-based views of marginalized students and their communities, given the level of influence that universities hold in the field of education, a failure to critically examine the underlying ideologies of research, especially those that offer normative solutions to problems of equity, may be aiding these deficit perspectives nonetheless (Philip et al., 2018). At their core, deficit-based views of students combined with traditional power structures serve to deprive students of agency within educational practices, as they serve to exclude students from meaningful participation in educational design.

Beyond the immediate ethical problems such deficit-based discourses pose, literature that view marginalized students and their communities from an asset-based perspective (e.g. González et al., 2006; Rios-Aguilar et al., 2011; Yosso, 2005) have helped the field see the pragmatic opportunities that may be lost when these assets are not meaningfully considered in the formation of educational practices, and expand opportunities to nurture student agency. The earlier illustration from Hong Kong, Detroit, and Los Angeles had sought to highlight some of the assets and experiences that students bring to bear in any school environment, and the way these assets may develop and be utilized across schooling ecologies. In many ways, taking asset-based perspectives on marginalized students and their communities lead to diametrically opposite outcomes than those of deficit perspectives. While there are questions about the extent

to which these outcomes truly challenge entrenched, macro-level inequities (Rios-Aguilar et al., 2011), asset-based perspectives on marginalized students have been used to, among others, connect academic content to students' lived experiences (e.g. Barton & Tan, 2010; Lee, 2005; Moll et al., 1992), develop hybrid practices (e.g. Gutiérrez et al., 1999), develop students' civic orientations and skills (e.g. Kirshner, 2008; Ozer et al., 2010) and develop educational technology practices and tools that reflect students' epistemologies (e.g. Druin, 2002; Mirra et al., 2018; Schwartz, 2015). In addition, some of what are considered "best practices" of technology use, such as "connected learning" practices (Ito et al., 2013), are founded on objective to connect student assets to broader sources of social, economic, and political capital. Such pedagogies simply cannot be developed without aligning the practices with existing student assets. While the success of these asset-based approaches to educational design have been well-documented, they remain elusive within typical schooling contexts. One natural outcome of viewing students from an asset-perspective is to create opportunities for students to participate in the formation of their educational experiences. Furthermore, if educational design processes that pay attention to student assets are to be made more available, the question that ought to be raised is: How do we develop processes that allow such design processes to flourish and sustain themselves in school settings? As demonstrated above, plenty of literature demonstrates the proof of concept around integrating students' assets into the design of school practices broadly, and technology practices specifically. However, where the literature needs more depth is how such processes can be built in schools.

Supporting Local Student Agency Through Participatory Design

A Design and Research Method Committed to Equity, Collaboration, and Pragmatism

At the core of participatory design as a research and design methodology is the commitments to agency, collaboration, and pragmatism that were particularly useful in conceptualizing solutions to the design challenge of developing equitable local technology practices (Bang & Vossoughi, 2018; Le Dantec & Disalvo, 2013; Spinuzzi, 2005). While a number of research approaches, none of which are mutually exclusive, position students and broader stakeholders as legitimate partners in education through asset-based perspectives, such as community-schooling models (Benson et al., 2009), research-practice partnerships (Coburn & Penuel, 2016), and youth participatory action research (Mirra et al., 2015), this study uses participatory design as an organizing framework due to its focus on the ongoing iteration of design practices to support stakeholder agency, and commitments to local innovation. This section will discuss participatory design as a design methodology, and primarily discuss why participatory design was thought of as a suitable approach to address the design of school technology practices.

The most important facet of participatory design for this study was that most strands of participatory design have philosophical roots in what can best be described as Deweyan participatory democracy (Bang & Vossoughi, 2016; Dewey, 1954 [1927], Le Dantec & DiSalvo, 2013). This core goal of participatory design orients such endeavors towards stakeholder agency, collaboration, and pragmatism. While not mutually exclusive from representative democracy, participatory democracy emphasizes “on the ground” democracy where stakeholders of pertinent community problems collaboratively address local problems. In other words, participatory design is a process of exerting agency to one’s lived worlds in partnership with others. Le Dantec & Disalvo (2013) explain the history of participatory design of facilitating negotiations and workplace improvement between labor unions and corporations in Scandinavia during an influx of digital technologies in the work environment as the formation of “publics”, social

infrastructures where Deweyan democracy is practiced to solve workplace and community problems through the equitable participation of stakeholders. This view of participatory design was important for this study because of the stated goal to democratize the process of technology integration in schools, and the implicit assumption that all stakeholders of design have tacit knowledge and assets to contribute to the design process. Furthermore, participatory design holds an inherently interventionist stance that seeks solutions to local problems of practice aligned to the local context. This characteristic of participatory design was important because this research takes as its mission both the democratization of design processes, and making available high-quality technology practices for marginalized students.

Focus on *Infrastructuring*, Student Participation, and Local Technology Practices

While participatory design offers a broad framework for how students may be brought into the process of designing school technology practices that alone does not sufficiently guide how these processes may be built into contexts where students do not currently participate in the design of school technology practices. In other words, if there are no spaces and practices in a school for students to participate in the design of technology practices, such spaces and practices, or what Le Dantec and DiSalvo (2013) call “publics” must be cultivated. Following theories in broader sociotechnical studies that view the adoption of technologies as a process of social and technical infrastructure building (Star, 1999), scholars of participatory design have conceptualized the process of organizing the social activity systems to support participatory design as *infrastructuring* (Bjorginsson, Ehn, & Hillgren, 2012; Le Dantec & DiSalvo, 2013). Much like the design targets themselves, participatory design infrastructures are built through the collective refinement of design activity to remove barriers for the participation of stakeholders and support the design and implementation of the design targets. As such, equity in this instance is

conceptualized as both the attainment of agency by marginalized stakeholders in the design process, as well as the design and implementation of tools that represent the assets and lived experiences of these stakeholders. Therefore, this study will pay particular attention to the infrastructuring process, student participation in the participatory design infrastructures, and the resultant technology design and implementation outcomes.

Research Context: Need for an Organizational Approach to Technology Design

Based on these goals for participatory design processes and equity in school technology practices, I initiated a research-practice partnership (Coburn & Penuel, 2016) with a university-assisted community school (Harkavy & Hartley, 2009) that was informed by theories of participatory design aimed at co-designing technology practices with students. As it will be further discussed in both the methods section and findings sections, as a teacher-led community school focused on social justice, with its own governance structure and degree of agency, as well as regular partnerships with university researchers, the school served as a friendlier environment to experiment with participatory design methods with students. The school's explicit educational vision and many practices clearly demonstrated its orientation towards social justice, asset-based views of the community and students, and ongoing improvement and inquiry. This allowed me to partner with a small class of high schoolers to co-design technology practices while approaching the infrastructuring process of participatory design in a through more open-ended approach that allowed for iterative refinements to the design infrastructure.

On the other hand, in spite of the general organizational culture and practices, there had been very little design work that had explicitly addressed the need to develop pedagogical practices with technology, and none that explicitly sought to include students in the process.

While utilizing technology to inform their social justice missions was a stated goal for many teachers and administrators, there were few recognizable public and explicit efforts within the organization that addressed the integration of technology into teacher pedagogy. While some teachers were finding ways to incorporate digital tools on their own, these efforts were mostly isolated. Many innovations that the school sought to implement through the new investments in technology had only materialized sporadically, with many teachers suggesting that while they had general thoughts about how to use the newly acquired technologies, they had not been able to strategize ways to implement these ideas in ways that fit the school's equity-oriented curricular goals as well as other demands to their work. With a student population of 80% Latino and 14% Asian students, and 55% of students classified as "Limited English Proficient", the lack of opportunities for students to participate in forming their own educational experiences, and the struggles to utilize technology for equity-oriented practices mirrored the broader equity issues around technology use in schools (e.g. Fishman & Pinkard, 2001). As a result, my proposal to initiate a systematic process of participatory design with students to co-design school technology practices, with broad argumentative parallels to what has been described here was accepted by the school's research review board.

Research Foci and Questions

The need to better understand equity in school technology use in the ways it has been viewed in this study, as both a process in which students are positioned from an asset-perspective and participating meaningfully in co-design, as well as the design and use of local technology practices that address local meaningful issue of equity, necessitated research foci that were longitudinal and ecological. Following McKenney and colleagues (2015) who identified analyses

of design processes as technical (“models and frameworks to guide design”), phenomenological (“designers’ reflections on and responses to the environment, and their related experiences”), and realist (“what designers actually do, how they do it and why they do it”), the goal of this study was to offer an integrated view from all three perspectives of one participatory design effort to better understand how equity in student participation and technology practices are built through the infrastructuring process for participatory design. Therefore, the research questions for this study were:

RQ1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?

RQ 2: How did students participate in co-design through the context of these design infrastructures?

RQ3: How did the design infrastructures mediate the design and implementation of the school’s technology practices?

By addressing these research questions, this dissertation makes theoretical contributions to domain theories - theories about the problems spaces the designs are intended to address, design frameworks - generalized solutions to the problem spaces, and design methodologies - generalized design procedures (Edelson, 2002), around the problem space of needing to develop design processes that allow students to express their assets and agency in the design of school technology practices.

In addition to making contributions to theory building, as a participatory design research project, the study had sought to make observable impacts to the practices in the school.

Therefore, based on the conceptual foundation of the study that sought to change the power dynamics in the process of designing school technology practices, the following outcomes were sought for the processes and outcomes of technology practice design, as well as an intervention outcome for the research:

- Students have been positioned in the design process to leverage their lived experiences for the design of school technology practices. These lived experiences are visible in the design process and outcomes of the collaboration.
- Design infrastructures are built on an ongoing basis to support the ongoing co-design and implementation of co-designed school technology practices.
- Technology practices co-designed with students are refined, implemented, and utilized in broader school site community.
- Participatory design processes and outcomes can be traced to local theories of equity.

Theoretical Guideposts

Sociocultural theories on learning stemming from Vygotsky's work (1992), in particular, cultural-historical activity theory (Engeström, 2001) served as the theoretical foundation that informed the study's perspectives on its key concepts and goals, including the analysis of the design infrastructure, definitions of agency (Sannino, 2015), and the views on student assets and the ecologies they were developed in (e.g. Moll et al., 1992).

Present day cultural-historical activity theory views human action through collective units of activity organized around an "object" – in the sense of the word that connotes a collective goal – and the interaction across various activity systems (Engeström, 2001). Each activity system operates under a structure that contains its own participants ("subjects"), rules, tools and signs,

roles (“division of labor”), and objects that organize the activity system leading to particular outcomes. Activity systems develop through the principle of “double bind” where an activity system recognizes incongruences in its own processes and reorganize elements of its collective work towards its objects. Furthermore, diverse activity systems of different sizes and specificity operate and interact in the same space simultaneously, with individuals also participating in multiple activity systems simultaneously. Incongruences may appear across activity systems that overlap as well, which can lead to productive adjustments across both activity systems (e.g. Gutiérrez et al., 1999). In very simplistic terms, this may look like a student-athlete who needs to “code switch” between the activity systems of academics and athletics, which have separate, and at times competing, goals, expectations, and cultures.

Viewed through activity theory, the problems of technology use at the particular school site can be viewed as incongruences between several activity systems. For example, students’ technology use outside of school may be quite expansive in relation to what a student might experience in classrooms. Where a student’s role outside of the classroom might be best described, for example, as a producer of media content, the same student might not have the opportunities to transfer the knowledge and skills developed outside of the classroom into the in-class activity system. Without a role for students to participate in the formation of the in-class activity system, the classroom will not be able to adjust to the knowledge and expertise the student develops outside of it.

Activity theory offers perspectives on the idea of agency as well. According to Sannino and colleagues (2016), agency in activity theory can be seen as, “breaking away from the given frame of action and taking the initiative to transform it.” Agency, then, from an activity theory perspective, points to the students’ ability to conceptualize yet-to-be created technology practices

align with their own educational goals. The participatory design infrastructure, then, can be analyzed as its own activity system with an object of supporting student agency in the design of school technology practices, and the specific designs as an outcome of that student agency-oriented activity system. Therefore, for this research, student participation and agency were viewed through the extent to which students participating in the participatory design activity system participates in expanding the scope of the participatory design activity system, as well as broader school activity systems around technology use.

Chapter 1 Summary

This chapter has sought to make visible the stakes of this research centered on the three research questions of:

RQ1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?

RQ 2: How did students participate in co-design through the context of these design infrastructures?

RQ3: How did the design infrastructures mediate the design and implementation of the school's technology practices?

I viewed these research questions as urgent contributions both to research and practice given the ongoing proliferation of digital technologies both visible and invisible in the school ecology, and the potential for such tools to both support and inhibit opportunities to produce equity for marginalized students. Undoubtedly, much of these outcomes will be contingent on the

interactions across broader political contexts, school organization, the affordances of the tools, and instruction in the classroom among a myriad of other factors. However, this dissertation was built on the argument that developing local theories of equity through collaborative design is a key starting point to designing and implementing practice that can meaningfully impact the local landscape for equity in technology use. Students must be a vital part of this work, as they can both benefit from, and hugely contribute to such collaborative endeavors through their lived experiences.

Chapter 2: Literature Review

Chapter 2 Overview

This chapter summarizes the empirical base for this study, including literature that highlights the opportunities and tensions around equity in relation to technology use in schools, how these tensions and opportunities can be meaningfully addressed at the local level, and what role students can play in the work to do so. This will be followed by an overview of the methodological and analytic frameworks around infrastructure in participatory design and cultural-historical activity theory that helped the conceptualization, implementation, and analyses of this study.

The Intersections of Technology and Equity in Education

Reflecting the Broader Context

In 1996, Nardi (1996) edited a book that collected papers viewing human-computer interaction (HCI) through activity theory, moving away from behavioral, individualist, and psychological perspectives on HCI that dominated the field. This analysis, that HCI is situated within broader social contexts, is useful in understanding the state of technology use in schools today, in particular, the issues of equity that arise from them. Recent research has produced ample evidence that demonstrate the diverse ways in which broader social contexts, and the issues of equity that are attached to them, are reflected in our interactions with technology. For example, Noble (2013) demonstrated the ways in which Google search engine algorithms hypersexualized black girls and women, rendering their diverse lived experiences invisible, and normalizing racist and sexist narratives about them that are common in the mainstream. Viewed from an activity

theory perspective, these outcomes are perhaps unsurprising, given that inequities are embedded in the activity systems that design and use emerging digital technologies.

Equity Concerns for Technology in Education

Then, it is even less surprising that in spite of the increasing availability of digital technologies in schools (Smerdon et al., 2000), the use of digital technology in schools seem to reflect broader issues of equity in education. In schools, the concept of the digital divide has been used to broadly describe the gaps in technological access, use, capacity, and educational opportunities among those from different demographic groups and geographic locations (Warschauer & Matuchniak, 2010). Warschauer and Matuchniak's comprehensive review of the digital divide in the context of American schooling suggests that while in and out of school gaps in access to digital technologies between traditionally marginalized students and their more privileged peers have steadily narrowed, gaps in access to educational experiences that creatively utilize such technologies persist. While Warschauer and Matuchniak focused on access to the types of school pedagogy for their study, similar divides have been observed along other conceptual lines as well. For example, Watkins (2010) argues that the digital practices of Black and Latino students, such as participation in hip-hop culture, are excluded from what is viewed as legitimate uses of technology in learning spaces. Other issues might include ensuring student privacy and safety (Ahn, 2011; Marwick & Boyd, 2014), supporting the development of new literacy practices (Cope & Kalantzis, 2000), and the acquisition of advanced computing expertise (Margolis, 2010).

Mediators of Equity: Knowledge, Pedagogy, and Organization

The research literature is equally diverse in terms of potential solutions that respond to these issues of equity, most with significant merit. These include discussions on pedagogy, teacher knowledge and practice, and broader questions of alignment between students' lived experiences and technology practices. From a pedagogical perspective, many have examined the affordances of digital technologies to facilitate the type of learning that connects students' lived experiences with broader social domains. For example, Ito and colleagues (2013), through research related to "connected learning" practices, have highlighted the affordances of emerging technologies to bridge student epistemologies and goals for participation and agency in broader civic, economic, and educational activities (Ito et al., 2013). Such practices are predicated on boundary-crossing processes in which new forms of educational practices are conceptualized through stakeholder knowledge and needs to make participation in capital-producing activities more accessible (e.g. Schwartz, 2015). A good example of this type of pedagogy is the example of Digital Youth Network in Chicago, where interest-driven spaces for students to participate in music production, robotics, game design, and more were created in libraries, after-school, and in-school spaces for students to develop digital production knowledge (Barron et al., 2014). Others have focused on issues of teacher and school organizational preparedness. Koehler and Mishra (2009) for example, focus on teacher knowledge, specifically, an intersection of their technological, pedagogical, and content knowledge as a mediator of successful use of technology in classrooms, while Fishman and Pinkard (2001) have pointed to the degree of organizational readiness as a key factor that impacts the success of school technology use. Alignment between the school context and the practices developed around learning technologies have been found to be key mediators of successful implementation (Blumfeld et al., 2000). Selwyn (2006) provides a

particularly useful review of the literature that examines the intersection of digital technologies with macro-level politics, schooling as an institution, schools as organizations, and the lived experiences of teachers and students. He advocates for critical research in the field of digital technologies in schools that pay attention to the interactions across ideologies, economic systems, the affordances of emerging technologies, equity, and pedagogy.

Defining Equity

The rich literature on learning and digital technologies makes it clear that rather than identifying theoretical “best practices” to implement in educational settings to produce equity for traditionally marginalized students, local educational stakeholders need to engage in the complex process of negotiating and responding to the multilayered demands and ideologies for equity that are present in local contexts. North’s (2006) review of tensions within conceptions of social justice in education that points to tensions across the ways equity is conceptualized through access and/or recognition, sameness and/or differences, and macro/micro processes, and provides a useful reminder that even within those working towards social justice, there are diverse perspectives on how equity may be obtained. Ladson-Billings (2006) argues that there are historical educational debts that are owed to marginalized students as a result of their continued exclusion from productive educational domains, and therefore, a purely access-based response to technology integration is unlikely to fundamentally transform the deep roots of inequity in education. One expression of such a debt is the power dynamics within schools that exclude marginalized students from shaping their own educational pathways. Nondominant students, in the context of their schools, tend to be excluded from roles that allow them to meaningfully shape the educational practices that serve them (Delpit, 2006). Philip, Bang, and Jackson (2018)

encourage their colleagues to critically examine the “how”, “for what”, “for whom”, and “with whom” of educational research in relation to the historical and spatial context of equity-oriented work. Vossoughi, Hooper, and Escudé (2016) also urge educators to examine how normative “solutions” to educational problems may privilege certain epistemologies while excluding others. Given the shifting landscape of power and equity, and the tendency for technology use in schools to reflect these landscapes, it becomes of paramount importance to identify methodologies and processes of school technology design that can respond to these landscapes of power and equity in ways that respond to specific contexts. These calls for localization and critical examination of equity in local contexts do not endorse participatory processes that simply “make up the numbers”. Rather, recognizing that dominant ideologies that have produced present inequities in education also underlie its educational practices (Apple, 1990), the call has been to develop participatory processes in education that position traditionally marginalized stakeholders as knowledgeable and agentic actors in re-positioning the impetus for local educational change.

Then, from an equity perspective, questions around the use of tools such as e-portfolios, which organically emerged as the design foci for the participatory design work analyzed in this dissertation, becomes less about whether such tools are being widely used or not, but whether they are being used in ways that reflect local equity goals that are formed through the meaningful participation of local stakeholders. While e-portfolios have been used for student advisement and career preparation, tracking progress within educational programs, documentation of skills and expertise, self-reflection, and course evaluations (Lorenzo & Ittelson, 2005), pertinent questions for equity may include, among many, who was involved in developing local practices around e-portfolios, whether the e-portfolios allow for students to make visible knowledge and assets that

are typically not recognized in official school scripts, and whether the use of e-portfolios are made equitably accessible to all students through appropriate learning supports.

Participatory Democracy, Learning, and Agency

Philosophical Foundations of Participatory Methods

This dissertation conjectured that building participatory processes for the local design of technology practices as a possible response to broader sources of inequity in education, as well as site-specific problems of practice and more generally observed constraints to the implementation of equity-oriented technology practices. While recognizing that the “how” of building these structures were up for negotiation, the core assumption was that meaningful, agentic participation by local stakeholders, especially those who were traditionally excluded from design processes, needed to be a fundamental characteristic of the design process. As such, the study was informed by literature stemming from three broad theories of learning that shared a commitment to reorganizing social activity to support the agency of educational stakeholders. These philosophies included Freire’s (2018 [1968]) critical pedagogy, Dewey’s (1927) notion of democratic publics, and sociocultural theories of learning (e.g. Engeström, 2015 [1987]).

Albeit from slightly divergent assumptions and ends, each of the above-mentioned theories of learning have played a central role in conceptualizing this study to consider the role of local context and stakeholders in the production of educational practices and knowledge. John Dewey’s (1954 [1927]) political philosophy examined how democracy may operate outside of formal representative channels by asking what kind of collaborative *public* may be formed by local stakeholders to address issues of concern at the local level and advocate for their needs.

Dewey made an important contribution to our thinking of democracy by positioning agency with local actors, and highlighting the need to examine how democracy is practiced and built. While Freire (2018 [1968]) does not directly reference Dewey, his pedagogical philosophy can be thought of as a close, and more critical application of his thinking onto educational processes that pay particular attention to the political objectives of learning and knowledge-production. His call to develop a vocabulary of education that is rooted and built on marginalized communities was aimed at resisting educational practices focused on “banking” dominant domains of knowledge into oppressed communities. He saw the reorganization of these power dynamics in education as a key process in broader social transformation. Gutiérrez and Vossoughi (2016) have argued that sociocultural theories of learning can complement and support Freire’s political agenda by providing a framework that helps analyze the ways in which Freire’s broad visions for social transformation are operationalized in practice. Sociocultural theories of learning, in particular, cultural-historical activity theory as articulated by Engeström (2015 [1987]), offers an analytic framework to examine elements of collective activity organized around a common goal, such as member roles, organizing tools and language, and agreements and expectations. In addition, the theories offer frameworks to examine how activity of various grain sizes interact with one another, and how activity may be transformed when actors identify internal dissonance within or across activity systems (Akkerman & Bakker, 2011). Such a view on learning is particularly useful in examining the longitudinal arc of the kind of social transformation that Freire envisioned, as it allows us to examine the dialogic interplay between emergent participatory activity, local educational practices, and broader social organization. More recently, scholars have leveraged these affordances of cultural-historical activity theory to push for local educational activity that account for broader social transformation (e.g. Gutiérrez and Vossoughi,

2010; Moje et al., 2007). Together, these theories of collective problem-solving for equity broadly address calls to view the development of equity-oriented practices at schools as a learning process that requires attention to historicized power dynamics in local contexts, and the development of infrastructures that support the transformation of local educational activity (e.g. Neri et al., 2019; Politics of Learning Writing Collective, 2017)

Community Participation at Schools

In American schooling contexts, community schools, which the school site in this study identified itself as, may serve as fertile grounds for building the kind of processes at the school level that contribute to equity-oriented social transformation (Daniel et al., 2019; Oakes et al., 2017, Quartz et al., 2017). According to Oakes and colleagues, community schools, which follow a schooling tradition initiated by Jane Addams and John Dewey in the early 20th century (Benson et al., 2009), are built around the following four principles: 1) Integrated student supports; 2) Expanded learning time and opportunities; 3) Family and community engagement; 4) Collaborative leadership and practices (Oakes et al., 2017). These four dimensions of community schools were collectively intended to address persistent issues of equity that affect marginalized communities. At its core, community schools seek to expand the learning context for students by integrating domains that are traditionally outside of the realm of schooling, such as socioemotional supports and students' home/community experiences, and democratize the school's educational processes by building "a culture of professional learning, collective trust and shared responsibility using such strategies as site-based learning/governance teams, teacher learning communities, and a community-school coordinator who manages the multiple, complex joint work of school and community organizations" (Oakes et al., 2017, P.7). Empirical research

on community schools suggest that such models of schooling lead to positive learning outcomes for students (Oakes et al., 2017), but more importantly in the context of this study, community schools appear to serve as useful contexts that support collaborative problem-solving and knowledge creation. Bryk, Camburn, and Louis (1999) found, in the context of school reform efforts in Chicago, that schools conducive to school-level, communal problem solving by teachers tended to develop innovative school practices that were able to accommodate the complex challenges of urban schooling. Quartz and colleagues (2017), drawing from the experiences of four university-assisted community schools, highlight the affordances of such schools as spaces where university researchers and school-based stakeholders can collaboratively learn and design around persistent problems of practice.

The Role of Research

University researchers have played increasingly meaningful roles in such local collaborative problem-solving efforts both as a means to achieve for greater reliability in research findings, and to serve interventionist goals to improve educational outcomes (Coburn & Penuel, 2016). While research-practice partnerships can take many forms, including the formation of university-assisted community schools (Quartz et al., 2017), they are almost always built on long-term mutualistic partnerships that seek to address pertinent problems of practice that are relevant to practitioners. Furthermore, a number of research-practice partnership efforts have centered their efforts on the co-design and implementation of educational innovations (Penuel et al., 2011; Bang & Vossoughi, 2016). By centering design in research-practice partnerships, researchers have sought to develop educational theory by examining the relationship between the problems of practice the designs address, the conjectures that drive the designs, the design outcomes, and

the implementation of the designs (Edelson, 2002; Sandoval, 2014). Designing as a conceptual framework has also allowed researchers to consider how the collaborative design of educational practices and the design processes themselves may serve as social interventions that support the agency of marginalized stakeholders (Bang & Vossoughi, 2016; Zavala, 2016). In an autoethnographic study of a teacher-led grassroots organization aiming to resist school takeover by charter management organizations, Zavala (2016) found that the expansion of participation by key stakeholders in the actions of the grassroots organization allowed for the continuous reinvention of the collaborative social infrastructure, allowing for new modes of activity that served the political goals of the participants. Research-practice partnerships, and in particular, design-based approaches to such partnerships build on the assumption that stakeholder participation both allow for the expanded understanding of the problem of practice at hand, and more refined design interventions as a consequence of varied perspectives that contribute to the designs, yet, barring a few examples (e.g. Druin, 1999), the role of students in such endeavors have been rarely discussed,

Exclusion of Marginalized Students

If community participation is to be considered a viable approach to local equity-oriented work in schools, the meaningful participation of students in such processes needs to be encouraged and supported. This is particularly true given the historical exclusion of marginalized students from processes of community self-determination (Ginwright, Cammarota, & Noguera, 2005) . There are few empirical studies that adequately show the overall scale of this exclusion, barring a few exceptions. A study by Kahne and Middaugh (2008) conducted a survey of 2,500 juniors and seniors in California, and found that a “student’s race and academic track, and a school’s average

socioeconomic status (SES) determines the availability of the school-based civic learning opportunities that promote voting and broader forms of civic engagement”, and that, “students attending higher SES schools, those who are college-bound, and white students get more of these opportunities than low-income students, those not heading to college, and students of color.”

Ginwright, Cammarota, and Noguera (2005) the availability of the school-based civic learning opportunities that promote voting and broader forms of civic engagement”, and that, “students attending higher SES schools, those who are college-bound, and white students get more of these opportunities than low-income students, those not heading to college, and students of color.”

Reviewing literature on youth’s participation in policy formation that affect their communities, Ginwright, Cammarota, and Noguera (2005) discuss five areas of consideration that need to be examined to advance the thinking on student participation in democratic processes. These include: 1) the positioning of students as “second-class citizens” as a means to exclude them from political participation; 2) existing frameworks for youth development that are “problem-driven” - placing blame on social problems experienced by youth on youth, or “possibility-driven” - disenfranchising youth through top-down implementation of “solutions”; 3) the need to view youth development through macro-level, political and economic contexts; 4) developing a social justice framework to examine youth development that emphasizes “young people’s potential to play a vital role in social and community problem solving”; and 5) identifying “critical factors in urban youth’s social activism by reviewing examples of young people’s collective capacity to change coercive and debilitating public policy”. In very simple terms, these five points can be interpreted as a call to find ways to move away from deficit-based perspectives on urban youth, identify capital and assets that youth build in their communities, and examine processes that can support collective action towards equity.

Ginwright and colleagues (2005) identify deficit-based perspectives on students as a fundamental challenge to a more just representation and theorizing of marginalized students' participation in their education. These deficit-based perspectives place the blame of educational challenges experienced by marginalized communities on the marginalized students themselves and communities based on harmful stereotypes (Solorzano & Yosso, 2001; Valencia & Black, 2002). Valencia and Black (2002) point to the ways in which these narratives have been reinforced in academic research such as those conceptualized through "cultural deprivation" models that pointed to "family characteristics" of marginalized groups as disengaged with academic work, as well as "at risk" child literature that primarily focus on family characteristics and personal characteristics of students as a predictor of their academic success. Both forms of academic work general view the students' experiences and family contexts as sources of problems that inhibit the students' successful participation in educational activities. In addition to these academic sources, Solorzano & Yosso (2001) identified mainstream media, such as television, films, and print media as sources of narratives that position marginalized students' experiences and their communities as constraints to their academic engagement. One can immediately recognize in the racist social media discourses of the current US administration the legacy and increasing degree of violence in these negative representations of nondominant groups. Furthermore, as discussed above, these racial assaults are embedded in invisible media mechanisms such as search algorithms that are employed by most people on a near constant basis (Noble, 2013).

Asset-Based Frameworks to View Student Development

Asset-based perspectives of marginalized students directly challenge deficit-perspectives in mainstream and educational discourse. These perspectives have been developed through sociological research in critical race theory (Yosso, 2005), as well as sociocultural theories of learning (Moll et al., 1992). Both of these perspectives view marginalized students and the communities they participate in (such as cultural, ethnic, political, interest-driven communities) as important sources of learning and capital that students leverage in their participation educational activity, and provide useful frameworks to reconsider the role of students in educational activity. Moll and colleagues (1992), in their study of working-class Mexican communities in Tucson drawing from sociocultural theories of learning, pointed to the household “funds of knowledge” that families in the border region develop through their economic activity, as well as through exchanges that occur across social networks as families navigate changing social and economic contexts. Through their analyses, Moll and colleagues illustrated the active, and complex learning that occurs in immigrant households, directly challenging deficit views that positioned these families as lacking and disengaged from learning practices. Furthermore, they demonstrated the ways in which these funds of knowledge can be valuable resources for classroom teaching. When teachers participated in the ethnographic work of identifying these household knowledges, they were able to develop more nuanced perspectives of their students and their families that did not rely on stereotypes, and develop classroom practices that positioned students as active learners. Yosso’s (2005) review of research that identify assets of marginalized communities categorized community cultural wealth that challenged narratives of the kind of community and cultural practices that count as “capital” and urged schools to recognize these assets as fundamental building blocks to an equitable education system. The six

forms of capital that Yosso (2001) identified are worth restating here, as they serve the analysis of student participation in this study. The forms of capital include:

1. *Aspirational capital*: “the ability to maintain hopes and dreams for the future, even in the face of real and perceived barriers.” (P.77)
2. *Linguistic capital*: “the intellectual and social skills attained through communication experiences in more than one languages and/or style.” (P.78)
3. *Familial capital*: “cultural knowledges nurtured among *familia* that carry a sense of community history, memory and cultural intuition.” (P.79)
4. *Social capital*: “networks of people and community resources” (P.79)
5. *Navigational capital*: “skills of maneuvering through social institutions.” (P.80)
6. *Resistant capital*: “knowledges and skills fostered through oppositional behavior that challenges inequality.” (P.80)

In addition to these sources of capital, researchers like Nasir and Hand (2008) have identified ways in which students’ participation in cultural affinity spaces like basketball served as spaces where students developed identities that bridged academic and out-of-school cultural domains.

Such student assets have also been identified in spaces related to digital technologies. One of the most detailed analysis of such assets in relation to students’ use of digital technology is Ito and colleagues’ (2009) ethnography of children’s processes of developing expertise and identities through engagement with various forms of digital media. Their collection of studies that examine a range of digital media use among children point to the ways in which children’

interest and increased engagement with activities such as gaming, music production, and social media use are mediated by their home life, socioeconomic contexts, and interactions with peers. Jenkins (2009) similarly points to the low barrier of entry into digital media production and online affinity groups based on a range of topics including politics, literacy practices, and other more niche pursuits, to suggest that while many young people engage in some form of digital media production and participation in affinity groups, schools remain an important facilitator of students' participation and skills development in these spheres. Pestone (2013) and Hedges (2011) point to popular culture as sites where students develop meaningful interests and literacy development. Ahn (2011) found that at the time of his study, traditional predictors of access to digital technology did not apply to youth's use of social networking sites. For example, while race remained a predictor of social networking sites use, these were not according to traditional binaries, with Black students more likely to participate than their White peers. Barron (2006) suggests that when youth develop interests that are meaningful to them, it sparks self-sustained learning across their lived ecologies, where through their own volition, they leverage the appropriate learning resources available in those ecologies to further inform their interests.

The most pertinent question regarding student assets in relation to this study is asked by Rios-Aguilar and colleagues (2011), who, in their theoretical examination of how student assets, conceptualized as funds of knowledge, may intersect with notions of social and cultural capital, and may be (mis) recognized, transmitted, converted, and activated/mobilized as forms of capital that gives marginalized students value of exchange to participate successfully in educational settings. Rios-Aguilar and colleagues identified gaps in prior literature that examined pedagogical interventions that sought to identify and utilize student funds of knowledge as resources in learning contexts, pointing out that such studies did not adequately consider how

power dynamics across learning contexts, such as between the homes of marginalized students and schools, may impact the extent to which student funds of knowledge are recognized and put to use by students and educators. Therefore, the authors argue that researchers must pay greater attention to how educational practices can help students recognize, transmit, convert, and activate/mobilize their funds of knowledge for more empowered participation in educational, economic, and political activity.

Transforming Through Student Assets: The Individual, the Learning, and the Broader Context

A number of researchers have pointed to the opportunities that the kind of student assets described above can pose for the development of educational practices in schools. Gutiérrez and colleagues' (1999) conceptualization of hybridity in the third space serves as a useful framework to consider the kind of educational opportunities are developed when student assets are brought into conversation with existing educational script. In their ethnographic study, Gutiérrez and colleagues described the emergence of a "Third Space", or a new form of learning activity that combined elements of the official and unofficial space of learning, in the literacy practices of a dual immersion classroom. The article describes how a teacher taking up unofficial scripts of students engaging in conversations about homosexuality led to a unit of study examining the human reproductive system which continuously drew from students' cultural knowledge combined with more formal scientific discourses to construct the classroom's learning practices.

Barton and Tan's study (2010), on the other hand, shows how bringing students' assets into the learning process can help students position themselves as more central figures in the

process of local knowledge construction. The study follows a summer science unit for 10 to 14 - year-olds, describes how students participating in the unit, which examined the relationship between the urban environment, energy use, and scientific phenomena, which was designed for students to use their knowledge of their local community to engage in scientific investigations that connected their lived experiences with climate science. The study found that in the video documentaries students created to explain the phenomena of urban heat islands, students positioned themselves as experts of the local scientific phenomena, and developed further motivation to investigate more deeply and teach others about the scientific concept they were studying. As such, connecting academic spaces to student assets, while transforming the social script of the classroom, as was observed in Gutiérrez and her colleagues' study (1999) discussed above, but also may serve to transform the self-conception of students as more agentic actors in learning activity.

Following the above studies which found that students' lived experiences as legitimate scripts in the formation of educational practices can both support the conceptual expansion of educational practices, and position students as agentic actors within these educational practices, other researchers have examined the ways in which digital technologies can serve as key tools in the mutual transformations of learning contexts and learners. Schwartz's study (2015) examined how an after school study group's social network site and a multimodal wiki that contained artifacts that represented student identities served as semiotic resources that helped a teacher and researcher design in-class writing assignments. The researcher and teacher in the study analyzed the artifacts, discourses surrounding them, and the student interactions with technology to identify the students' funds of knowledge. Based on their analyses and what they learned about the students' assets, the researcher and teacher then designed an in-class writing assignment,

asking students to write about a research piece about an “issue of community identity”, which created further opportunities to make visible the identities and assets of a new group of students through multimodal text such as wikis and social network sites. Students participated in this new writing assignment by drawing from their own lived experiences and developing new literacy practices, while also practicing their agency to develop a range of multimodal text. Providing insights into how students may assert agency in broader political discourse through digital technologies, Jenkins (2015) found that online affinity groups for the *Harry Potter* franchise used the narrative as an entry point for broader political education. In Bilkstein’s (2008) study with public schools in neighborhoods with low socioeconomic standing in Brazil demonstrated that when various digital technologies were made available and used through community practices and stakeholder control to address community problems that were familiar to students, students were able to produce digital artifacts that directly addressed local issues of equity, such as community health. Such processes align with broader conceptualizations of the role of digital technologies and new media in education termed, “connected learning”, that seeks to use new media to broaden “access to learning that is *socially embedded, interest-driven, and oriented toward educational, economic, or political opportunity* (emphasis in original)” (Ito et al., 2013. P.4). While many of these studies have examined how students’ assets may be a key resource in the transformation of educational practices, the following section considers how students themselves actively participate in the formation of educational practices and technology.

Student Participation in the Design and Implementation of Educational Activity

Participatory Design from the Human-Computer Interaction Tradition

Research on students and children's participation in design related to digital technology has mostly been driven by work connected to *Cooperative Inquiry* processes originally developed by Allison Druin at the University of Maryland in the late 90's (Druin, 1999) and still practiced in more recent years (e.g. Guha et al., 2013). Cooperative Inquiry methods were developed to accommodate young children in the design of computational artifacts informed by participatory design with adults (Schuler & Namioka, 1993). In such collaborative design processes, children have taken on roles within the continuum of user, tester, informant, and design partner (Druin, 2002), while adults mirror these roles by taking on the roles of observer, test facilitator, interpreter, and design partner (Yip et al., 2017). Such design partnerships have led to ongoing refinements in design methods (Guha et al., 2013), technologies for children that were affectively resonant with children (Druin, 2002), key learning outcomes by participating children and adults, including technological skills and knowledge, collaboration skills, design process knowledge, and content knowledge (Druin, 1999; Yip, 2013), and new forms of relationships between designers, family members, and children (Yip et al., 2016). Furthermore, these methods have been adopted by others to expand the boundaries of the design efforts. For example, Rode and her colleagues (2003), have looked more closely at how Cooperative Inquiry processes can better support the design of technological innovations that align with existing curricular goals.

In spite of these gains made by researchers in understanding the role that children can play in designing aspects of human-computer interaction and the processes of participatory design, perhaps because of the young age of their partners, much of this work did not address what Björgvinsson and colleagues (2012) call "agonistic" participatory design that recognizes the sociopolitical contexts that influence the children's identities, collaborative processes, and use of design outcomes. Questions such as how marginalized youth may be positioned as legitimate

agents of design within a broader social context that views their knowledge and lived experiences as problematic, need to be considered along with their participation in design activities. Therefore, the following section will aim to draw insights into how students may form a sociopolitical voice through their participation in design from literature on youth participatory action research (Cammarota & Fine, 2010).

Youth Participatory Action Research and Student Activism

The literature on youth participatory action research (YPAR) has developed a rich tradition of investigating how research methods can inform and be transformed in partnership with youth to actively contribute to community equity (Cammarota & Fine, 2010; Morrell, 2006). Like much of the research discussed above, one of the basic assumptions of YPAR methodologies is that marginalized students' epistemologies, developed through their lived experiences, are critical perspectives that need to be part of social critique (Caraballo et al., 2017), with its own associated pedagogies (Cammarota & Romero, 2011). For example, the Council of Youth Research (Morrell, 2006) drew from theories on critical research (Kimcheloe & McLaren, 2011) that advocate for democratized, participatory research that shifts the center of authority in knowledge-production from individual, "objective" processes, to collective, activist orientations, in conjunction with sociocultural learning theories on "legitimate peripheral participation (Lave & Wenger, 1991) that articulates the ways in which people participate in, and increasingly become experts in a community of practice, to organize summer programs for traditionally marginalized students to engage in critical research on local educational issues. Through the program, research groups comprised of students, teachers, and university researchers collaboratively investigated questions such as, "what does every student in California deserve?",

and, “what inequalities arise in the experience of California’ students?” (Morrell, 2006, P.115). Consequently, students presented their research findings to a diverse set of community members, including state policymakers. Furthermore, students had developed identities as “researchers and agents of change” (P. 124), with a sense that they can leverage what they’ve learned from the project to engage in broader social change efforts. Other scholars researching YPAR projects and youth organizing have found that participation in such processes give youth opportunities to develop psychological empowerment, leadership skills, traditional academic content, and broader understandings of sociopolitical contexts (Christens & Dolan, 2011; Kirshner & Ginwright, 2012; Rogers et al., 2007).

Some scholars have considered how YPAR and youth activism might intersect with emerging digital technologies. Garcia and colleagues (2015) explored the relationship between digital media and emerging literacies, critical literacy, and YPAR contexts, and found that YPAR provided students with an authentic context to participate in key critical digital literacy practices, such as the critique and production of digital media. On the other hand, digital media resources that were available to the project, such as video cameras and blogs, provided the student participants with a powerful tool to enhance their research and activist work. Finally, the study found that the use of digital media through YPAR provided students with opportunities to engage in literacy practices that were thought of as traditionally academic literacies, in conjunction with their more progressive, multimodal views of literacy. Kahne and colleagues (2016) drawing from a wealth of existing literature and experiences of educators in Chicago, Los Angeles, and Oakland, conceptualized how participatory politics, forms of political participation that leverage the affordances of digital technologies to forego traditional political institutions, can inform civic education for students, particularly those who are traditionally marginalized. Conceptualizing

participatory politics as a combination of students engaging in investigation and research, mobilizing for change, production and circulation, and dialogue and feedback, Kahne and colleagues encourage educators to pay attention to the ways in which participatory politics, which increasingly more young people engage in out of the classroom, may inform traditional civic education processes. Finally, the researchers argue that a central focus of building educational practices based on participatory practices must be issues of equity that address issues of access, representation, and pedagogy that may unjustly exclude marginalized students from productive participation in participatory politics.

Kirshner's study (2008) is particularly relevant to the analysis in this dissertation for examining the various ways in which the tension between youth empowerment and the need to develop important practical skills for activism were negotiated to respond to the complex situatedness of three different adult-youth collaborations for youth activism. Using Rogoff's (2003) sociocultural learning theory of guided participation that describes the ways in which novices within a community of practice actively leverage the available resources in the environment, including more experienced mentors, to become increasingly expert members of the community. All three youth organizations that were examined in the study sought to influence key policy areas, such as equity for youth of color, education, and environmental justice by organizing students to communicate effectively with institutions using a variety of channels (e.g. websites, reports, conferences) to advocate for their policy positions. Kirshner found three ways, *facilitation*, *apprenticeship*, and *joint work*, in which students were guided to develop key skills and expertise for activism while also privileging their voice in the youth advocacy work. The three processes varied in their degrees of adult participation in the campaigns and the level of structure that was provided for youth participation and learning.

These variations were informed by a number of contextual factors, including the complexity of the projects, the institutional context and goals, and the prior expertise of the youth. The study suggests that one of the key concerns in partnership work with youth need to be the ways in which partnership practices are developed in response to the local context, goals of the partnership, and the needs of the stakeholders.

Infrastructuring for Student Agency in Participatory Design

Gaps in the Literature

The review of literature so far has examined the implications for equity related to technology use in schools, participatory theories and educational approaches that center local stakeholders and their lived experiences in the design of educational activity, and the ways in which students have been centered in political and educational advocacy as well as technology design. The review suggests that one path to designing school technology practices that produce equity for marginalized students in ways that align with the local context and the students' lived experiences, is to develop design processes that support the meaningful participation of students in such design processes. The review has also made visible the extent to which efforts to develop local technology design processes, especially ones that center students, need to address related complexities, such as existing power dynamics, learning at the social and individual level, and multiple conceptions of equity that may be challenging to integrate with one another. Yet, in the domain of technology integration in schools, the field has lacked the literature that provides insights into the ways evolving design activity, stakeholder participation, and design outcomes dynamically intersect with one another over time to (or at times, not) produce equity. In response, this dissertation's contribution to the literature on technology integration in schools

stems from utilizing the methodological affordances of participatory design and the concept of *infrastructuring* in relation to it (e.g. Le Dantec & Disalvo, 2013), as well as the analytic affordances of cultural-historical activity theory, to better understand how equitable approaches to technology integration is *learned* through the development of collaborative design infrastructures that help students participate in local educational design.

Focus on Infrastructuring in Participatory Design

This study draws from methodologies of participatory design that are rooted in the original conceptualization of participatory design in Scandinavia as a political *and* technical intervention in the workplace that was used by labor unions to participate in the negotiations and design of increasingly computerized workplaces (Spinuzzi, 2005). This form of participatory design stands in contrast to processes that were popularized in the United States that focused more exclusively on the design of technologies and useful systems, and instead view the ongoing formation of issue and place-based *publics*, or participatory design collaborations that help stakeholders develop agency in their participation in design activity (Björgvinsson et al., 2012; Le Dantec & Disalvo, 2013). Such agency is built on an ongoing basis through the examination of how designs are experienced by the stakeholders and what may constrain the stakeholders' visions. Informed by broader conceptualizations of infrastructuring by Star and Ruhleder (1996), who examined the “connection between systems development aimed at supporting specific forms of collaborative knowledge work, local organizational transformation, and large-scale infrastructural change” (P.111), Le Dantec and Disalvo (2013) view the process of forming democratic publics through participatory design as a form of such processes. They describe this orientation towards participatory design as the following:

The idea of infrastructuring through design employs the distinction between PD concerned primarily with design-for-use, centered on useful systems, and PD focused on design-for-future-use, structured to create fertile ground to sustain a community of participants. This entails a shift from treating designed systems as fixed products to treating them as ongoing infrastructure, socio-technical processes that relate different contexts (Star and Ruhleder, 1996). (P. 247).

By situating participatory design within communities and viewing it as a process of building social infrastructures for democratic problem-solving, this conceptualization of participatory design orients itself towards a broader collaborative process of asking and designing around questions of what, how, for whom, and why certain technologies may be utilized in particular community contexts. This makes participatory design of this kind particularly useful in examining how schools might adapt equitably to shifting landscapes facilitated by emerging technologies. In their article that examines infrastructuring in the formation of publics, Le Dantec and Disalvo (2013) describe two community-based design activities, one addressing information systems for local homeless populations, and another that sought to develop a community information system on traffic conditions at a newly renovated bridge. In both cases, the authors describe how the formation of diverse stakeholder design groups made visible key social tensions that needed to be addressed in the design and implementation of various technological tools. The ongoing unearthing of key tensions in relation to the designs allowed for the building of infrastructures to respond to those tensions, pointing to the dialogic relationship between the lived experience of what is designed and the

evolution of the participatory design infrastructure. This points to the most important aspect of this type of participatory design, which is that it is a living infrastructure that responds over time to changing contexts or new insights. Therefore, how stakeholder agency is supported is an evolving process as well. In this dissertation, cultural-historical activity theory was viewed as the most appropriate theoretical tool to examine such processes.

Viewing Agency through Cultural Historical Activity Theory

Cultural-historical activity theory views human action through collective units of activity (activity systems) organized around an “object” – in the sense of the word that connotes a collective goal – and the interaction across various activity systems. Each activity system operates under a structure that contains its own participants (“subjects”), rules, tools and signs, roles (“division of labor”), and objects that organize the activity system leading to particular outcomes (Engeström, 2001). Engeström (2001) provides a succinct summary of the ways activity theory views how learning occurs in activity systems, which he terms “expansive learning”, which can be leveraged to initiate organizational change efforts. Using collective reform efforts in the Finnish medical system that brought together patient groups and mirrored processes of participatory design, primary care physicians, nurses, large central hospitals and researchers to better integrate the care of child patients across multiple sectors of the healthcare system, Engeström identified key tenants of how activity systems organize around change efforts. As a result of identifying key discontinuities communication in care pathways for patients with multiple conditions who traveled across varied caregivers, the multi-institutional group was able to design new work routines, tools, division of labor, and networks to integrate care across stakeholders. The study makes visible the five core mechanisms of how expansive

learning can be understood and facilitated. First, “a collective, artifact-mediated and object-oriented activity system, seen in its network relations to other activity systems, is taken as the prime unit of analysis” (P. 136). Second, multiple voices are always present in activity systems, as, “the division of labor in an activity creates different positions for the participants, the participants carry their own diverse histories, and the activity system itself carries multiple layers and strands of history engraved in its artifacts, rules and conventions” (P.136). Third, activity systems are inherently historical, and, “history itself needs to be studied as local history of the activity and its objects, and as history of the theoretical ideas and tools that have shaped the activity” (pp. 136-137). Fourth, contradictions, “historically accumulating structural tensions within and between activity systems” (P.137), drive the change and development in activity systems. Fifth, activity systems can undergo “expansive transformations” (P.137) with new objects and ways of achieving them. These principles of activity theory combine to offer a way of viewing learning through the ongoing dialogic process of stakeholders identifying key constraints within and across activity systems, and making modifications in activity to address them. Therefore, activity theory offers a succinct analytic framework to examine what infrastructuring through participatory design may look like over time.

In addition to framing how activity systems may transform and expand to address problems of practice through stakeholder participation, activity theory also provides a framing for the ways in which stakeholders and participants in collective change efforts may practice agency. Observing that words like “struggle,” “power,” and “agency” are missing from the literature on design research, Engeström (2011) argues for the need to recognize the political nature of organizational interventions and change efforts, and develop an argumentative grammar for such efforts that supports the humanistic nature of design, as he states,

“interventions in human beings’ activities are met with actors with identities and agency, not with anonymous mechanical responses. If agency is not a central concern in the methodology, there is something seriously wrong with it” (P.603). Among the tenants of this argumentative grammar that shares much of what has been articulated above (e.g. activity as a unit of analysis), he adds “agency as a layer of causality” (P. 609) to urge analyses of collaborative change efforts to pay attention to the ways individual and collective actors transform activity systems by inventing new artifacts that support the action and control the interactions with other activity systems. Once again, this provides a useful analytic framework to understand how participatory design infrastructures might support the agency of stakeholders. Through a study responding to labor shortages at surgical units in Finnish hospitals that led to new division of labor among stakeholders, Engeström observed five ways in which agency was practiced in collaborative change efforts. These included, “resisting the (outsider) interventionist or the management,” (P.622) “explicating new possibilities or potential in the activity,” (P.623) “envisioning new patterns or models of the activity,” (P.624) “committing to concrete actions aimed at changing the activity,” (P.624) and “taking consequential actions to change the activity” (P.624). From an activity theory perspective, this type of agentic actions are key components in facilitating the core process sought in intervention work informed by cultural-historical activity theory that is, “ascending from the abstract to the concrete,” (Sannino et al., 2016) or the development of local theories on problems of practice and potential solutions that are operationalized through experimentation and continuous learning.

Chapter 2 Summary

This section identified one problem of practice related to technology integration in schools as the need to develop practices that respond to local issues of equity and theories of action that respond to the local contexts. In response, the review sought to build a case to examine how students, especially those that are traditionally marginalized, can be supported to take agentic roles in the formation of these local theories of action. The study followed a rich tradition of participatory design (e.g. Le Dantec & Disalvo, 2013) and participatory action research (e.g. Ginwright et al., 2005) that takes an activist and interventionist stance towards research endeavors. Cultural-historical activity theory was identified as an analytic framework that was particularly well-suited to examine how infrastructures to support student agency may be developed, and how such infrastructures may lead to more nuanced conceptions of technology use in schools.

Chapter 3: Methods

Chapter 3 Overview

As a study of participatory design that seeks to examine the intersection between a) the broader design context; b) the evolving design activity and outcomes; and c) student participation in such design activity, it is important to highlight that any of the processes examined in this study did not occur in isolation. As such, the study was a design ethnography (Barab et al., 2004) of a participatory design collaboration that examined how one particular participatory design effort responded to the broader sociocultural and historical context of technology use. It will also describe the resultant activity of the participatory design efforts by researchers and students to design local technology practices. This study examined the student participation in the design of a school-wide e-portfolio system (Lorenzo & Ittelson, 2005). While the efforts to develop school technology practices went beyond the specific design of the e-portfolio system, with students and educators participating in a number of other technology design and implementation efforts, data pertaining to the e-portfolio design process was isolated for analysis here because the study required a longitudinal analysis of participation and implementation. Therefore, fieldnotes, audio recordings, participant interviews, and design artifacts pertaining to student participation in the e-portfolio design process was analyzed to connect the evolution of the design infrastructure, student participation, and the e-portfolio design outcomes.

The primary goal of this section will be to demonstrate the alignment between the school context, and broader issues of equity in school technology use that were explored in Chapter 1, and to make visible the affordances of participatory design research to address these issues of equity. To do so, the section will first provide an organizational and demographic overview of

the school site, including a summary of the school's historical background as a university-partnered community school. This will be followed by an overview of the ideological and philosophical orientation of the school from a historical perspective, and how those ideological orientations are made visible in the everyday experience at the school. This will be followed by an overview of the technology use at the school prior to the partnership that prompted the participatory design effort will be described. Then, the section will consider the role that participatory design has played within the broader field of design-based research (Design-Based Research Collective, 2003) and research-practice partnerships (Coburn & Penuel, 2016), and consider why, together with my positionality, such an approach to research and design was a good fit for this particular school context. Finally, a detailed overview of data collection methods, analytic perspectives, and limitations of the study will be shared.

Research Context

School Background

This study was conducted in partnership with students from a K-12 university-assisted community school (Harkavy & Hatley, 2009) in southern California. As part of an experimental agreement between the local public school district, the teacher's union, and the partner university, the school was established as one of ten public pilot schools that were governed by localized governance structures with a unique degree of school-level autonomy in hiring, curriculum decisions, and professional development practices. The school shared a large campus with four other similarly autonomous pilot schools in the middle of a high-density urban neighborhood that has historically been a destination for immigrant groups. While different demographics were represented at various points in the neighborhood's history, at the time of the

study, there was a strong presence of Mexican, Korean, Salvadorian, and Filipino immigrants. There were some prevalent power dynamics among the immigrant groups that occupy the neighborhood, with many of the businesses owned and operated by Koreans, while much of the labor deriving from Latino immigrants. The neighborhood had also experienced a level of gentrification, with an increasing presence of large corporate retailers and luxury condos.

In many ways, the school was a representation of the community at large in which it is situated. At the time of the initiation of the study, enrollment was open to anyone who reside in the immediate neighborhood, and out of the approximately 1,000 students enrolled for the 2017-2018 school year, 81% were Latino, 15% Asian, and 2% African American. Furthermore, 35% of the students were English Language Learners, representing the diverse cultural and linguistic assets embedded in the school. 92% of the students were also considered “socioeconomically disadvantaged”. The school outperformed the district on a number of student measures, including college enrollment and persistence, standardized test scores, and student satisfaction. The educators at the school also reflect the students’ cultural, linguistic, and academic assets. Although only 44% of the teachers are Latino, 28% are Asian, 6% African American, and 20% White. 85% of the educators are bilingual, and a further 9% are trilingual. 69% of the teachers hold master’s degrees, 19% hold national boards certification, and several more held doctorate degrees.

A Democratic Community

The vision of the school was founded on Deweyan perspective on democratic schools, as well as a number of social justice goals. As such, the collective vision of the school was inherently

oriented towards collective decision-making and a bottom-up perspective on equity.

Commitment to social justice, the agency and autonomy of educators, and inquiry through research-practice partnerships drove much of the school's local activity and culture. These cornerstones of the school culture were felt in most aspects of the school. The architecture was covered in large, 3-story murals that affirm the identity of students, especially those of immigrant backgrounds. Instructional practices were refined in teacher-led inquiry spaces, and often in partnership with university researchers. Finally, students participated in, and often facilitated, various interest-driven activities along with educators, such as organizing for local and national political issues, research partnerships with university researchers, and various artistic endeavors.

An ideological orientation aligned with Deweyan perspectives combined with the unique learning structure informed by research-practice partnerships helped the emergence of a locally developed school vision framework known as the 4 Core Competencies (4CCs). The 4CCs drove much of the school's instructional practices and design activities, and were referred to often. The 4CCs were co-developed by the initial school design team that included university researchers, teachers, administrators and local community members in 2007 and continues to drive the educational practices at the school. The 4CCs include goals for students to be "Self-Directed and Passionate Learners", "Masters of Content Knowledge and Skills", "Biliterate, Bilingual, and Multicultural", and "Active and Critical Participants in Society". The school viewed the 4CCs as an embodiment of their social justice mission, and considered them as guiding posts towards equitable educational outcomes. The framework held organizing power within the school, and references to the Core Competencies were heard frequently during teacher professional development sessions and classroom instruction. How the Core Competencies were understood by the school stakeholders could differ, and be contested at times, especially how they should be

operationalized into school practices. For example, to be “Active and Critical Participants in Society”, had been understood by teachers in terms of personal accountability such as being “law-abiding” and “not associated with gangs”, at the same time as more critical interpretations like being “involved with community organizing” (Quartz et al., 2014). Furthermore, in line with the school’s commitment to localized inquiry, the interpretation of these concepts evolved and were operationalized differently over time.

Technology Use at Study Site

At the time this participatory design collaboration was initiated, the technology practices at the school reflected much of what has been documented in the broader literature about technology use in education in Chapter 1. These included broader macro-level shifts in ideological orientation towards education and how the school responded to such shifts, the extent to which the school’s technology practices aligned with these orientations, and the organizational preparedness and processes to operationalize these goals. Much of the technology practices intersected with the school culture as described immediately above, and this section will focus more specifically on how the school culture and practices informed interactions with available digital technologies, serving as both assets and constraints to the implementation of technology practices aligned with the school vision.

Reflecting the school site district’s broader efforts to invest heavily in digital technology resources (citation redacted to protect privacy), the school site had invested a considerable amount of resources into updating its digital technology. Immediately prior to this study, the district had made a considerable purchase of laptops, with a plan to transition most schools to 1-

to-1 student-to-device schools. While this commitment was not followed through before the district shifted its policies, and the study site had not received any of the investments from the district, the school utilized independently acquired grant money to invest in a number of hardware and software tools. Prior to, and during the study, the school purchased learning management systems (LMS) like Schoology, as well as a slew of hardware including Chromebooks, Apple computers, and tablet devices gradually transitioning to a 1-to-1 student-to-device ratio. The school site had made these purchases through a broad understanding that investments in technology was a vital element in designing instructional practices that afforded students vital skills in the present moment.

The school's investment in technology was driven to a large extent by the educators' explicit and implicit pedagogical orientations. As described in the section above, the educators' pedagogical practices, while anchored to the locally developed 4CCs, tended to express themselves in a multitude of interpretations and resultant practices. Consequently, there was diversity in the ways in which digital technologies were thought to support the educational goals of the school rooted in the 4CC's. These views included, a) a constructivist orientation towards education that valued students' participation in knowledge production practices that align with shifting economic landscapes (e.g. Levy & Murnane, 2005); and b) pedagogy that pays attention to sociocultural aspects of learning, such as the students' racialized experiences, community assets, and social justice goals (Ito et al., 2013; Margolis, 2010), and c) to unload cognitive load such as communication and data collection/representation (Salomon, 1997). The school's educational vision, interpreted within the organization in diverse ways, were reflected in the diverse conceptions of how technology should be used at the site. For example, in reference to ideas embedded in Core Competency 1, for students to be "self-directed and passionate

learners”, technology use was seen simultaneously as a way for students to participate meaningfully in classroom knowledge creation by making their thinking public on online message boards, for students to visualize and track their academic standard mastery, as well as for students to engage in more independent knowledge-seeking behavior through online research that could supplement what is taught in class. Furthermore, individual educators would typically hold their own conjectures about how technology may supplement the school’s, or their own pedagogical goals. It was also noteworthy that certain conceptions of educational technology that have been researched were not prevalent among the educators. In particular, there were very few discussions about the ways in which digital technologies mediate the formation of, and participation in “affinity groups” (Jenkins, 2009), as well as how student assets developed in these spaces might inform the instructional practices at the school.

Existing Infrastructures for the Design and Implementation of Technology Practices

Elements of the design and implementation processes for technology practices at the site prior to the study were reflective of the school’s broader learning culture centered on distributed inquiry, while other elements took on either more isolated, individual characteristic, or hierarchical processes. Much like what had been observed in other schools around the country (Fishman & Pinkard, 2003) the study site did not have dedicated organizational processes or strategies to systematically introduce emerging digital technologies into the pedagogical practices of the school. The use of technology in school practices were often isolated and conceptualized on an ad hoc basis, without a consistent, school-wide rationale on how emerging technologies may shift or supplement the existing pedagogical goals of the school. On the other hand, reflecting the general orientation towards local problem solving by teachers, they had developed a laptop cart

sharing system at a time when the school was still transitioning to a 1-to-1 ratio that positioned particular teachers as “mayors” that were responsible for tracking the movement of the carts.

In addition, prior to this study, there were no systems in place for students to explicitly participate in the design of school technology practices. This is not to suggest that there were no systems and cultures in place at the school that valued student voice. In fact, the school had a rich history of student-led inquiry efforts and representation in school governance. For example, the school’s local governing board was required to include two student representatives, while a number of student-led clubs advocated for pertinent local issues on behalf of the student body. On the other hand, it was less common for students to have a direct say in the instructional practices of the school, and in spite of the evident prevalence of digital devices being utilized by students in the hallways, there were no sustained efforts to determine the characteristics of student use, or how they conceptualized their utility for instruction.

Participatory Design as Research-Practice Partnerships

History of Participatory Design Research

Whereas earlier, participatory design was discussed through the lens of a design methodology aimed at the formation of publics (Le Dantec & Disalvo, 2013), here, I will discuss the affordances of participatory design-based research (Bang & Vossoughi, 2018) as an approach to research that emphasizes building equity in communities and rigor in knowledge through research-practice partnerships (Coburn & Penuel, 2016). Research-practice partnerships serve as a broad methodological approach that orients researchers towards improving educational practices through research by forming mutualistic, collaborative partnerships with stakeholders of the research. Participatory design research follows a rich history of design-based research that

has experienced various phases of methodological evolution (e.g. Brown, 1992; Collins 1992; Design-Based Research Collective, 2003; Gutiérrez & Vossoughi, 2010), and probably fits most closely with the broader visions for research-practice partnerships. Design-based research's core methodological assumption has remained constant: that knowledge production and innovation in the social sciences has much to gain from examining theories and designs that embody them by putting them to work "in the wild". By positioning designs in their use contexts and observing their use, design-based research helps researchers develop domain theories about the problem of practice that the design hopes to address, generalized design frameworks for solutions to the problem at hand, and design methodologies (Edelson, 2002). Furthermore, use in real life contexts allows for the iterative refinement of the designs. In more recent years, however, many researchers conducting design-based research have built on its earlier contributions and taken a more "political turn" to consider how the research with an on-the-ground interventionist orientation may act as catalyst for building equity in the partner communities (e.g. Gutiérrez & Vossoughi, 2010). Without an explicit research design that considers how partner communities and stakeholders may gain equity from a research partnership, design-based research risks reproducing potentially exploitative power dynamics between researchers and marginalized communities that simply see those communities as a means to an end in research (Murphy & Ringwell, 2001). In other words, design-based research methods alone did not always provide enough framing to conduct research in partnership with stakeholders, and participatory design research can be seen as an innovation that facilitates greater alignment between research and practice.

Fit of Participatory Design Research with Local Problem of Practice

Given the commitment of participatory design methodology to develop research approaches that center design in ways that build equity in communities, the approach offered frameworks that were deemed to be well-suited to address the school's design needs (Bang & Vossoughi, 2016; Le Dantec & DiSalvo, 2013). First, participatory design makes explicit its ideological stance towards democratic participation. This characteristic of participatory design was important because of the stated goal of the study to democratize the process of technology integration in schools. This commitment was based both on ethical imperatives as well as pragmatic ones. From a pragmatic perspective, the possibility of such processes granting stakeholders, designers, and researchers access to diverse epistemologies can further expand the boundaries of the design and research outcomes, and generate greater rigor in the design and research outcomes from the perspective that views "relevance to practice as a criterion for rigor" (Gutiérrez & Penuel, 2014). Finally, participatory design is inherently an interventionist stance that seeks solutions to local problems of practice and find ways to make innovations. This characteristic of participatory design was important because the goal of this proposed study was to address a fairly imminent need to develop instructional practices with technology that fits in to the local schooling ecology. Therefore, while modifications to participatory design structures must be made at the local level, broader frameworks characteristics of participatory design as described in the literature offered a methodology that fit well with the ideological and pragmatic elements of the design and research agendas of this proposed study.

Staying Accountable to the School Community

Part of the work of this research was to remain faithful to the basic goals of participatory design and ensure that the design activity was aligned with the needs of the school community. The

goals of participatory design required that the research process has embedded member checks to allow for participants to adjust the design and inquiry directions on an ongoing basis. In the case of this partnership, the most important aspect of this alignment was with the students. While students' meaningful participation in the process was an a priori goal of this research from an activist perspective, students' meaningful participation in the design, feeling that the design process and outcomes were useful and accessible to them, was also the basis for rigor in the research analyses (Gutiérrez & Penuel, 2014). Therefore, students were regularly consulted about their participation in the study, and how, from their perspective, the design and research methods can be improved. Furthermore, given that the project also held the implementation of the design outcomes as a key goal, the educators at the school were consulted regularly as well. This included my own membership in the school's Research and Accountability Committee that monitored and vetted research partnerships, and bi-weekly meetings with the school's research director to refine the direction of the study. Finally, the design outcomes were shared in-person or through a number of practitioner-friendly newsletters to seek feedback.

Researcher Positionality

As my own positionality as a researcher greatly influenced the formation of the partnership which this study was built on, this serves as an ideal moment to share my own relationship to the development of this study.

Prior to developing more theoretically informed perspectives on this work, I was committed to reverse power dynamics in schools around the use of technology that marginalized the expertise of teachers and students. This study has served as an ideal setting to examine *how*

my own educational goals may be operationalized in complex educational settings. As a collaborative endeavor, the role and expertise of the researcher plays a significant role in mediating the outcomes of participatory design and research (Bang & Vossoughi, 2016). As a full participant in the design work, my educational goals undoubtedly influenced the processes and outcomes of the collaborative design work. I have attempted to deal with these biases by including my own actions in the data analysis, and my own contribution to the design and implementation processes are made visible in the findings section. In addition to my educational ideologies, the following section summarizes and discusses the implications of pertinent aspects of my positionality, such as my background, as well as ideologies towards technology, education, and research. Because much of my background and ideological stance has been discussed in the opening illustration, I will simply list key points about my relationship to the foci of the study:

- I am a Korean-American male that grew up in a technology-rich home and schooling environment, with adults around me that generally encouraged me to take agency in cultivating my own interests and using digital technologies to enhance my engagement with those interests. This has led me to learn to become more critical about the role of technology in society through my years in teaching and graduate school, rather than naturally thinking critically about potentially negative impacts of digital technologies on education.
- My ethnic and cultural background constituted insider and outsider identities in relation to the community in which this study took place in, and in which I resided in for significant portions of this study. While many Korean-Americans resided in the neighborhood and had immigrant backgrounds like I do, there were visible power

dynamics between Koreans in the neighborhood and immigrant groups from South and Central America as well as the Philippines, that position those with Korean backgrounds as economically and politically dominant. Most students that participated in the study originated from South and Central America, and the Philippines. This had potentially encouraged students to grant me more space and influence in the collaborative process.

- I was deeply influenced by Freirean pedagogy as a teacher, and viewed educational practices described as “connected learning” (Ito et al., 2013) that connect students’ lived experiences with the use of digital technologies in learning as important models of pedagogy that reflect the positive potential roles digital technologies can play in education. I had actively tried to represent some of this research and thinking as a participant in the design process.
- In approaching this study, I was clear about my activist stance through participatory design. This meant being open about both the pragmatic affordances of designing through participatory design, but also my own ideological motivation to make student assets more visible in the school. I had acted as an advocate for participatory design as a democratizing learning process at the school site, and had consistently encouraged educators at the school site to involve students in the design and implementation of school technology practices.
- I viewed the students I worked with as mentees, and prioritized their developmental needs ahead of their participation in the research and co-design processes.

While making these biases transparent, I have been fortunate enough to be able to work in close partnership with teachers and students at this university-assisted school for four years, developing strong personal and professional relationships, and participated in important

functions of the school such as its research and accountability committee that vets potential research partnerships. It would be important to consider these aspects of my background as I analyze data that is heavily mediated by my involvement.

Project Outline and Data Collection

Overview

As is typical in research-practice partnerships, this study was conceptualized through extended negotiations and relationship-building with school stakeholders that led to the formation of a participatory design project aimed at working with students to co-design technology practices for the school. While the partnership with students was the more foundational element of this design partnership, the student partnership was ultimately part of larger efforts to develop technology practices that aligned with the school context and educational visions. This section provides an overview of how students participated in co-design processes within one thread of these efforts, which was the development of a school e-portfolio system.

Over the four-year period this study's analyses focused on, there were primarily two groups of students that participated in the design of the e-portfolio system. The first group were initially recruited in the 2014-2015 academic year from an advisory class of one teacher, who shared an interest in investigating uses of technology and having her students participate in a collaborative research study. From this group of 15 students, two students conceptualized a student e-portfolio system, and one of them carried on the refinement of her e-portfolio prototype into the second year of the collaboration, along with four others who took on various other projects. This was followed by students participating in an elective class called "seminars" that was co-taught during the 2016-2017 school year by the school's research director and I, along

with a teacher who had planned for the school-wide implementation of the e-portfolio system. From this group, four students volunteered to continue supporting the implementation of the e-portfolio system at the school. The following provides a timeline of the design partnership to design the school e-portfolio system and the data that was collected in each design partnership. Due to the emergent nature of participatory design research, joint design and data collection was negotiated on an ongoing basis, which explains the changes in data collection over the years.

2014-2015 Academic Year

I partnered with an advisory teacher and her advisory group with a research agenda to study student participatory design of school technology use. A focus on the use of Schoology was identified as a design focus, and students engaged in projects such as using the platform to disseminate college-going information and developing a personal e-portfolio using the platform. The student model of the e-portfolio was shared with a broader teacher group at the end of the school year. In total, I engaged in 30 design meetings that lasted approximately 30 minutes, and two more broader joint meetings with adult educators to share the design outcomes. Each of these meetings were audio recorded, and produced 15 fieldnotes. Five students participated in 45-minute interviews that discussed their technology use in and out of school, and their participation in the co-design efforts. Finally, the first year produced a number of design artifacts, including prototypes that students had created of their designs, presentation slides they had created to share their designs with teachers, and various documentation of their brainstorming.

2015-2016 Academic Year

The student participatory design group moved to an afterschool space to accommodate students based on interest rather than class assignments. Four students from the first year joined in the second year to redesign the participatory design space and helped mentor incoming students. As the new group of students began to find their own identity and projects, most of the students from the first year moved on from the project. One student from the first year's partnership who created a prototype for a school e-portfolio continued to support the design and implementation of the e-portfolio by creating instructional materials. At the end of the year, she presented her prototype to teachers. Concurrently another graduate student and I met with school administrators and university faculty members to propose a plan to develop structures of organizational learning on technology integration, including combining the student e-portfolio prototype with original teacher visions for a similar tool. Data from this year in regards to the e-portfolio is limited outside of further prototypes and a set of instructional materials that the student had created to help teachers set their students up with e-portfolios that were ultimately unused.

2016-2017 Academic Year

In the summer of 2016, two teachers had volunteered to work on another iteration of the e-portfolio system, especially focusing on students' academic self-reflection, and shared the results with staff. Due to push back from teachers who asked for more detailed instructional material, a pilot class with 12 students was formed in the second half of the year for the school's seminar classes (an elective program) to test and co-develop the e-portfolio concept further with students.

Students in this space participated in creating evaluation frameworks for student e-portfolios, created their own e-portfolios focused on their identity development based on the evaluation framework, and shared the thinking behind their work extensively within the school to teachers, as well as outside of the school in university settings. Data from this year include design artifacts including prototypes developed with the teachers and students, notes taken during design meetings with teachers and students, and artifacts from the various presentations given by the students and teachers to share their designs to broader audiences.

2017-2018 Academic Year

Four students from the previous year's seminar class volunteered to continue participating in the design and implementation of the e-portfolio system. This included co-planning for a second round of the seminar class. This time, a new teacher would be the instructor on record, and the students volunteered as "mentors" to help students develop their e-portfolios, planning classroom activities and implementing them on a weekly basis. The class had approximately 30 students enrolled. In the second semester of the academic year, the four students helped plan for the implementation of the e-portfolio across all 9th graders in partnership with the 9th grade English teacher, and served as in-class mentors in every 9th grade English class to help students create their portfolios. The four mentor students were interviewed individually for approximately 45 minutes primarily about their participation in the design and implementation of the e-portfolio system. Notes and artifacts from planning meetings for the implementation of the e-portfolio in the seminar and 9th grade English classes, as well as the in-class implementation itself were available as data from this year of the collaboration.

Project Outline and Data Collection Summary

The efforts to co-design technology practices with students at the school site had led to a number of design infrastructures over the four years of collaboration to design a school e-portfolio system, which will be discussed more in the findings chapter. For this dissertation, it was important to isolate a thread in the collaboration that had, longitudinally, seen a number of iterations to the partnership infrastructure in order to understand how those infrastructures were developed, how students participated in those infrastructures, and that kind of design and implementation outcomes were mediated by the design processes. As such, data that was related to the co-design of a school e-portfolio system was isolated from a broader set of partnership data, even though the data was not always consistent across the four years of partnership due to the ongoing changing nature of the work. The following table summarizes the design work, participants, and data collection pertaining to the e-portfolio design from each academic year of the partnership.

Table 3.1. Summary of Design Activities, Participants, and Data Collection

Year	Design Activity	Participants	Data Collection
2014-2015	Partnership with an advisory class to co-design technology practices with students. Weekly design meetings with students and their advisory teacher. Two students create an e-portfolio prototype to be shared with teaching staff.	One teacher (Ms. Kim) 12 students in advisory class	Design meeting audio recordings and notes Design artifacts (design prototypes; presentations; brainstorming material) Student interviews
2015-2016	One student from the initial design group continues to refine the e-portfolio prototype and develop tools to	One student	Design artifacts (e-portfolio prototypes; manual for e-portfolio implementation)

	support teacher implementation.		
2016-2017	<p>In the summer of 2016, two teachers volunteer to work on another iteration of the e-portfolio with classroom implementation as goal.</p> <p>One of the teachers co-teach a new elective focused on student e-portfolio development as a trial.</p> <p>Students in the elective class design additional tools for classroom implementation and further refine the e-portfolio format.</p>	<p>Two teachers</p> <p>12 students in new elective class</p>	<p>Seminar class audio recordings and notes</p> <p>Design artifacts (e-portfolio prototypes; presentations; brainstorming material)</p>
2017-2018	<p>Four students from the elective class volunteer to support the implementation in a larger elective class in the first semester, co-designing lessons and mentoring students in class.</p> <p>In the second semester, students support the implementation of e-portfolio practices across 9th grade in a similar manner to the first semester.</p>	<p>Four students</p> <p>Two teachers</p>	<p>Student interviews</p> <p>Design meeting audio recordings and notes</p> <p>Design artifacts (e-portfolio prototypes; presentations; brainstorming material)</p>

Data Analysis

This section describes the frameworks used to analyze the design infrastructures, student participation, and design outcomes. Following Barab and colleagues (2013), much of the frameworks derive from sociocultural perspectives on learning (e.g. Gutiérrez & Rogoff, 2003) and cultural historical activity theory (Engeström, 2001). These frameworks were particularly useful for this study because of the unit of analyses they provide, which contextualize individual participation and learning within social and cultural units of activity organized by particular goals. Cultural historical activity theory in particular also allowed for analyses that examines the

interaction across social groups. As such, they provide useful ways to examine the relationship between the design infrastructures, student participation within them, and how the design outcomes and implementation process interact with the broader community. As mentioned earlier, these perspectives guided both the formation, facilitation, and development of the co-design activity, as well as the analyses of the data and provided the most effective framework to guide both. Here, I will discuss in more detail how literature based on these perspectives on learning and activity inform the analyses of key concepts in this study.

Design Infrastructure

The infrastructuring that occurred in participatory design will be viewed through the lens of “activity” as used in cultural historical activity theory (Engeström, 2001). As discussed earlier, cultural-historical activity theory views human action through collective units of activity organized around an “object” – in the sense of the word that connotes a collective goal – and the interaction across various activity systems. Each activity system operates under a structure that contains its own participants (“subjects”), rules, tools and signs, roles (“division of labor”), and objects that organize the activity system leading to particular outcomes. This provides a useful framework to view the infrastructures of the participatory design work because participatory design is inherently a social endeavor that is object-oriented. Furthermore, the conceptualization of *infrastructuring* in participatory design as a process of building social arrangements through the increasing identification of “attachments”, or aspects of the broader context that are relevant to the design goals (Le Dantec & Disalvo, 2013) draws parallels with the concept of “double binds” and “expansive learning” in activity theory, which describes the ways in which activity systems identify and reorganize themselves to accomplish their goals. The

utility of activity theory was that it allowed for a more precise analysis and description of infrastructuring over time.

Student Participation and Agency

Activity theory also provided a useful framework to view student agency in the context of participatory design because it provides a framework to view agency within activity systems (Sannino et al., 2016). From the perspectives in activity theory, agency is built through a person's ability to transition from one form of activity that is not aligned with the object of that activity into one that is. This may stem from a person's ability to shift internally the contradictions within activity systems they are part of, or their ability to influence other activity systems to align its work to theirs. This is what Sannino and colleagues (2016) call "transformative agency". In the context of participatory design, this may look like the students playing a role in identifying issues in the design infrastructure or in the activity system of technology use in the school and transforming the processes to varying degrees. Therefore, this study examined the extent to which the participatory design infrastructures afforded students opportunities to express their agency by identifying constraints within the design infrastructure as well as school technology practices and transform them. In addition, learning in student participation was viewed through sociocultural perspectives on learning that observe the nature and degree of individual participation in broader cultural activities (e.g. Rogoff, 2008).

Student Assets

As articulated in previous chapters, student assets needed to be a central construct that was visible in the infrastructuring process, design process, and the design outcomes. This was because of the empirical foundation of the study that marginalized students embody practices (González et al., 2006) and forms of capital (Yosso, 2005) that are developed in their out-of-school lives. If students were to express agency in the design process, they would have to leverage these assets in conjunction with those developed inside of school. These assets were identified primarily through Yosso's (2005) community cultural wealth framework as the most comprehensive framework that names the assets that traditionally marginalized students develop through their lived experiences.

Design and Implementation Outcomes

Finally design and implementation outcomes were analyzed through a combination of the above-mentioned frameworks. The designs and implementation in the context of this study were facilitated outcomes based on the interactions between design infrastructure, student participation, and student assets. Therefore, the characteristics of the designs and implementation processes were analyzed through questions such as: How did the various design infrastructures facilitate student participation? To what extent were students able to utilize their assets to participate in the design process? To what extent are student assets visible in the design outcomes and implementation processes?

Chapter 3 Summary

The school site in which this took place in was identified as experiencing similar problem around technology use that had been documented in the literature. However, as a university-assisted community school, it was unique in that the existing culture and practices were geared towards developing partnerships with university researchers to address relevant problems of practice, which allowed me to negotiated a research and design foci that met the needs of the school, and my own needs as a university researcher. Consequently, a small group of students from one advisory class was recruited to participate in a participatory design effort (Le Dantec & Disalvo, 2013) that was originally broadly defined as an effort to develop school technology practices that were meaningful to students. Through this initial partnership, the design of a school-wide e-portfolio system became one of the focal point of the collaborative design efforts. In total, various groups of students participated in the co-design effort to varying degrees over a four-year period. The dissertation was developed as an ethnographic study of this particular design process (Barab et al., 2004), with cultural-historical activity theory (Engeström, 2001) as the primary analytic framework to examine the evolution of the collaborative design activity, and the role of the participants and the artifacts that were designed within them.

Chapter 4: Findings

Chapter 4 Overview

This findings chapter has three aims. First, it illustrates the longitudinal development of the study's participatory design infrastructure for the design of the school's e-portfolio system. Second, it offers analyses of the resultant design outcomes. Third, it examines characteristics of student participation in the endeavor, particularly of their learning. This findings chapter is organized into three sections that represent key moments in the students' participation in the design infrastructure of the participatory design work. Each section within the findings chapter, besides the introduction and final summary, are organized around the design narratives of these three distinct iterations of the collaborative work with students. Such an organization has analytic affordances because some of the most grounding features of the design infrastructure, such as the shared design goals and the location of co-design where the co-design took place shifted along with the three periods focused on here that spanned four years. Within these three sections and the broad collaborative infrastructures with students they represent, the narrative will provide a more nuanced view of refinements to the collaborative infrastructures that were made within them, and how those refinements mediated the further design activity and outcomes.

Following recent design-based research studies that organize their findings around design narratives due to their ability to illuminate design decisions and processes over time (e.g. Hoadley, 2010; Yip et al., 2016), each of the findings sub-sections will be foregrounded with a narrative overview of each phase's design work as it related to the e-portfolio design. Following the narrative overview, a narrative discussion section will explicitly examine how the design narratives in each section address the research questions by focusing on the features of the

collaborative infrastructure and how they were developed, the ways in which these infrastructures mediated student participation in the co-design work, and the ongoing outcomes of the co-design work as they led to the design and implementation of a school e-portfolio practice.

Narrative 1 provides a detailed narrative of the work leading up to the participatory design project with students, including key features of the school context in which the participatory design project took place. This narrative is particularly important because it connects the school site culture and practices with to the formation of the collaborative project with students. The section will highlight the ways in which existing culture and practices for local design and inquiry by teachers had set up key spaces, tools, frameworks, and needs that allowed me to initiate a collaboration with students to design local technology practices that were informed by existing literature on processes of technology integration and equity in schools, as well as the organizational aspirations, assets, and learning needs of the study site. Narrative 2 focuses on the first year of participatory design with the students that took place in an advisory class of high school juniors. The narrative illustrates how the iterative refinement of the participatory design infrastructure, including the articulation of student-level design and learning goals, relationship building with educators, and work to make student knowledge visible led to the final design outcomes, including a prototype of the school e-portfolio created by students. The narrative primarily informs capacity-building within new design partnerships. Finally, Narrative 3 focuses on the roles a group of students played as the e-portfolio was scaled from implementation in a small elective class, to an entire grade level. This group of students transitioned from being the first group of students who trialed a version of the e-portfolio in a classroom setting, to making significant refinements and additions to the design of the e-

portfolios, then becoming central figures in broader implementation and knowledge-sharing. The narrative focuses on student agency and learning within the implementation of local designs.

Table 4.1 summarizes the main themes and implications of each narrative.

Table 4.1: Findings Chapter Section Summaries

Narrative	Descriptive Components	Findings Overview	Implications
Narrative 1: School Context and Assets for Participatory Design Prior to Project Initiation	School’s culture and practices around practitioner inquiry and design, instruction, and technology use, including vision for equity. Process of conceptualizing participatory design project with school site educators.	School lacked dedicated infrastructures connecting school technology practices to local equity vision, and for students to participate in the process. Existing culture and practices for local educator inquiry and design allowed for the conceptualization of design processes with students reflecting broader school culture.	"Fit for purpose” infrastructures for participatory design need to be developed to address emerging problems of practice. Local assets, including those embedded in community, organizations, practices, and individuals can be leveraged to do so.
Narrative 2: Project Initiation to Bridging Educator and Student Goals	Students and researcher build a collaborative project through the academic year by refining collaborative practices, design goals, and the broader identity of the collaboration. Design cycle ends with students developing and presenting designs with teachers, including e-portfolio prototype.	Student agency and learning in the design of school technology practices was built through ongoing refinements in the design infrastructure responding to student goals and needs. Student prototypes and presentation reflected self-identified educational goals and perspectives on schooling, and aligned with educator equity goals.	Design efforts aimed at stakeholder agency can co-develop design infrastructure with participants to honor local context, stakeholder learning, and design goals. Co-design efforts need to continuously expand the boundaries and networks of the design and implementation effort.
Narrative 3: Student Learning through Participation in the Refinement, Implementation, and Scaling of E-Portfolio System	Students who participated in a small elective class to trial the e-portfolio became key figures in the scaling and knowledge-sharing about the e-portfolio beyond school confines.	Participatory design processes created opportunities for students to play key roles in the implementation and scaling of e-portfolio practices. Students leveraged lived experiences to participate in design, and identified new domains where their assets are valuable.	Participatory design efforts need to be developed through intentional infrastructures to make visible how students’ lived experiences and connect them to the design processes and domains. This can build capital for collaborating students.

Together, these three narratives address this dissertation’s research questions by illustrating the ways in which infrastructuring within participatory design, the ongoing

refinement of design activity to democratize a design processes informed the participation of high school students in a collaborative design effort to develop school technology practices, and the resultant design outcomes related to a school e-portfolio system. The results will show that during this project, design activity evolved through interactions across the local school culture, attention to students' educational goals, knowledge (of themselves, peers, school context, and digital technologies), and motivations for engaging in design, and the small "t" and large "T" theories on equity in education. Some aspects of student participation in these design infrastructures remained consistent during the design collaboration, such as their deepening roles in refining the design processes, conceptualizing design outcomes, and creating design prototypes. Students engaged in these processes supported by the broader school context and facilitation by the researchers, as well as their knowledge, perspectives, and assets accumulated through their lived experiences. On the other hand, students played increasingly central roles in the design and implementation of technology practices in spite of considerable turnover as the design goals became more visible, the design infrastructure evolved to include different stakeholders, and students gained new knowledge, skills, and aspirations in relation to the design object. Through the evolution of the design infrastructure and the students' participation in the design efforts, the design outcomes, including a school-wide e-portfolio system, represented a hybridized practice representing the equity goals of multiple stakeholders, and a tool that positioned student users from asset perspectives. The findings show that when infrastructures for design and implementation of local school technology practices were developed in partnership with students, students became increasingly agentic actors in the design process.

Design Narrative 1: School Context and Assets for Participatory Design Prior to Project Initiation

Design Narrative 1: Introduction

This first narrative analytically focuses on the school context in which this participatory design partnership took place in. In particular, it examines how the school's culture and practices around local inquiry, existing problems of practice around technology use, and my background and interest as a researcher intersected to form the outline of a collaborative project with students to co-design technology practices that responded to student assets and needs. In particular, the section will illustrate how the local school culture and practices, with an emphasis on Deweyan democratic processes centered on local stakeholder decision-making and design (Harkavy & Hartley, 2009) had created frameworks and orientations towards equity that were friendly towards participatory design work with students, and gave the yet-to-be formed partnership a broad mandate to examine technology use in relation to the school's equity goal as a problem of practice that emerged in teacher-led inquiry. The section will show how such a culture, and the problems of practice around technology use that emerged from that culture directly aligned with building participatory design processes with students informed by theories of participatory design (Bang & Vossoughi, 2016), asset-based perspectives on marginalized students (e.g. Yosso, 2005), and sociocultural perspectives on technology use (e.g. Fishman & Pinkard, 2001; Kaptelinin & Nardi, 2006).

Design Narrative 1: Overview

A School Built on Community-Based Inquiry

As previously discussed, the school was founded on a Deweyan model of community schools that characterizes schools as sites of participation by stakeholders in democratic processes, both as an end-in-itself vision of democracy in practice, and as a pragmatic process to solve complex social problems faced by the kind of marginalized communities the school served (Dewey, 1927). As such, the school was oriented towards collective decision-making and a bottom-up perspective on equity (Quartz et al., 2014). To engage in this orientation, educators at the school regularly participated in collective inquiry and improvement processes that were relatively well-supported through the administrative culture, structure, and resources. Teacher agency in this setting was valued, and the professional practices at the school had been designed to privilege the agency and professional culture of the teachers.

With the added dimension of its status as a university-assisted community school, research partnerships were also a valued feature of the school. Teachers and students regularly participated in research-practice partnership studies with university researchers centered on locally relevant problems of practice. The school had built systems that shaped the way the school engaged in these research-practice partnerships. Some important components of this system included a research committee in which teacher representatives, along with current university researchers affiliated with the school would vet, facilitate, and evaluate research proposals by university researchers based on their alignment with school priorities, burden on the teachers and students, and practicability given the unique school context, among other concerns. Other components of the research-practice partnership infrastructure included summer funding for teachers to engage in inquiry work of their interest along with university researchers, locally developed data tools such as educator and student surveys, and a dedicated university researcher that oversaw all of the research projects taking place at the school, including the training of

graduate students (Rivera-Torres et al., forthcoming). These systems combined to create a research-practice partnership ecology where not only was research conducted regularly within the confines of the school, but where such research activity would be refined on an ongoing basis based on critical input from local stakeholders. Such processes had led to a number of local innovations, including a framework that organized the school's orientation towards social justice named the 4 Core Competencies.

The 4 Core Competencies: A Local Framework for Social Justice in Education

Social justice and equity were fundamental fabric of the school and teachers' identities, and the ethos of the school was characterized in an educational framework known as the 4 Core Competencies (4CCs). The 4 Core Competencies were guided by Deweyan perspectives on education, and relevant educational frameworks that explicitly address issues of equity such as culturally-relevant pedagogy (Ladson-Billings, 1995) and critical pedagogy (Freire, 1992). The 4CCs were co-developed by the initial school design team that included university researchers, teachers, administrators and local community members in 2007, and continued to drive the educational practices at the school. The design of the competencies was also influenced by the unique professional learning and design infrastructure informed by research-practice partnerships. The 4CCs drove much of the school's instructional practices and design activities. Their influence was explicitly evident as the 4CCs were referred to often by the educators and researchers at the school site, reflecting attention to learners, content, values around language and cultural competencies, and a vision for how learners (and practitioners) will operate in society. The 4CCs included goals for students to be:

- Self-Directed and Passionate Learners
- Masters of Content Knowledge and Skills

- Biliterate, Bilingual, and Multicultural
- Active and Critical Participants in Society

The school viewed the 4CCs as an embodiment of their social justice mission, and considered them as guideposts towards equitable educational outcomes. The framework held significant organizing power within the school, and references to the Core Competencies could be heard frequently during teacher professional development sessions and classroom instruction. How the 4CCs were understood by the school stakeholders varied, and at times were contested, especially in regards to how they should be operationalized into school practices. For example, to be ,“active and critical participants in society”, had been understood by teachers in relation to personal accountability such as being “law-abiding” and “not associated with gangs”, while at the same time that others saw it through a more critical lens like being “involved with community organizing” (Quartz et al., 2014). Furthermore, in line with the school’s commitment to localized inquiry, the interpretation of these concepts evolved, and were operationalized differently over time.

While some individual-level interpretations of the 4CCs may have diverged, certain structures and practices were consistently available for students to engage in the 4CCs. For example, for the middle schoolers and high schoolers, the teachers offered courses called “seminars”, which were designed autonomously by teachers based on their personal interests. These seminar courses included courses on gardening, entomology, and world sports. Senior internships offered senior students, regardless of their academic standing, to receive credits to gain working experience by interning at local partner organizations, and the bilingual program offered students at all levels of Spanish fluency to develop bilingual competencies. In addition, students were encouraged to take activist stances on local politics, and participated in formal

decision-making of the school through student government and participation in a school-level governance board.

Developing Assessments that Fit the School Vision

One lane of teacher-led inquiry work at the school that would become relevant to the participatory design work were the efforts, described by Quartz and colleagues (2014), by the school to develop internally aligned school assessment practices. The study by Quartz and colleagues highlight how the school stakeholders, leveraging the school's position as an autonomous pilot school, sought to understand and operationalize its stated vision to facilitate student engagement with the 4CCs, and provides insights into how the school's commitment to social justice, the agency and autonomy of educators, and inquiry through research-practice partnerships were experienced by the educators. The article describes how a school-based team known as the Data Collection Action Team (DCAT) was formed to operationalize the school's 4CCs by developing locally meaningful assessment practices. Recognizing that externally developed assessments alone would not adequately help the school measure student growth in the 4CC framework and provide school stakeholders with the necessary data to inform practice, the DCAT team and smaller content-area teams formed inquiry groups to conceptualized and designed assessments that would serve the specific needs and goals of the school and content-area teams.

This led to the design and implementation of some assessments, such as with the history department who rejected pressure from the district and partner university to trial a newly developed content-area assessment based on the Common Core State Standards on the grounds that the external assessment did not represent the content that was taught at the school, and instead, designed their own assessments modeled after the external assessment that was more

representative of instructional practices at the school. On the other hand, an e-portfolio system that was intended to house student data and academic artifacts to facilitate student goal-setting and self-regulated learning was put on hiatus due to considerable teacher pushback. After a teacher-led summer inquiry by two teachers and university researchers to identify e-portfolio platforms and designs that would support the 4CCs, the inquiry team shared the findings with the broader teaching staff. Yet, due to teacher concerns about teacher workload to master an entire technology platform, as well as their ability to adequately protect student privacy and teach digital literacy practices, the implementation of the e-portfolio was put on hold until a more comprehensive infrastructure can be built.

Existing Technology Trends, Practices, and Narratives

The school site had invested a considerable amount of resources into updating its digital technology resources, reflecting the school site's district's broader efforts to invest heavily in digital technology resources (citation redacted to protect privacy). Immediately prior to this study, the district had made a considerable purchase of laptops, with a plan to transition most schools to 1-to-1 student-to-device schools. While this commitment was not followed through before the district shifted its policies, and the study site had not received any of the investments from the district, the school utilized independently acquired grants to invest in a number of hardware and software tools. Prior to, and during the study, the school purchased learning management systems (LMS) like Schoology, as well as a slew of hardware including Chromebooks, Apple computers, and tablet devices gradually transitioning to a 1-to-1 student-to-device ratio. The school site had made these purchases through a broad understanding that investments in technology was a vital element in designing instructional practices that were timely and innovative.

As described in the section above, the educators' pedagogical practices, while anchored to the locally developed 4CCs, tended to express themselves in a multitude of interpretations and resultant practices. Consequently, there was diversity in the ways in which digital technologies were thought to support the educational goals of the school rooted in the 4CC's. Categorized here into three broad and overlapping categories discussed in earlier in Chapter 1, these views primarily included, a) a constructivist orientation towards education that valued students' participation in knowledge production practices (e.g. Halverson & Sheridan, 2005; Levy & Murnane, 2005); b) pedagogy that pays attention to sociocultural aspects of learning, such as the students' racialized experiences, community assets, and social justice goals (Ito et al., 2013; Margolis, 2010), and c) to unload cognitive load from complex activities such as communication and data collection/representation (Salomon, 1997).

While these pedagogical orientations associated with emergent digital technologies have been discussed in more depth in Chapter 1, these ideologies around technology and learning were operationalized at the local level through the 4CCs, and offered a diversity of practices that correlated with the diversity of interpretations of the 4CCs. For example, in relation to ideas articulated in Core Competency 1, for students to be "self-directed and passionate learners", technology use was seen simultaneously as a way for students to participate meaningfully in classroom knowledge creation by making their thinking public on online message boards, for students to visualize and track their academic standard mastery, as well as for students to engage in more independent knowledge-seeking behavior through online research that could supplement what is taught in class. While educators would offer thoughts on how technology should be utilized to improve educational outcomes when asked, there were no explicit school-level visions or documents that outlined how technology use may fit the overall educational vision of the

school. In other words, individual educators would typically hold their own conjectures about how technology may supplement the school's, or their own pedagogical goals. Furthermore, certain prominent conceptions of educational technology use were noticeable absent, such as the ways in which digital technologies mediate the formation of, and participation in, "affinity groups" (Ito et al., 2010) that further advance users' identity development.

Much like what has been observed in other schools around the country (Fishman & Pinkard, 2003) the study site did not have dedicated organizational processes or strategies to systematically introduce emerging digital technologies into the pedagogical practices of the school. The use of technology in school practices were often isolated and conceptualized on an ad hoc basis, without a consistent, school-wide rationale on how emerging technologies may shift or supplement the existing pedagogical goals of the school. Reflecting the general orientation towards local problem solving by teachers, they had developed a laptop cart sharing system at a time when the school was still transitioning to a 1-to-1 ratio that positioned particular teachers as "mayors" that were responsible for tracking the movement of the carts.

Consequently, the kind of creativity seen in many aspects of the school practices did not extend to the ways in which technology would be designed and implemented for instructional practices. In particular, the school had not implemented technology practices that explicitly aligned with the 4 Core Competencies. There were efforts like that of the DCAT team to find appropriate web-based tools for students to monitor their own academic growth, as described earlier in this chapter where technology use was viewed through a strategic, organizational lens rather than the isolated work of individual teachers. However, as described in Quartz and colleagues' (2014) manuscript, the effort was stalled due in part to many teachers' views that there were inadequate resources to support the learning process necessary to adopt and

implement the necessary technological tools. In addition, those practices that have been implemented and adopted widely were generally those that required minimal shifts from traditional teacher practices, and were implemented through a top-down implementation processes, such as the implementation of a new learning management system for teachers to upload and share student grades, which was identified and purchased through the research of an administrator. Finally, in spite of the teachers' stated need for learning opportunities to design and carry out some of the more ambitious technology-supported instructional practices, the teachers identified that there were few resources in place to support the professional learning of the teachers.

Researcher Identity and Organizational Needs in the Formation of a Research-Practice Partnership

A viable research-practice partnership study that aligned my interest as a researcher, and the educators' needs began to emerge after a year-long period of fact finding and relationship building at the research site that included conversations with teachers, university researchers affiliated with the school site, and school administrators, as well as classroom observations that started in the Fall of 2013.

As a teacher, I had centered my teaching practices on Freirean theories of critical pedagogy (Freire, 1993) that advocates for educational practices that privilege marginalized learners' contextual knowledge, experiences, and empowerment through the dialogical development of educational practices. My practice as a teacher was heavily impacted by joining a professional learning program that trained teachers to develop a politically conscious curriculum through multidisciplinary projects that positioned historically marginalized students as knowledge-producers using digital media and technology. I had also experienced a

considerable amount of pushback from school administrators for implementing such a curriculum that was seen as inadequately emphasizing testing preparation. Consequently, as a researcher, I had hoped to facilitate the uses of technology that paralleled my own practice as a teacher, specifically by investigating how schools may adopt such practices within the broader contexts of schooling, including the culture of high stakes testing, organizational (un)readiness, and the knowledge-base of educators and students.

As a new graduate student and novice researcher, I was immersed in a learning trajectory that bridged the theoretical and methodological training at the university space and ongoing work at the university-assisted community school. At this stage in my graduate studies, 5 months removed from the teaching profession, I was enrolled in a qualitative research methods course with a focus on conducting literacy research from sociocultural and asset-based perspectives (e.g. Moll, et al., 1992; Yosso, 2006). The course included a field work component that gave me access to the school site once a week to volunteer and research in an elementary after school program at the school site. I had also concurrently worked on a research-practice partnership study (Coburn & Penuel, 2016) guided by participatory design-based research methodologies (e.g. Bang & Vossoughi, 2016) at another university-affiliated school. As a result, like other researchers who saw compatibility between sociocultural theories of learning and participatory design with critical pedagogy and community asset-based research (Bang & Vossoughi, 2016; Gutierrez & Vossoughi, 2016), I sought to utilize this newly acquired knowledge of participatory design, design-based research, and sociocultural theories of learning to shift the power dynamics of technology use at schools.

Having part of my graduate student training situated in the university-assisted community school allowed me to informally develop an understanding of the school's professional,

instructional, and technology practices through conversations with teachers and administrators. The initial conversations with the educators surfaced the tensions that were felt in the school's technology use as articulated above. This, in turn, made visible the areas of alignment between my own research agenda, and the practical needs of the school as articulated by the educators. Over several conversations with the research director, it was jointly conjectured that recruiting students to a participatory design-research study along with the researcher would address some of the school's needs for the following reasons:

- a) Participatory design will position students from an asset-based perspective in ways that align with the school culture (Bang & Vossoughi, 2016).
- b) Students can develop valuable skills and expertise by engaging in meaningful inquiry and design (Cammaraota & Fine, 2010).
- c) Participatory design will facilitate key organizational learning processes (Edelson, 2002) by:
 - Helping the school better understand the school's current practices from the students' perspectives.
 - Leveraging student assets in addressing technology-related problems of practice and refining existing practices.
 - Adding to formal organizational structures that address technology practices.
 - Creating a space where students can build general and technology-related skills.

With these core assumptions, and a lengthy period of fact-finding and relationship building with the school educators, I proposed a study that was vetted by the school's R&A

Committee, which allowed for several more rounds of refining the study. The committee had identified the need, in particular, to design and implement a school-wide e-portfolio system (Lorenzo & Ittelson, 2005) as a tool for students to become more reflective in their academic engagement, and consider the role a newly purchased learning management system might play in this process. The school educators and I had slightly divergent ideas about the specific design goals of the collaboration, as the researcher was more interested approaching a group of students to collaboratively articulate a design goal, whereas the educators had more specific outcomes in mind. The former approach was chosen with the idea to keep the findings from the collaboration with students available to the educators on an ongoing basis with an eye towards finding opportunities for deeper collaborations between the students and the educators. Based on this understanding, the R&A Committee approved and the specifics work of recruiting students to the collaboration had begun.

Design Narrative 1: Summary and Discussion

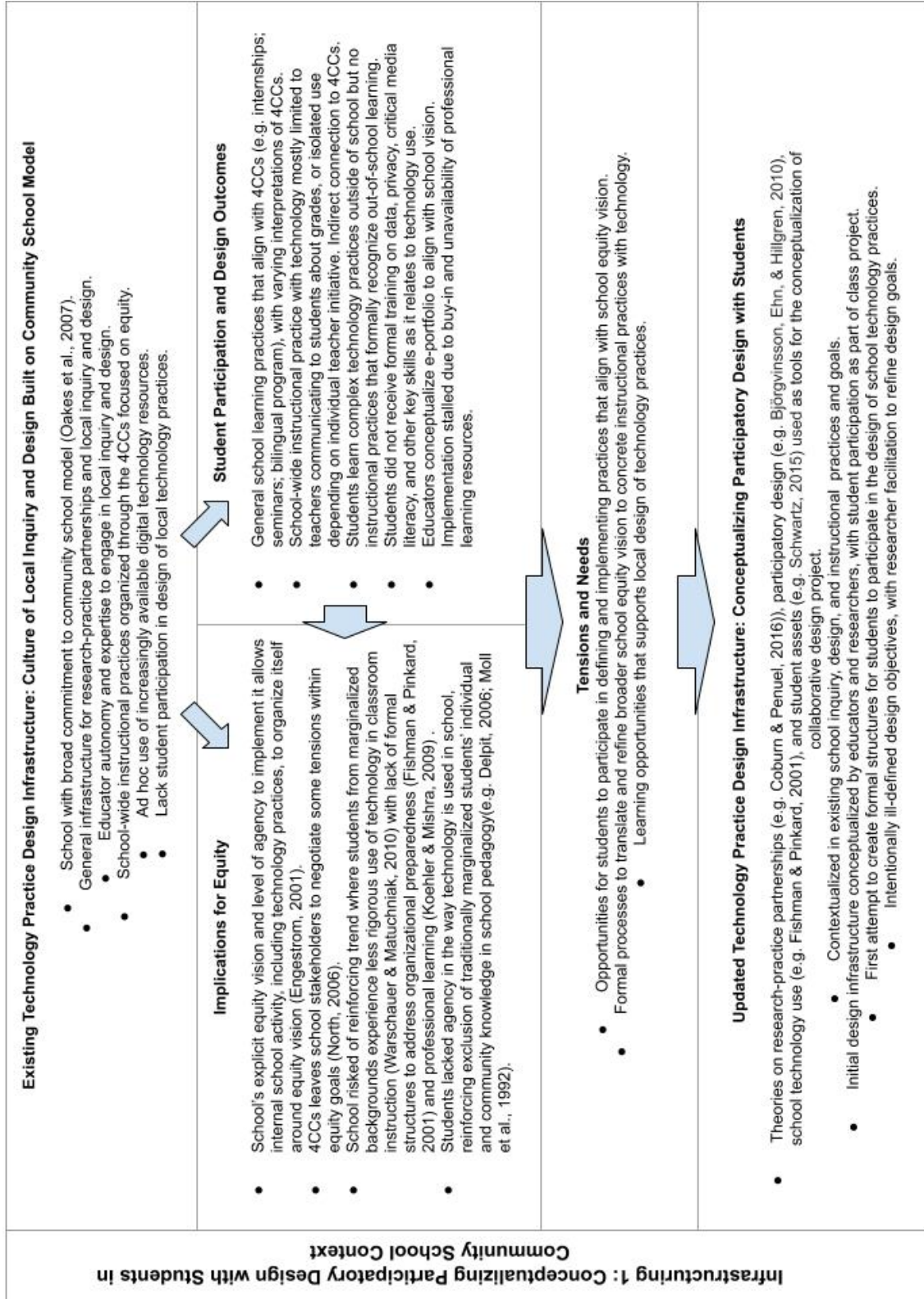
RQ1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?

The school context prior to the project initiation was characterized by a number of assets that made it a fertile ground to initiate the participatory design work with students addressing the school's technology practices (Diagram 4.1). The school, built on Deweyan concepts of community schooling (Harkavy & Hatley, 2009), had nurtured a culture and practices to sustain locally grounded design work and partnerships with researchers. The educators at the site were accustomed and skilled at conducting inquiry and design to address local problems of practice. Formal structures built to support such work, including an MoU with the local district that gave the school, and educators within it, added autonomy over its educational practices, the Research

& Accountability Committee, and the Data Collection Action Team, opened the school to collaborative research and design efforts, while also ensuring that such efforts were critically examined through collectively identified local priorities. These formal structures had led to the articulation of student outcome goals that had been operationalized in the form of classroom time dedicated to student agency and community-building work. The existing culture and practices around local inquiry, design, and instruction then allowed the school to identify a potential research partnership with the researcher as one that will likely align with the school's priorities and broader educational vision. The existing infrastructure for design and research at the school site, and the artifacts and practices that emerged from these efforts such as the school's 4CCs, played a central role in the researcher and educators' ability to identify appropriate boundaries for collaborative research and design, including the identification of the relevant problem of practice, design processes, and desired outcomes for the study. In other words, the school operated as a strong community of practice or activity system where the members shared explicit goals and embedded practices, roles, and expectations to achieve them (Engeström, 2011).

Diagram 4.1: Infrastructuring 1 - Conceptualizing Participatory Design with Students in

Community School Context



RQ 2: How did students participate and learn in the context of these design infrastructures?

While existing school culture and practices mediated the initial conceptualization of this participatory design project, at this stage, the participatory design work with students to address local technology practices was a purely theoretical construct that was conceptualized in response to local and general educational areas of improvement. The identification of these needs were driven by the perspectives of university researchers and educators derived from their understanding of the literature on design and school technology use and excluded students. In particular, as the primary facilitator of the would-be participatory design project, the conceptualization of the design process and goals were informed by the researchers' experience and reading of literature in participatory design (e.g. Le Dantec & Disalvo, 2013), design-based research focused on social equity (Bang & Vossoughi, 2018), and asset-based educational analyses (e.g. Yosso, 2005), as well as a wide range of literature on digital media, technology, and equity in educational contexts (e.g. Selwyn, 2010; Warschauer & Matuchniak, 2010). On the other hand, formal opportunities for students to engage in the school's design of technology practices did not exist. Several teachers had engaged in designing various aspects of the school's technology practices, most notably, the implementation of a computer science curriculum, the initial conceptualization of a school-wide e-portfolio (Lorenzo & Ittelson, 2005), and the selection of Schoology as a local learning management system, the school had no central body that organized the ongoing implementation of these tools and practices, and students were not present in these decision-making processes.

RQ 3: How did the design infrastructures mediate the process and outcomes of the school's technology practices?

The school both reflected globally recognized problems of practice around school technology use and school design, while also positioning itself to address these issues by identifying these problems of practice and strategizing solutions. The literature on school technology use suggests that organizational strategy and preparedness, and educator knowledge and learning play significant roles in a school's ability to effectively integrate technology into its instructional practices (e.g. Koehler & Mishra, 2009; Fishman & Pinkard, 2001). The formative nature of the school's progress in both of these aspects of school technology integration, as described by a number of educators, likely explained the ad hoc aspects of the school's design of technology practices, as well as some of the road blocks it had experienced in implementing technology-mediated instructional practices such as a school-wide e-portfolio system that aligned with the school's pedagogical vision. The students at the school noticed this gap as well, with students in the yet to be formed participatory design group and a broader school student survey indicating that technology use at the school was generally limited to teacher unidirectionally communicating with students, mostly about their grades, with few opportunities for students to engage in what would be considered equity-focused use of classroom technology (e.g. Ito et al., 2013). This had meant that there were no explicit instructional practices around issues such as critical media literacy (Kellner & Share, 2005), privacy and safety, or those that connect with student interests (Ito et al., 2013).

The existing assets and gaps in local inquiry practices and technology use had created an opportunity for collective action between the researcher and school stakeholders that responded to local and global concerns at the intersection of both. While there was a documented desire for the educators at the school to address these issues, as a school serving traditionally underserved students, the existing technology practices likely reflected a broader problem where the

technology-mediated learning experiences of traditionally underserved students at school tend to be less rigorous by most measures compared to schools that are well-resourced and serve mostly White students (Warschauer & Matuchniak, 2010). Furthermore, while the school generally viewed the students and the immediate community from an asset-based perspective by positively recognizing their cultural practices and the personal expressions of them (Moll et al., 1992; Yosso, 2005), the lack of formal processes to make these assets visible for the design of technology practices meant that the students' agency in technology use was greater outside of school than it was inside of it. This is not to suggest that students having more agency in their technology use is necessarily more productive for their learning. In fact, given serious concerns around privacy, data use, and other risks associated with digital media use, it is imperative that students receive the appropriate guidance in navigating these tools. However, formal processes to recognizing student and community assets in educational designs have been shown to support student understanding and engagement in in-school learning, lead to the implementation of pedagogy previously unavailable in the local context, and reposition student roles in the learning process to more empowered ones (e.g. Barton & Tan, 2010; Moll, et al., 1992; Schwartz, 2015). The tensions that were collectively identified between the educators and researchers on the school site's technology practices and design processes facilitated the conceptualization of the initial participatory design work with students.

Table 4.2: Summary of Design Narrative 1 Findings

RQ 1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?	RQ 2: How did students participate and learn in the context of these design infrastructures?	RQ 3: How did the design infrastructures mediate the process and outcomes of the school's technology practices?
School context with culture and practices to sustain locally grounded design work	Participatory design work with students to address local technology practices was a	Technology use at the school was generally limited to teacher unidirectionally

<p>and partnerships with researchers.</p> <p>Existing culture and practices around local inquiry, design, and instruction then allowed the school to identify a potential research partnership with the researcher as one that will likely align with the school’s priorities and broader educational vision.</p>	<p>purely theoretical construct.</p> <p>Students engaged in independent discovery and use of technology that was accessible to them, with no processes to transfer that learning into school practices.</p>	<p>communicating with students, mostly about their grades, with few opportunities for students to engage in what would be considered equity-focused use of classroom technology</p> <p>Lack of explicit instructional practices around critical media literacy (Mirra et al., 2018), privacy and safety, or those that connect with student interests (Ito et al., 2013; Selwyn, 2010).</p>
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Design Narrative 2: Project Initiation to Bridging Educator and Student Goals

Design Narrative 2: Introduction

The second narrative follows the first year of collaboration between me as a researcher, and a group of high school students as we built out an infrastructure for participatory design to center student needs in the design process and outcomes, facilitated the gradual “centering” of students within the design process, and designed technology practices that were responsive to the local context and available assets. The narrative will demonstrate how the design infrastructure, student participation, and design outcomes were built on each other, as they were iteratively refined to serve the needs and agency of the students, and respond to the school context. As a result of this iteration, abstract design frameworks and participatory goals were increasingly contextualized, leading to the participatory design group facilitating the exchange and collaboration between students and educators.

Design Narrative 2: Overview

Project Initiation

In the Fall of 2014, I was introducing the new research-practice partnership to his primary partners, a group of 15 high school 11th graders who were enrolled in Ms. Kim's advisory class, nearly a year after school educators and the researcher first begun exploring the possibility of a partnership. The class, reflecting the broader demographics of the school, was comprised of 13 Latin@ students, and two Korean-Americans with about an even number of girls and boys. Ms. Kim, a veteran, Korean-American special education teacher who was a member of the R&A Committee, had agreed to implement the project in her advisory class, viewing the project as a learning opportunity for her students, and a way to gain insight into some of the technology practices that she was involved in articulating. Due to the flexibility of the advisory classes where general culture-building and peer interaction were the goals, and relative latitude teachers and students had in how to utilize the time, it was deemed a good fit to conduct the participatory design project in the advisory space.

From the beginning, I communicated that the goal of the project was for students to become more meaningful voices in the way that the school designed and implemented its technology practices, and that such efforts would also be aligned with existing work by the school's educators. The students in Ms. Kim's class were recruited to participate in the study with the explanation that the project was "intended for university researchers and students to research the school's technology practices and collaboratively design plans to support the school's goals by forming a collaborative work group." The students were also told that the goal of the project was to "develop a critical student voice within the school while providing an additional resource for the school to implement its technology infusion goals." As a result, all students in the advisory except one agreed to participate in the study.

The first formal session was intended to make student identities visible, and communicate that the collaboration encouraged the expression of their diverse identities. Participants were asked to briefly introduce themselves as a student (“Who are you as a student?”), and describe a digital technology tool or digital media that they interact with most frequently. The first to respond was Ms. Lee, the advisory teacher. In her re-introduction to her advisory class, she positioned herself both as a professional who utilizes digital office tools to address her professional goals, as well as someone who utilized personal social media accounts to interact with friends outside of the professional setting. The students who followed her described themselves both in terms of the way they engage in school work, such as “tries not to mess up” and “likes learning but not fond of school work”, as well as their various out-of-class interests, such as “basketball”, “reading”, and simply “kicking it”. Their technology use was concentrated mostly around tools that did not fit into the official script of school life. Students spoke mostly of integrating and sharing media with friends on social media sites such as Instagram, Snapchat, and Youtube.

While the introductions made clear that students saw their general technology use mostly situated outside of the classroom, the initial conversation also allowed for a more nuanced look into the students’ sense-making around technology in which they had to grapple with complex issues like safety and privacy without the guidance of adults. For example, contrary to the myth that students are somehow inherently drawn to technology, the students demonstrated more complex relationships with the technologies they used. When asked what he used Youtube for, a student indicated that he used it to learn more about music, something he was passionate about, connecting his technology use with a personal interest. On the other hand, when another student brought up the fact that he used Snapchat frequently, the room erupted in laughter, perhaps in

response to Snapchat's reputation as a space where more private, and at times sexual, material is shared due to its primary design feature that automatically deletes any material shared on the platform. Similarly, when another student mentions an application named Kick, an application that connects strangers, another student warned to "be careful". These instances suggest that outside of the classroom, students were making meaning out of their own participation in the complex socio-technical systems and developing an understanding of how particular design features of the tools they use combined with the cultural practices that mediate their use affect their own lives.

Building a Student Participatory Design Infrastructure from Existing School Structures

A defining characteristic throughout the design process that was already a prominent feature of the collaboration at this time was the way participants engaged in refining and building the social infrastructures for design. One student, Jessica, interviewed at the end of the first academic year of the project, described the process in the following terms when asked to contrast "the way we do things" in the project with how students typically participate in schooling:

I think it's different because we actually get ... it's not a topic that's thrown at us.

You know how we come up with the problems we saw, how we should, we're the ones setting it up for the group... It's a decision, a mutual decision between the group, of what is it that we're doing. It's not like an assignment that's thrown at us, you know what I mean?... We're building, you know?... The 5th Pyramid... like a ladder, where you go to reach whatever you need. (Jessica, 2/4/2015)

The type of collaborative design infrastructure building, or, infrastructuring (Le Dantec & Disalvo, 2013), that Jessica discussed remained a consistent element of the participatory design activity system. This process of infrastructuring addressed, among others, participant roles and agency, design goals, and interactive routines. As would be evident in the analysis of the first year's collaboration, the shifts in the design infrastructure resulted from intentional shifts in the objectives and constraints of the participatory design work identified through ongoing inquiry and negotiations among the participants, and facilitated the opening of new directions for the collaborative design activity.

Existing assets embedded in the school, such as specific classroom practices and relational trust served as foundational assets to the formation of the initial infrastructure. As mentioned earlier, the initial collaboration was situated in one of the school's advisory classes, a school-wide practice aligned with the educators' goal to build a school community for students where they have a sense of belonging. Consequently, the advisory was a space where students and teachers can build meaningful relationships with each other through the discretion of each advisory teacher. Following this school tradition, the students and Ms. Lee had developed a strong sense of trust with each other, with students jokingly calling her "mom", and feeling empowered to ask questions, disagree, and respectfully choose not to participate in the official activities of the class and work on other assignments instead. This kind of trust seemed to have given students a sense of agency within the school. During a discussion on whether students feel like they need more involvement from their parents, a student made a claim that indicated the level of agency students feel at the school:

In this school, no one really fails because everybody knows each other and the teachers care. But in other schools they're like "oh the students don't wanna..." but it's really just the teachers that don't want to teach... Since we're old enough to know what we're doing, they mainly associate with us... For example, if it's discipline, you can't tell us "we're gonna call your parents." It's not gonna have the same effect as a little kid. (David, 9/26/2014)

The claim by the student suggested that the existing practices at the school had already cultivated a level of trust and agency among students and teachers that encouraged the students to engage actively in negotiating their school experience.

At the same time, existing power dynamics and traditional school practices seemed to prevent students from fully engaging in the participatory design process. During the first several sessions, and to a lesser extent throughout the first year, general discussions tended to be muted, with the participating students needing regular reminders that their vocal participation in design discussions were paramount. Asked to speak on this issue at a later interview, Jessica responded, referring to the fears associated with speaking out, "the thing too that I feel, they're scared of the recording too. I think it's because they think that somebody superior might walk through and hear them or something. They might blurt out something they're not supposed to." Jessica's analysis of why students may have found contributing to discussions challenging suggests that some existing power dynamics, in this case the role of adults as evaluators of student speech, could have acted as an impediment to full participation in the design process.

Yet, as some traditional school structures may have been impediments to student engagement in the design process, they also served as initial assets to the collaboration. It was a

meeting early in the collaboration, organized along traditional classroom power dynamics with the adults as primary facilitators and decision-makers, that helped build one of the cornerstones of this iteration of the design infrastructure. In taking the initiative to build the student-based design infrastructure, the researcher had decided the group needed to first articulate a “collective understanding of what we want to achieve and how technology relates to it.” To do so, debate was utilized as a discussion tool for students to make their own thinking visible and reflect on them.

Identifying Student Educational Goals to Guide Design

By the second session with the students, I was able to leverage the traditional adult roles in the classroom and facilitated a discussion from a position of authority to make visible the students’ educational goals to frame the collaborative design process. Making visible the students’ educational goals was a natural first step in organizing design work that sought to make school technology use more relevant to students’ goals and needs. On September 19, 2014, the students stood in an open area within the classroom where they can stand comfortably unobstructed from the classroom furniture. Along four corners of the outer perimeter of this opening where the students stood, signage with the words “strongly agree”, “agree”, “disagree”, and “strongly disagree” were taped onto the wall. At the beginning of the section, the e-portfolio explained that the students were to stand in a corner that most closely represented their level of agreement with the “claim” of the debate. He further explained that the goal for the students were to convince other students to move to their corner, and that anyone was free to change their positions at any point.

The “claim” to be debated was shared with the students as “the goal of education should be college admittance”. The following excerpt from the debate, which begins when a student

who takes a “disagree” stance in relation to the claim asks another student why she took the stance of “strongly agree”, has been highlighted to demonstrate how three of the four final educational goals that were identified to drive the participatory design work emerged.

Dialogue 4.1: Complicating College Going Through an Equity-Lens and Expanding Educational Goals Beyond Academics (9/19/2014)

Turn	Speaker	Dialogue
1	Jessica	I want to ask Evelyn why she is standing at “strongly agree”.
2	Evelyn	I strongly – if you want to go to college education is something we need. That’s why I strongly agree. I want to know why they’re there.” (Pointing to the disagree section)
3	Naldo	Because we’re talking about education in general not only going to college. You can learn from any experience. It’s not just about going to college. Education is learning and you’re learning every day.
4	Lilia	You spend 12 years trying to go to college. The whole goal of high school and everything is to get into higher education.
5	UL (Author)	I strongly disagree now because what we learn in college at least in my own experience, hasn’t been about making my community better or the people that I love better. Everything I learned in college and school for that matter has always been about passing tests and getting certain grades. When I graduated college, I really had to reexamine what made me happy and how to do the things that make me happy. I had to relearn a lot of stuff. I think I learned a lot more doing that than in college. I think the goal of education should be to make my community a better place. (UL moves to the “strongly disagree” section.)
6	Lilia	I still agree with that. It’s still a lot of people’s goal. To go to college.
7	UL	Would you guys say that’s the goal of a lot of students here?
8	David	Everyone thinks about finishing high school first. People think about it differently.
9	UL	Tell me more?
10	David	People have different issues, family-wise or financial. It’s different for everyone.
11	UL	If they had those resources, should that be the goal?
12	David	Of course.
Redacted		
13	Student	There are a lot of things in school that you’re never gonna use in your life, like the Pythagorean Theorem. Who’s gonna ask that walking down the street?
14	Student	You might need it for your career.

	2	
15	Evelyn	I might go back there (pointing to agree) because it depends on what you do as an individual. Even if education doesn't provide those opportunities, you can do that yourself. Not the school's responsibility. Education isn't there to help out the community but individuals can do that.
16	UL	Does anybody disagree with that?
17	Jessica	Education is every day. School doesn't teach about life experiences. Life isn't going to be reading books and writing. There's more to it. Nobody teaches you how to prepare yourself to... you know what I mean?
18	Evelyn	Not everyone has the opportunity to go to college and don't know what to do once they're there.
19	Jessica	There's more to college... A life. Not just books.
20	UL	So, our education should be more about what?
21	Naldo	Not more necessarily but more balanced.
22	Notes	I write "education should balance" on poster paper, and ask, "what?"
23	Student 3	Education should balance social life and school.
24	UL	Can I change "life" to "skill"?
25	UL	Any more input? Someone had stated earlier that there are a lot of people who want to do different things.
26	21	Students can explore their interests in seminar. For example, if someone is into entomology, they choose it because they're into it. That's what the school is trying to do.
27	UL	So, "education should..."
28	David	I don't know.
29	Jessica	"Help us explore various interests outside of the core classes".

From the beginning of the debate, students drew from their own educational experiences to highlight tensions around college going, a common educational goal which most high schools are organized around, as a primary educational goal. One student (Evelyn) recognized the educational capital that is embedded in college going, and suggested the utility of such capital makes it a worthwhile educational priority (Turn 2). In response, Naldo pointed out that learning occurs beyond the official curriculum of the school in the daily lives of the students (Turn 3). Another student (Lilia) pointed out how their schooling experience has centered on college-going, and highlights the extent to which educational institutions already prioritize college-going, and the extent to which students have bought into this educational script (Turn 6). This led

to another student, David, problematizing the idea that college access as a taken-for-granted educational goal has to be complicated given that students come with different needs and backgrounds (Turn 8, 10).

As a result of this debate, the group identified the students' educational goals that addressed some of the tensions in current educational settings that were discussed in the debate and would be examined through the co-design process. The student discussion that stemmed from the debate was categorized into the following three educational goals, which were presented to the students the following week. In the next meeting, students were asked if the following three points were an adequate summary of their educational goals based on the debate. These goals will be references as Student Goals (SG) from this point out:

SG 1: Students need resources for college access.

SG 2: Education should balance social skills & academics.

SG 3: Education should help us explore various topics outside of core classes.

In response, one student, possibly referring to the idea that students should be given opportunities to explore topics outside of core classes, commented on the seminar classes offered at the school. The seminar had been a teacher-driven space that was part of the initial school design, where teachers can teach a class, for credit, a class that aligns with their subject matter through non-traditional methods such as special projects and topics. The student stated, "for seminar, instead of the school giving us options for us to choose from, we should give them options about what we want." Asked how that might be worded into another educational goal,

Naldo suggested, “give your opinion?” After a few iterations, and a discussion on whether it was more important for students to have a voice in how they choose their seminars specifically, or their educational path more broadly, the group decided to add “students should have a greater say in how the school is run”, as another educational goal to pursue. Consequently, the group settled on the four educational goals of:

Table 4.3: Year 1 Student Educational Goals

Student Goal	Rationale
SG 1: Students need resources for college access.	Much of schooling is organized around college going, and it remains a central goal for many students. College graduation is a necessary condition for many pathways.
SG 2: Education should balance social skills & academics.	Career and life outside of high school, including college, is going to require skills beyond academic content knowledge.
SG3: Education should help us explore various topics outside of core classes.	Life beyond high school is going to require students to identify interests and pathways that are outside of the boundaries of core academic classes. Important learning occurs outside of core classes.
SG 4: Students should have a greater say in how the school in run.	Students should be key voices in articulating what their educational pathways to attaining their educational goals should look like.

These educational goals would serve as a framework for the collaborative design work and the design of an e-portfolio system.

Participation in Design for Student Learning

In spite of the researcher’s efforts to center the design outcomes on the students’ educational goals as described above, he had reflected that he had not discussed how the students wanted to participate in the design work itself. In preparing for a meeting shortly after determining students’ overall educational goals, I wrote:

I realized that we haven't had a conversation around what kind of goals students have for participation, and the skills the students want to develop in light of those goals. We will begin with a 10-minute conversation where we ask what the students want out of this experience, and the skills we have to practice to get there. (UL, 10/03/2014)

Consequently, during the following session, the researcher asked the students to consider how they see their own development in the context of the collaborative work:

We talked about our educational goals, but we haven't talked about what we want to be able to do and what skills we have to develop to be able to do the work that we committed to... What do you guys think about where you guys want to be in one year through our experience together? What do you guys wanna say we did? Like we were able to do this, we were able to do this... (UL, 10/03/2014)

In the ensuing conversation, students began articulating not just what their design goals were, but how they see themselves participating in the operationalization of those goals. For example, Maria replied, "in general, (I want to) get better at discussion skills. And achieve some of the educational goals... Mr. Garcia told us when we're in college depending on the college the smaller the class the more discussions this could help if we get good at discussion. It's a good tool for us... You said we would split into groups. I think this will help us get more comfortable and then we can try as a whole."

Yet another student, referring to a comment made about sharing our findings with school stakeholders, including teachers and administrators, added, “I think we should be able to discuss our findings with our principal and vice principals so that they are able to have input from students about what they think about how technology is being used in the school.”

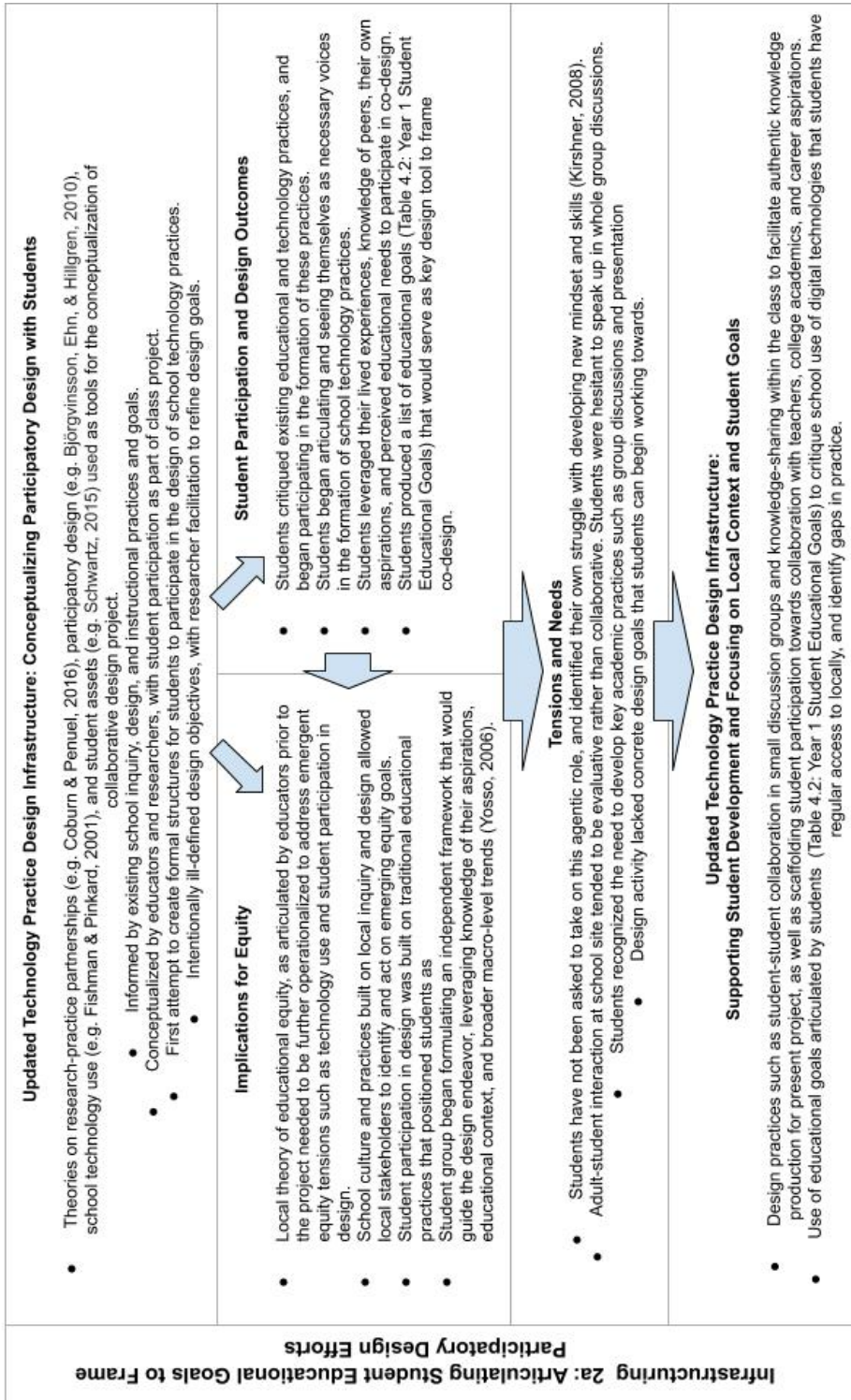
Asked if there were any skills that can be developed to achieve some of these processes, Naldo further added, “Communicating. We do have a problem with that. Maybe people have ideas but they’re scared they’re wrong.”

In response, I asked what might give students the confidence to communicate more, Maria responded, “I think the information that we have. Depending on how much of it we have. We need to have something to talk about... We need different ideas and perspectives.”

This session, in addition to similar conversations in the future, demonstrated that the student participants desired a design infrastructure that would facilitate the development of skills that would advance the design work directly and their lives more broadly. Specifically, the students considered processes that required them to engage in critical discussions with each other and share their knowledge with a broader audience to be beneficial for their personal educational growth and for the success of the project. Furthermore, the students identified specific processes that they theorized would mediate this development such as splitting into smaller groups to practice their discussion skills before engaging in larger discussions, and expanding their knowledge of the various perspectives within the school about technology use to advance their expertise and authority within the design domain. Diagram 4.2 illustrates how the initial design infrastructure which was facilitated by me through traditional classroom practices helped make the students’ educational goal visible, and how generally passive participation of students in the

discussions led to refinements in the design infrastructure to focus more on scaffolding participation for students.

Diagram 4.2: Infrastructuring 2a- Articulating Student Educational Goals to Frame Participatory Design Efforts



The following sections will demonstrate how the broader educational goals that were articulated by the students in earlier discussions, combined with how they conceptualized their participation in the participatory design process, led to the various design outcomes of the first year's collaboration.

Co-Evolution of Student Participation, Design Goals, and Design Infrastructure

When the design work was centered on students' educational goals, and the design practices were adapted to meet the students' goals for participation, it created opportunities for students to participate in critical discussions that connected their existing knowledge of technology and the school's practices in relation to their educational goals. In response to the students' desire to engage in small group work to develop their discussion skills, and the educational goals that have recently been articulated by the students, I planned for a design meeting that would have the students to practice these skills while also identifying problems of practice around technology use that the design collaboration can address. The students were asked to split into groups of three or four students, and to choose a digital tool that they identified as accessible in the school ecology the previous week and create two columns on butcher paper. On one column, they were asked to identify, in their groups, how the tools they chose were currently used (or not) to further the educational goals they identified previously, and on the other, how they saw the digital tools potentially being used to advance their educational goals.

Three weeks later, students were presenting the outcome of their discussions. The following excerpt from one of the student presentations represents the new ways students positioned themselves in relation to the design goals, how students' developmental goals were served in the process, and the ways students began refining the educational goals they have articulated in relation to technology use at the school.

Dialogue 4.2: Critiquing Technology Use with Student Frameworks (10/24/2014)

Turn	Speaker	Dialogue
1	Notes	Maria and Evelyn are standing on both sides of the poster.
2	Notes	Evelyn starts off the presentation by saying “my name is Evelyn”, which is quickly followed by “my name is Maria”. Evelyn quickly takes over again and says “Our topic was Google Apps”. There is a rhythm in the way they are speaking back and forth, as if they have been rehearsing.
3	Maria	We use Google Apps now for college folders in certain classes, we share documents, assignments, personal essays or outlines, and we send emails. We browse for college majors.
4	Evelyn	And then for the other side, “how could it be used?”, we suggested that we should have connections with administrators from universities of colleges, or just people who have connections that can help us out. We also suggested that everyone should have a college folder since we noticed that only seniors or AP classes give you a chance to do it. We also suggested that everyone should practice writing personal statements. Everyone should start at like 9 th grade or something because it is super helpful. Not only that but we also wrote down...
5	Maria	That we can increase our social skills by communicating with professors, college administration, and all that.
6	Notes	There is a brief pause as Maria looks to Evelyn.
7	Evelyn	Oh, and then the last one was we could create a Google Form and share it with the whole school from 9 th through 12 and have a survey asking what classes, what they like to take and have the option so that they can tell us what they want to learn besides the basics like math and social classes.
8	UL	So, like a survey for the seminar classes?
9	Notes	Evelyn and Maria exclaim “yeah!” at the same time.
10	Evelyn	And that’s it!
11	Maria	Any questions? Comments?
12	Ms. Kim	Do you guys have any comments?
13	David	I like the poster, it looked very nice looking and you can tell they actually know what they’re talking about... they looked happy about what they were talking about like they meant it. They had a nice presence.
14	UL	I want to add to that. The nice presence thing, I felt like you guys had a lot of confidence because you planned out what you were going to say.
15	UL	I have a question. When you guys said college folders, what do you imagine to be in that college folder?
16	Maria	Well, we know some students have college folder, and teachers provide information about how to apply or how to structure their personal statement...
17	Evelyn	Yeah for example we have a college folder for our AP English class, so our teacher he provides us with examples of certain essays that could help us later on, and also what she mentioned, structures, like he gives us

		surveys and questions that are like actual scholarships so he helps us with that.
18	Maria	Edits.
19	UL	And are these college folders only available to your AP classes for now?
20	Evelyn	Well we asked students in the regular English class, and they said they don't have one.
David	Mauro	You guys had a good attention grabber.
22	Jessica	The poster is an attention grabber.
23	UL	Anyone has something else to say? Ideas to add to what they were saying? Agreements? Disagreements?
24	Naldo	I agree.
25	UL	With which point?
26	Naldo	With everything.
27	UL	Can you be a little more specific, because I think if you're meeting with other researchers, we're gonna want to know a little more than that right?
28	Naldo	So the whole purpose of this is to make a... what?
29	Maria	Why do you say you agree with everything?
30	Naldo	Cause I was reading right now and like everything is accurate.
31	Maria	Well we're supposed to think about how we can use the tools to get to our goals.
32	Naldo	Well yeah, I mean cause you can store like all your information right there it will be easier for you. Not just for school but socially too like interact with friends and family. You know what I'm saying?
33	UL	You mean share resources?
34	Naldo	Yeah stuff like that.
35	UL	Yeah, I can see like if you get a resource from an AP class and you think "oh this is a really good tool" you can kinda throw it in Schoology or something like that right? I think that's a really good point.

As the students had predicted, splitting into smaller groups to help students feel more comfortable in making their perspectives more visible and practice important collaborative skills noticeably changed the nature of student participation in the design endeavor, and led to the further refinement of design goals and infrastructures. The most immediately visible shift in student participation was the broader engagement of students in the design process. In previous sessions, student engagement was either concentrated on smaller segment of the class, or passive to the extent that they simply responded to the questioning of the e-portfolio as the facilitator. However, as the design process was adapted to fit the needs and goals of the students, with

students working through small group discussions and presentations framed by self-identified design goals, a greater share of the students added their perspectives to the design process. The students highlighted here were observed “performing” professional presentations (Turn 1, 2), fulfilling their own desire to practice presentation skills through the design process to prepare themselves for future academic and professional work. The other students had taken new roles as well, providing feedback about both the professionalism of the presentation and participating in the refinement of the shared ideas (Turn 21, 22, 32).

Perhaps more importantly, students began expressing increased agency in relation to the design domain, with students positioning themselves as evaluators of current technology practices at the school and envisioning possible designs for technology practices, both through measures that they have played a central role in conceptualizing (Turn 4, 5, 7). While there were undoubtedly a number of factors that went into the shift in discourse from students simply identifying the technologies that they used to critically analyzing technology use at the school site and building insights for future design work by identifying problems, the identification of student educational goals (framing the design) and the intentional building of design practices to support student learning both contributed to the forms of participation by students. Students were examining the technologies that were locally accessible, and critiquing their use in relation to their educational goals, which then ended up making visible further opportunities for design. The activity structure afforded the students an opportunity to convert what they knew about various technologies and web tools, their uses at the school, and their own needs and preferences, to begin conceptualizing design ideas that could potentially be implemented in the local context.

Building a Collaborative Infrastructure with Teachers

Forming small groups to reflect on the school's current technology use made visible to the participatory design group where the gaps were between the students' educational goals and the way digital technologies and web tools were being used at the school site. In summarizing the discussions, the group came up with the following "problems" with the ways technology was being used in relation to their educational goals:

- Important websites for learning were blocked at the school.
- Tools that can enhance student voice, such as survey functions on Schoology and Google Forms were not utilized for students to have more of a say in the ways they shape their educational experiences (such as what types of courses should be available).
- Access to college going resources were inconsistent, where some students access more resources through classes like AP English that others do not. Tools like Google Drive can be used for students to share the resources and give each other feedback on college applications.
- The potential for social networking tools like Facebook that can help balance social skills and academics are not explored. Schoology has similar functions to tools like Facebook, but teacher monitoring can complicate use. Teachers can make snap judgements about who you are and when they see your communication online, therefore, tools that teachers can monitor were not always the best tools for learning.

Two major design decisions followed the identification of gaps in the school's technology practices in relation to the students' educational goals. The first was to expand the design infrastructure to include channels of communication with teachers. The second that will be discussed in the subsequent section, was to organize the design work around Schoology, with

students exploring different uses of the recently purchased tool that could inform their educational goals.

Identifying the relationship between teachers and students as a key component in the problems of practice around technology use the students identified, I planned for a meeting to identify how the students wanted to work with teachers. The researcher, informed by the students’ request to use the participatory design space to practice critical discussion skills, organized a “fishbowl” activity. The activity positioned four students in the middle of a circle created by the other participants to freely discuss the chosen topic, while the participants in the outside circle were free to “tag” someone in the middle to join the discussion. The discussion topic, “should we collaborate and work with teachers to achieve our goals for this project?”, aimed to refine how the group can operationalize one of the particular educational goals in the context of the collaborative design project that, “students should have a greater say in how the school is run.”

In the discussion that followed, the group began articulating how, and why, teachers should be considered collaborators in the work that the group was embarking on. The discussion, which a partial transcript is shared below (Dialogue 4.3), acknowledged both the pragmatic perspective that teachers were the primary authorities that implement instructional practices and experts in their fields, as well as the aspirations of the students to have a greater voice in the ways school practices. Once there was consensus that teachers should be brought in as collaborators, the group also started strategizing how these collaborations might be built, and what their relationship with teachers should be.

Dialogue 4.3: Reaching Out to Teachers (11/07/2014)

Turn	Speaker	Dialogue
1	Naldo	We should have more power, so we should tell them our ideas and see if

		they agree with it, so we can work something out like, “get on that”, and you know, “make that happen.” You know what I’m sayin’?
2	Mauro	I agree with the question that you gave us. I agree because when we present, even with the posters, it was kind of like I think our group was kind of messing around, but when it comes to actually teachers, say we present to adults and stuff, that’ll be different because we’ll actually take it seriously.
3	David	They’ve been teaching the same way for so long, like why am I gonna change if this works? They’re just... not lazy but... lazy to like change it or, kinda like, scared to change their whole lessons and whatever and way of teaching. Like they’ve already been teaching in a way that’s worked for them so...
4	Jesus	I agree with him because then it changes the whole lessons and stuff, and they’ll been using something they’re not really used to it...
5	UL	What do you guys think... if we want those kind of teachers to change, like the old school teachers, how can we work with them? In what ways... what approach can we take?
6	Adam	Can we like show them the advantages of using technology? Like it makes things much easier...
7	Evelyn	I agree with Adam about showing them how that would work better with us. Since we’re more into technology and stuff.
8	Naldo	I think we should actually start telling the teachers, like getting them more related... into... maybe not go in and ask for everything, but little by little bit. We’re talking about this, this will help us, we think you should... we should be able to... there shouldn’t be a limit to education, and learning and shit... something like that...
9	Mauro	Like let them know what we’re trying to achieve.... That’s why I agree with him....
10	UL	So, in what ways can we do that?
11	Naldo	Maybe... you can help out (looking at Ms. Kim)?
12	Ms. Kim	Oh, ok what can I do?
13	Naldo	You can like tell the teachers cause you meet up with them you have meetings, you know... you can tell them we’re doing this advisory thing. Like make that face...
14	Ms. Kim	What face?
15	Naldo	Like you found out someone died or something.
16		(Class erupts in laughter)
17	Naldo	So you should tell them what we’re doing right now. Then maybe don’t tell them everything we’re doing, but just tell them we should have more say in the school...
18	Ms. Kim	So are we... are we showing the teachers information or are we asking them something?
19	Naldo	We can do both. Show them little pieces of things we have, and then we could ask them what are their thoughts about it. Do they agree? Do they disagree? Something like that
20	Mauro	Disagree or agree we can try to add and move on from...

22	Naldo	And we can ask for feedback
23	Ms. Kim	So I think a question that I have is like, what do you guys want to focus on?
24	Mauro	The next step? I think it'll also be kind of better before we present to teachers or something like maybe we can also get people's opinions about this... but outside of this... like compare and see if they agree or disagree with what we say.
25	UL	I think that's a really good idea because we can use like a survey or something maybe?
26	Mauro	Yeah. On survey monkey or something...

In the beginning of the dialogue, students shared a number of diverging perspectives on why teachers should be reached out to for collaboration. These perspectives included the desire for students to have “more power” in the process of designing instructional practices (Turn 1), having an authentic audience for the student participatory design group to encourage more internal focus (Turn 2), and the belief that students’ ideas on how technology might be utilized in instructional spaces can be a catalyst for teachers to shift their own practices by helping them overcome emotional and technical barriers (Turn 3-6). Quickly, the students seemed to buy in to the idea of collaborating with the teachers, as they quickly moved on to discuss how they might begin working with the teachers.

The rest of the dialogue dealt with how students might begin building a relationship with teachers in a way that leads to concrete pedagogical shifts from the teachers. Evelyn led the group into this discussion by suggesting that teachers might benefit from the students’ expertise, as they are “more into technology” (Turn 7). Naldo and Mauro, in contrast to Evelyn’s implicit assumption that students had more technical knowledge, pointed to the broader educational goals that the students had articulated, and suggested that teachers and students developing a shared understanding of pedagogical goals and how technology might contribute to those goals (Turn 8-9). When I asked how these types of exchanges might be facilitated, Naldo, consciously or not, began to directly embody teacher-student collaborations. Looking to Ms. Kim, he asked if she, as

an insider, can act as a messenger to the teachers (Turn 11-17). This idea of unidirectionally “telling” teachers what to do shifted quickly when Ms. Kim asked if the students intended to simply present information to the teachers, or if they were going to ask them to take specific actions (Turn 18). Naldo and Mauro suggested that the exchange should be multidirectional, and that while students should articulate their perspectives, the conversation with the teachers should lead to a more mutual understanding of what the collective goals should be (Turn 19-22). Prompted by Ms. Kim again, the students then decided that as they represented student perspectives, they needed more data that can give them confidence that they reliably represented broader student voices, suggesting that they should understand the student perspectives outside of the immediate group by conducting a survey of students (Turn 23-26).

In choosing to collaborate with the teachers, the group then began discussing in more detail what this collaboration would entail. While the students had already decided they wanted a mutual exchange of ideas around their educational goals, and how technology might inform these goals, there were still many questions regarding how the group would organize such an exchange, and what the foci of the knowledge exchange would be. Drawing from their experience of splitting into groups to investigate various technological tools independently as they had done before, they decided that this time, they wanted to introduce more cohesion across the student group, as they wanted a more unified voice as they began working with teachers, and they felt that they could build on each other’s ideas and help each other improve the way they presented their own ideas. While some argued that working on a single issue might prevent the group from leveraging its diversity of perspectives and expertise, the students tentatively decided to focus on investigating the role Schoology can play in addressing their educational goals due to

the platform's increasing visibility and sense that the tool's affordances were not leveraged to its full capacity.

Focus on Schoology

Schoology had been a visible tool for the students, as evidenced by the fact that it was referenced frequently in the discussions of the participatory design group. In the early discussions, the students had expressed a mixture of bewilderment and resentment about the tool that had been purchased recently. Their evaluation of the tool included visceral reactions such as suggesting the tool is “wack”, and questioned why the school had shifted from a previous digital gradebook named Ngrade that they were accustomed to, to Schoology only to have it serve the same function of sharing grades with the students. Pablo summarized these feelings best, when he said, “we believe that Schoology wasn't really necessary. I don't know why they brought down Ngrade because it was important for us to check our grades. With Schoology, we feel like only teachers use them to talk to each other or post things that we students don't care about.” In spite of these feelings about Schoology, students also expressed a level of curiosity with the tool, wondering why, given the many features that they observed on the platform, they only saw it used to share grades to the students. Knowing the students' desire to begin collaborating with teachers, and having knowledge of the teacher-led process that led to the purchase of Schoology, Ms. Kim proposed inviting an administrator, Ms. Lee, to share with the class how the teachers ended up deciding to purchase the tool.

The following week, Ms. Lee had joined the group to share her insights on how the teachers at the school had come to purchase Schoology for the school. She explained to the students how the decision to purchase Schoology was made through a teacher-led inquiry process (“They looked at all the things that we want, they started researching different products.

Schoology, Ngrade, Google Apps, Misis, Naviance, Digication, anything that was available. They put green, red, and yellow, like so green means it has it, yellow means it's in the process of creating it, and red means they don't have it. And then they talked about pricing, how much storage, can it integrate with [School District], it was a full... it took a long time").

She then explained in more details the decision to purchase Schoology in response to the need for a user-friendly platform for teachers and students to share data more conveniently, communicate and stay updated with each other, and most importantly in the context of this analysis, to house student e-portfolios where students can make visible their holistic growth to different audiences:

We wanna make sure teachers can grade, that you can submit assignments, that you can actually learn in the class and everything is accessible online... We also wanted a portfolio. So, a portfolio is a kind of like a tool kit that has all the little pieces that describe who you are. And it can shape your identity, not just as a student but as a young person who is growing up, you know, and have all these different interests. Maybe you're into athletics, maybe you're into a club, you want to apply to college and you want to have a place where all the information is in one place. Ok, so we look at this as a K-12 e-Portfolio. "e" meaning electronic portfolio cause no one's going to carry around a big, big fat binder. That's not gonna happen... You want to have something that you can show right away ok? Then we thought about ways to communicate. We can do text messaging or messaging through the LMS, and a calendar, cause there's tons of schedules, different times and dates events that are going on, we wanna make sure everyone

knows. Then most importantly, it's the design and usability... It also needs to be very user-friendly cause as you know at our school, all the teachers, not only do they teach in classrooms, but they also do other things. We can't have someone who's just sitting down and solving all the problems that maybe the LMS might have. (Ms. Lee, 11/14/2014)

Ms. Lee also navigated the students through the various features and functions of Schoology, focusing in particular on the various utility and design features, as well as insights about usage data ("there's a lot of people that visited the site today... I love it, the students are beating the teachers. But do you see the pattern? When the teachers use it? The same students use it"), and the boundaries of their privacy ("even though I have access to your account, I actually can't see your personal folder"). In addition, Ms. Lee noted several times that the teachers too were still learning about how the tool can be utilized ("Right now, [Teacher Name], [Teacher Name], and I are trying to get this going, but you understand that it requires a lot of time to put training together, and also, there are some things that we don't know how to do yet, cause it's new to us"), confirming the students' assumptions that their teachers were also in the process of better understanding the digital tools at the school site.

The following week, the students-centered group continued to investigate Schoology as the central foci of the group's design work. After conducting their own investigations of the functionalities, design, and potential of Schoology that mirrored that of the teachers, the students formally summarized their evaluations of Schoology:

- a. Schoology looks a lot like Facebook. This can be both useful and problematic - useful because we are familiar with the format, a problem because students might see it as an outdated tool.
- b. Schoology is still mostly a tool for teachers.
- c. Schoology allows us to track our academic progress.
- d. We should carry out a survey to see how students feel about Schoology.
- e. Students need to be informed about the functionalities of Schoology.
- f. We need meaningful reasons to use Schoology for students to actually use it.
- g. Our group needs to understand the functionalities of Schoology better.

(12/12/2014)

These insights, along with insights from the group's prior work were combined to conceptualize the final design project for the group to round out the academic year.

The decision to focus on Schoology use as a problem of practice to address through student participation allowed the group to further refine the design efforts. Students were now conceptualizing ways to concretely contribute to the improvement of the school's use of Schoology. The group decided to create examples of Schoology use that responded to their own educational goals and gaps in the school's practices, and decided to split into four smaller groups with varying design goals addressing three different uses of Schoology, along with one effort to design a student survey addressing the school's educational practices and technology use. The three design groups, in addition to the survey items, included a group creating a prototype of a student e-portfolio, a group archiving various college-going resources, and a final group broadly examining the calendar function of Schoology to improve the school community's

communication practices and students' ability to balance multiple obligations. These design foci, summarized in Table 4.4, organized the remainder of the school year, and also represented the first time students would explicitly become part of the design of the school e-portfolio system.

Table 4.4: Year 1 Student Schoology Use Design Foci and Processes

Design Group	Design Goal	Design Rationale	Design Process
Student Survey Items on Schoology and Seminar	To develop survey items about Seminar classes and Schoology to be added to the annual school-wide student survey designed locally by educator teams.	Students should have a greater say in the way Seminar classes are designed as they allow students to pursue SG 2, 3, and 4. There needs to be better ways to make student thinking visible. The participatory design group needs to examine the validity of the claims they are making about Schoology.	Students worked with school Research Director to identify key constructs around student experience with technology and the seminar program to examine, develop specific survey items, and analyze data once the survey was administered.
E-Portfolio	To create a prototype of a student e-portfolio that showcases student learning and assets, and serve as a space for stakeholders and students to reflect on and improve student work.	Students should have diverse ways of showing their competencies (SG 2), and encouraged to show success outside of core classes (SG 3). Students need ongoing community support in their learning process (SG 2).	Students developed an e-portfolio prototype, based on Jessica's existing practice of archiving her work on Google Drive, in partnership with a university researcher who was working on a separate project to develop practices to encourage student self-regulation in language development.
College Going Resources	To create an archive of college going resources on Schoology that students can utilize to learn more about colleges and the application process.	Students still have many unknowns about colleges and the college application process, and do not have equal access to college going resources (SG 1)	Students worked with college counselor to identify and evaluate websites that consider their own needs as college applicants, including the need to identify programs that match their personal interests and ambitions, as well as financial circumstances. Students also identified friends who are seniors with resonant stories about the college application to be interviewed for their videos, using cellphone cameras and video editing apps to prepare the interview video.
Calendar Utilization	To investigate the functions of the calendar tool on Schoology and make recommendations	Students need more resources to manage the multiple academic, extracurricular, and social work they are responsible for more	Two students worked with Ms. Lee to examine if there can be a school-wide organization of Schoology's calendar function.

	for student use.	effectively (SG 3, 3)	
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Diagram 4.3 describes the infrastructuring process that led to the students' decision to focus on Schoology in their design efforts, and the decision to create technology practice prototypes on Schoology that aligned with their educational goals.

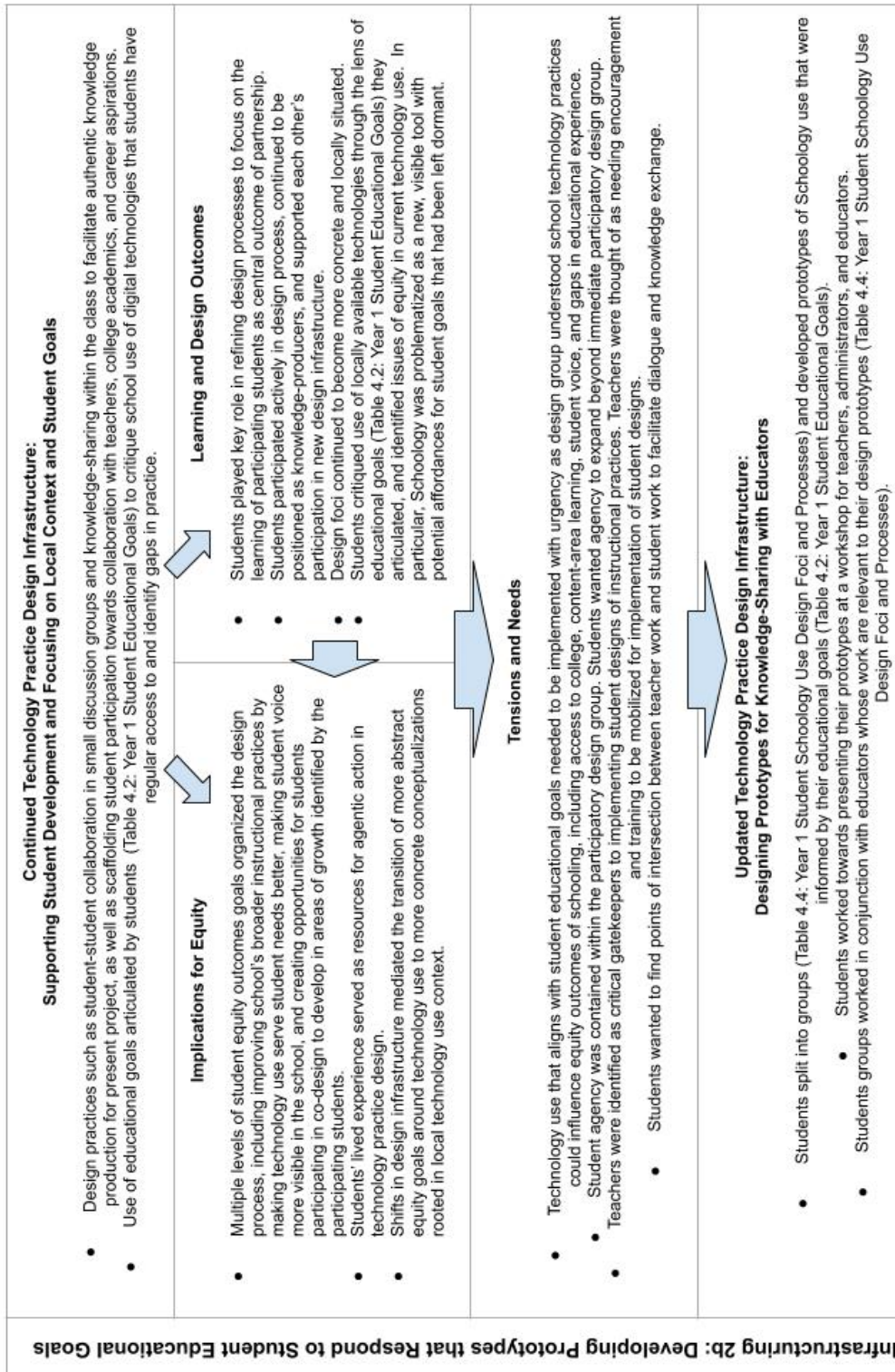
Sharing Design Outcomes with Teachers

As the students continued to develop their prototypes through the second half of the academic year, the group began discussing what to do once the students finished their projects. Echoing earlier conversations about the need to reach out to educators the students decided fairly quickly to present their work to the teachers with the rationale that teachers have power and authority within the organization, that exchanging knowledge with teachers can benefit their designs, that student perspectives on Schoology can expand its use beyond sharing grades, and that teachers can facilitate broader use of their designs by introducing them to their classrooms. Consequently, a plan was drawn up to invite teachers to an afterschool workshop where each group will present their work and facilitate conversations around their design goals. A date was chosen towards the end of the academic year, which gave the students about 8 weeks to complete their prototypes and prepare their presentations.

In the weeks leading up to the presentation for teachers, the student groups worked separately on their prototypes, and only reconvened as the date of the presentation approached to prepare the collective presentation. Each group had found natural adult allies who supported their work in different ways. For example, the group that decided to work on new items on the annual student survey worked closely with the school's research director, who was in charge of the

annual survey along with educators in the aforementioned R&A Committee, to refine the survey items

Diagram 4.3: Infrastructuring 2b - Developing Prototypes that Respond to Student Educational Goals



and develop data visuals that conveyed key findings aligned with the students' experiences. The group that was designing an e-portfolio also liaised closely with the research director, who was also involved in the original conceptualization of the school-wide e-portfolio system, as well as another researcher involved in a research-practice partnership at the site looking into students' self-regulatory processes.

Eight weeks later in May, close to the end of the school year, the students had gathered after school in a classroom with about 15 school administrators, teachers, and university researchers also involved in the school as audience members. Students representing three out of the four groups (the Calendar Utilization group had dropped out of the presentation, having been unable to finish their prototype) sat in the front of the room, waiting for their turn to present their cases, which are summarized in Table 4.5. The Student Survey group was the first to present. In planning meetings, they had been charged with introducing the group and its goals as a whole (e.g. "allow student input of what they think the ways that our school can improve the way our school uses technologies") and adding validity to the design rationales of the other groups through the findings from the student surveys (e.g. "Many students are only using Schoology to check their grades"). This was followed by the College Going Resources group, that had further split into two groups: one to evaluate college information websites, and the other to create video interviews of students who had already completed the college application process, both to be uploaded on to the college center's Schoology group. The group looking at college information websites shared websites that they thought helped students find colleges that best fit their personal interests and financial needs, while the other group shared an interview with two seniors discussing their experiences applying to college as first-generation college students. Finally, the group that created an e-portfolio prototype shared a version of Jessica's own e-portfolio that was

intended to, “collect work throughout the years and keep track of their own progress” and showcase “critical thinking, strength and stretches, and data that can be analyzed by student, parents, and teachers.” Within the Schoology platform, Jessica had set up a prototype including a “showcase e-portfolio” that showed a summative sample of her work, and a “progress e-portfolio” that linked to work in progress that can be shared with peers and adults to receive feedback.

Of the work by the students, the design strands with the most immediate relevance, at least to the attending audience members, were the e-portfolio prototype and the student surveys that contextualized the e-portfolio design. This was likely due to the fact that setting up an e-portfolio system had been an ambition that had stalled for a number of the educators who were present. While in the context of this study, it would be impossible to know the precise reasons why some strands of student work were leveraged more than others following the presentation as there were a number a variances surrounding the local context of each strand of work, the life cycle of the designs, as the students had predicted, depended largely on the follow-up by educators. The design outcomes, the narrative that students shared with educators about their designs, and how those designs were followed up by the educators are summarized in Table 4.5.

Table 4.5: Design Group Outcomes and Educator Partnerships

Design Group	Design Outcomes	Narrative to Educators	Educator Follow-Up
Student Survey Items on Schoology and Seminar	Survey items for the annual school-wide student survey in collaboration with the school’s Research Director, which were incorporated into the overall survey the same year. Visualizations of key findings that inform the work of participatory design	“Our group has achieved to find out ways to improve our school by allowing students to speak up for themselves and ways that they think [technology] should be incorporated into the classes. We can teach students how to use the different functions in Schoology besides only checking grades.”	Survey items developed by the group remain in the school’s annual student survey in subsequent years. Group was asked to present findings at whole school teacher professional development following student-organized event to contextualize the e-portfolio

	group.		design.
E-Portfolio	A “showcase e-portfolio” intended to show a summative sample of student work and broader identity, and a “progress e-portfolio” what shows students’ work in progress for peers and adults to provide feedback and support on student learning.	“The e-portfolio allows students to collect work throughout the years and keep track of their own progress. It showcases critical thinking, strength and stretches, and data that can be analyzed by student, parents, and teachers.”	Students were invited to present their prototype at whole school teacher professional development following student-organized event. Jessica continues on to create manuals for teachers to utilize her prototype in classrooms.
College Going Resources	Reviews of college resource websites for their ability to help students find the right “fit” based on personal interests and financial backgrounds. Interview videos of seniors who had already gone through the college application process focused on experience as first-generation college students.	“A lot of students don’t have the opportunities of getting college information from a more personal perspective, there is also a number of people who have experience and knowledge on the topic but don’t have the opportunities of sharing.”	None
Calendar Utilization	Project incomplete.	“We want to get teachers to use Schoology applications more. Keep teachers and also students updated on things that are due at school.”	None

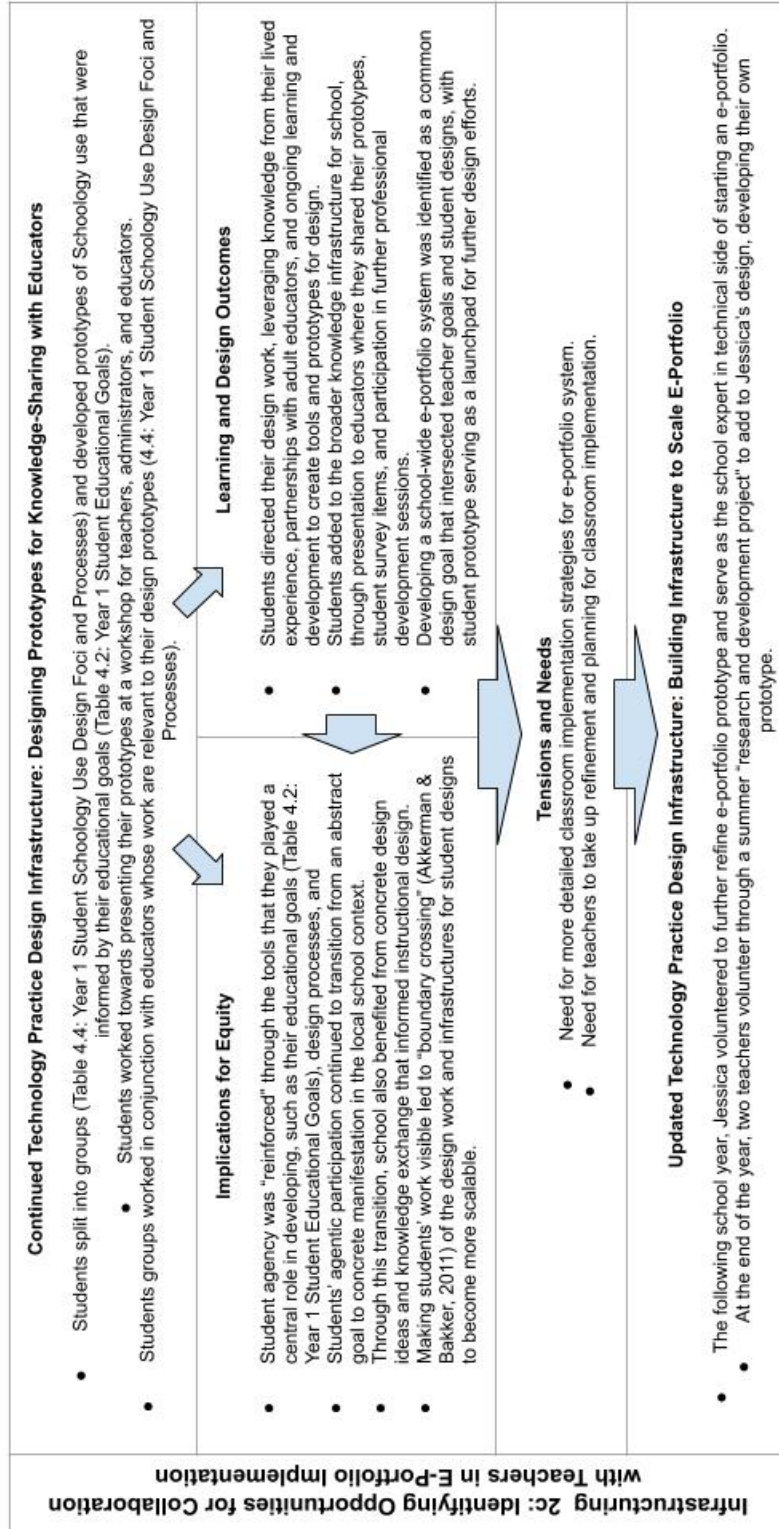
Convergence of Teacher and Student E-Portfolio Design Efforts

From the set of design outcomes from the first year of the student participatory design project, the e-portfolio was the design outcome that initiated the most organizing beyond the immediate work of the students. As shared in the findings section, *Narrative 1: Prior to Project Initiation*, the teachers’ own efforts to build a schoolwide e-portfolio system had stalled due to concerns about teacher workload, student safety and privacy, and the lack of institutional knowledge on digital literacy pedagogy. Having attended the student presentations, the school’s research director, who had been heavily involved in the initial educators’ process, invited the Student Survey group and e-portfolio designers to present at a school-wide teacher professional development. The rationale was that seeing student examples of e-portfolio built on with similar

goals to what the educators had conceptualized would energize the teachers to reengage with the stalled work, feel at ease about the technical and pedagogical knowledge needed to continue designing and implementing an e-portfolio system, and expand the design concept to incorporate student priorities as embodied in their prototype.

Two weeks after the student groups presentation, Jessica and Donaldo, along with Evelyn from the Student Survey group had prepared an updated presentation explicitly focused on advancing the conversation about e-portfolios among teachers. This time, all the administrators and teachers were present as audience members to the students' presentation. Although without her teammates this time, Evelyn kicked off the presentation, explaining to the teachers that the student survey had found that a lot of students, in spite of feeling comfortable with technology, felt that there were no meaningful reasons to use technology while at school, and that teachers generally did not incorporate available tools in the classroom. This was followed by Jessica and Donaldo once again sharing Jessica's prototype, walking the teachers through the ways she conceptualized a "process" and "showcase" portfolio. With Donaldo, closing out the presentation with the suggestion that teachers can begin incorporating the e-portfolio practices into their classrooms, Jessica let the teachers know that she was going to "create a handbook to show teachers how to develop e-portfolios." The session ended with teachers in attendance asking the students questions about strategies for parent involvement, meaningful ways to celebrate student achievements, and developing common instructional practices to ensure broader access to the practice and safety of students. Diagram 4.4 illustrates how students sharing their design prototype led to more targeted collaborations between the teachers and the students who designed the e-portfolio prototype.

Diagram 4.4: Infrastructuring 2c - Identifying Opportunities for Collaboration with Teachers in E-Portfolio Implementation



Design Narrative 2: Summary and Discussion

The infrastructuring for participatory design and the implementation of student-designed technology practices in the first year demonstrated a close relationship between the transformation of the design infrastructure, the students' increasingly agentic participation in the design processes, and the extent to which the design outcomes represented new forms of technology use at the school site.

RQ 1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?

The participatory design research led by myself as the researcher and students in Ms. Lee's advisory class was characterized by three key shifts in the design infrastructure as a result of students playing a key role in the infrastructuring process. As the quotation by Jessica that has been highlighted earlier, the infrastructuring for participatory design in this first year of the partnership was best described as a series of, "mutual decision(s) between the group... building... a ladder, where you go to reach whatever you need." Through the joint work between the student participants and I, the central goal of the partnership, for students to participate more meaningfully in the design of technology practices at the school, remained a central tenant of the joint work. Within this overarching direction of the evolution of the partnership, three key shifts in the design infrastructure were observed. These shifts were:

- a) The shift from a theoretical partnership between researcher and students, to the initiation of a formal partnership with students guided by participating students' broad educational goals (Table 4.2: Year 1 Student Educational Goals).

- b) Design processes aimed at students developing what they saw as important discussion and presentation skills for college and careers used to identify local problems of practice around technology use (Table 4.4: Year 1 Student Schoology Use Design Foci and Processes)
- c) Developing and sharing prototypes of educational practices to serve as guideposts and starting points for educators to refine and implement those prototypes (Table 4.5: Design Group Outcomes and Educator Partnerships)

These shifts in the infrastructure made visible three central themes in response to RQ1, which will be examined in more depth below. These three themes, which all served as infrastructuring processes to serve the foundational goal of supporting students to more meaningfully in the design of technology practices were:

1. The iterative refinement of design infrastructure to ensure that student needs were being met.
2. Continuing to build design infrastructure on local assets while also beginning to leverage resources developed in the context of the new participatory design work.
3. Moving from the abstract to the concrete (Sannino, 2011) through increasing “localization” of the design theories, processes, and outcomes, facilitated by collectively identifying needs in supporting student agency in the design of school technology practices.

These themes are discussed in more detail below.

One of the key characteristics of the infrastructuring process in the first year of the participatory design collaboration was its consistent orientation towards meeting student goals. Most of the key changes that were made to the design infrastructure were in response to the desire to ensure that the design outcomes, as well as the design processes, would respond to the goals and needs as articulated by the students. Consequently, the partnership began with a period where the students and I attempted to develop a broad framework of what students thought their education should entail to guide the design efforts (Table 4.3). This was followed by an equally important discussion on what the students wanted out of the design process, which highlighted the students' desire to use the participatory design process as an opportunity to develop important skills, such as discussion and presentation skills for college and beyond. This led to the group using practices such as small group inquiries and presentations to critique the use of technology at the school and organize the final presentation to the teachers, which was conducted with the assumption that the presentation will help the students accomplish their additional goals of having their voices represented in the school's development of technology practices and encouraging the teachers to implement their final designs. Therefore, at their core, each refinement to the design infrastructure were guided by the evolving goals of the students.

These refinements to the design infrastructure to meet students' needs would not have occurred without knowledge and assets that students had made visible in the context of participatory design. With the above-mentioned case where students advocated to refine the design infrastructure to support their discussion and presentation skills development in preparation for post-high school life illustrates this point. For students to reach this conclusion, they utilized a number of assets what would be considered community cultural wealth, assets that are developed though their minoritized circumstances (Yosso, 2006), as well as broader

knowledge from their lived experiences. This included their aspirational capital to attain higher education degrees, their navigational capital that helped them better understand processes they are unfamiliar with. This was also the case for the infrastructure students had built for the implementation of the design outcome, where their aspirations, knowledge of their own circumstances, and knowledge of local educational practices, among others, helped them articulate needs and solutions for both the design process and the design outcomes.

Much like the conceptualization of the project as described in the previous section, these refinements to the infrastructure in pursuit of student goals leveraged cultural, organizational, and personal assets embedded in the local context. Like the process of initiating the participatory design project, the first year's work with students made use of existing organizational culture and practices. This was evident in the relational trust that the students had already developed with their advisory teacher, Ms. Lee, as well as the educators' willingness to collaborate with students on their designs and attend a presentation that the students had organized at the end of the year that culminated in a final presentation by the students who had developed an e-portfolio prototype at another teacher professional development session. Existing educational culture played complex roles in the design process, however, as I was also able to leverage some of my traditional training as a teacher to organize key discussions in the course of the year, including the debate that helped identify the students' educational goals. These institutional and organizational assets did not always positively impact the design process as students had mentioned that traditional student-teacher dynamics where teachers are expected to evaluate students' voices for their "accuracy" made them feel uncomfortable to voice their perspectives in the context of the participatory design work.

What was noteworthy about this particular narrative, was that as the design partnership evolved, internally created resources began contributing to the agency of the students. This was most evident in the way the design infrastructure continued to build on the students' educational goals that were articulated at the beginning of the partnership (Table 4.2: Year 1 Student Educational Goals). After these goals were initially articulated, they became central building blocks in building the participatory design infrastructure. These student goals guided the students' evaluation of the school's technology practices, as well the design of their prototypes. In between such work were other artifacts and codified student knowledge that shaped the subsequent design infrastructure. For example, the group was able to conceptualize a teacher workshop centered around students sharing prototypes of Schoology use with educators, when the students' perspectives on problems of practice around Schoology use was codified into a concrete list. In this manner, as the design infrastructure evolved from an abstract one that I had initially conceptualized into a living design infrastructure dedicated to supporting student agency, it began producing its own artifacts that helped the participants assert their agency in the school's technology design process.

Finally, the development of the design infrastructure in the first year was best described as, what Sannino (2015) calls "ascending from the abstract to concrete", where theoretical guideposts for the formation of a participatory design infrastructure continued to take on more contextual relevance and theoretical clarity. In the case of the design infrastructure, I initially drew heavily from literature on participatory design (Le Dantec & Disalvo, 2013), youth participatory action research (Camarrota & Fine, 2010), and asset-based views of socially marginalized students such as literature on community-cultural wealth (Yosso, 2005) in the initial facilitation of co-design. In other words, while the initial design infrastructure built on

theories of co-design and student agency may have been theoretically sound, the infrastructure had not had the opportunity to take on the specificity in its own guiding theories and practices that were needed to adequately serve the local context. This was done through the actual participation and dialogue with students, who used their knowledge of self and the local context to identify local needs and possible solutions, such as reshaping the collaborative process to serve students' learning needs, and deciding to focus on Schoology as a design target due to the perceived lack its uses that were meaningful to students. As such, the design infrastructure continued to reorganize itself to address specific, concrete problems that were rooted in the local context. This transition was best summarized by Evelyn, who described the process in the following terms:

I feel that we kinda started off not bad, but people weren't interested... But once we... started gathering real information and data, students were getting into it like, "oh we're actually doing something." Maybe if we had started differently, maybe students would've liked it more in the beginning. The beginning was mostly brainstorming. People weren't taking it as seriously, like it's not really gonna happen. But once we created our different groups, we might've realized oh we're actually taking this somewhere. So maybe it was our involvement in the school, gathering information, and hearing out other people, those were the reasons maybe.

RQ 2: How did students participate and learn in the context of these design infrastructures?

The student participation in this first year of the participatory design project was characterized by their increasingly expert and authoritative roles within, 1) the design process, 2) in relation to the

design domain of school technology use, and 3) in their own self-identification. These developments in student participation directly informed the development of the design infrastructure, with students either being positioned in more expert and authoritative roles through emerging infrastructures, much of which they have played central roles in constructing. On the other hand, students also drew on their new roles and self-identification as experts and authorities as resources to influence the construction of emerging infrastructures and designs, essentially creating a bi-directional relationship between their own development within the design context and the development of the design infrastructure itself. Like they did for the development of the design infrastructure, the students drew from their own assets and resources accessible through the participatory design project to contribute to the shifts in their own participation.

One characteristic of student participation in this participatory design work was their increasing agency and authority in the building of the design infrastructure and their relationship to technology. Although students' participation in the building of the design infrastructure has already been discussed, here, I highlight how students increasingly played more authoritative roles in forming the design infrastructure for the participatory design efforts. As stated earlier, at the onset of the participatory design partnership, I had acted as the primary facilitator of the participatory design meetings. Some of this facilitation was guided by literature, while at other times, I utilized traditional classroom practices that I had used as a teacher. Regardless, these early, formative processes of building the collaborative infrastructure was characterized by its similar dynamics to traditional classroom structures where the adult forms a learning objective for the students, and designs the social processes for the students to reach those objectives. In the case of this participatory design process, however, students gradually took more ownership of

the design infrastructure, as they played an increasingly central role in defining the components of the design infrastructure. Consequently, students transitioned as passive participants in activities that I had organized, to defining their own learning goals and suggesting small group work, to eventually having final control over the design foci, educators they wanted to collaborate with, and the collaborative processes to develop their prototypes. A similar transition occurred in relation to the relationship between students and the technology use at the school. While in the beginning students were simply asked to state the kind of technologies they used and had regular access to, this transitioned to students critiquing the school's technology use through the lens of their own educational goals, to the students developing expertise around Schoology to build their prototypes, to finally sharing those prototypes to educators as local experts in Schoology use.

As the design infrastructure went through its transformations shaped by student input, and in turn, positioned students in increasingly authoritative roles within these design activity systems, the students saw themselves as increasingly important figures in the conversation about technology use at the school. This was evident especially as the students conceptualized and planned for their presentation for the educators. The rationale for the presentation, as expressed by the students, included the perspective that student voices simply ought to be represented in the design of the school's instructional practices, to one that argued that students simply "knew more" about technology than the teachers did, and that the teachers would be needed for the implementation of their prototypes and suggesting that their designs were valuable enough to be implemented school-wide. Regardless of the relative accuracy of these assumptions, they demonstrated an increasing student confidence in their own perspectives and designs. The decision by students to design the prototypes for Schoology use, as well as the student survey

items, also demonstrated the underlying belief by the students that their perspectives and designs had an important role to play in the development of school technology practices.

RQ 3: How did the design infrastructures mediate the process and outcomes of the school's technology practices?

Three outcomes from the design of school technology practices, as they related to the emergent design infrastructures will be discussed in this section. These shifts included:

1. Ascending from the abstract understandings of equity in technology practices to the concrete (Sannino, 2015): Broad theories of equity that already existed in the school, as well as those developed by the students gradually found concrete prototypes and strategies for implementation.
2. Boundary-crossing objects (Akkerman & Bakker, 2011) in design prototypes: Broad educational goals, and local theories of equity developed by teachers and students were jointly embodied in the design prototypes developed by students.
3. Co-design with students as a new knowledge hub for school technology use (Fishman & Pinkard, 2001): The participatory design group had become a new source of knowledge (among others) around technology for the school site.

These outcomes were important not just for the immediate work of the school, but for the future design and implementation of the e-portfolio as well, making them valuable outcomes from the first year of the design partnership.

In that the design of technology practices in the context of this participatory design work transitioned from abstract framings to concrete practices that were situated in the local context,

the technology design outcomes mirrored the ways in which the design infrastructure evolved from abstract framings to a concrete, situated design collaboration. At the onset, the design outcomes in this collaboration were the most ill defined aspect of the collaboration. Outside of being conceptually guided by the idea that school technology practices should recognize the lived experiences of students (Schwartz, 2015), there were no clear design outcomes that were being pursued. *Table 4.2: Year 1 Student Educational Goals*, *Table 4.4: Year 1 Student Schoology Use Design Foci and Processes*, and *Table 4.5: Design Group Outcomes and Educator Partnerships* demonstrate how the evolving infrastructure for design helped narrow down the design foci of the collaboration. As demonstrated in these tables, the design process followed an overall arc where the group first made visible the students' educational goals, then identified general problems of practice around technology use in relation to these goals, identified Schoology as a specific target with local significance, and finally designed local uses of Schoology that would meet the needs of students. As demonstrated previously, all of these processes were facilitated by changes to the design practices that were mediated in part by student feedback.

The design outcomes that stemmed from the design infrastructures increasingly centered on student-led refinements were best described as hybrid practices that spanned activity systems (Akkerman & Bakker, 2011; Gutiérrez, et al., 1999) represented by, among others, elements of traditional schooling discourse, the local theories of equity and corresponding work by the teachers, and the students' designs that were built on their lived experiences and critical analyses of their educational context. The final e-portfolio prototype presented by Jessica fits in this frame when analyzed along its design history. The primary design features of the e-portfolio were two-fold. First, a “progress” e-portfolio would allow students to share their academic work in

progress to educators to receive supportive feedback. This feature both challenged and reproduced traditional school instructional dynamics, teachers continued to be positioned as both the prescriber of academic goals, and ultimately its evaluator. Given the importance the students placed on college admittance and therefore achievement in traditional academic work, this remained a key goal for the design of technology practices. However, the design had also countered what the students saw was a tendency at the school to center its instruction on final evaluations of academic content, and the attempt to facilitate interactions between students and educators that are less evaluative and more constructive was visible in the “progress” e-portfolio feature. The “showcase” e-portfolio, on the other hand, was intended to make visible students’ academic accomplishments as well as accomplishments outside of the classroom that often go unnoticed in formal academic spaces. While recognizing such achievements were likely already valued at the school (e.g. 4CC: “Active and Critical Participants in Society), the school was lacking the technical infrastructure for students to make these accomplishments visible. As a result of the student designs, the school now had a design prototype that merged the previous work of the teachers, and the newly articulated student priorities.

What the hybridity of the e-portfolio and other designs from the first-year student designs suggest is that the school now had an activity system within its broader technology infrastructure that served as a knowledge hub that the school can leverage to “prepare for technology” (Fishman & Pinkard, 2001) in ways that students can offer their own expertise into the formation of technology practices. The design infrastructure that was built up in the course of the first year of the collaboration served a relatively uncommon role in a school’s technology integration process where students can offer the broader school stakeholders knowledge ranging from technical knowledge about tools accessible in the local context, its potential use in relation to

student goals in the form of prototypes, and direct communication with teachers to address specific constraints to implementation. These outcomes of the first year’s design continued to be mirrored in the participatory design of the subsequent years, and contributed to the broader implementation of the e-portfolio system, which will be explored in the following design narrative.

Table 4.6: Design Narrative 2 Findings

RQ 1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?	RQ 2: How did students participate and learn in the context of these design infrastructures?	RQ 3: How did the design infrastructures mediate the process and outcomes of the school’s technology practices?
<p>The iterative refinement of design infrastructure to ensure that student needs were being met.</p> <p>Continuing to build design infrastructure on local assets while also beginning to leverage resources developed in the context of the new participatory design work.</p> <p>Moving from the abstract to the concrete (Sannino, 2015) through increasing “localization” of the design processes and outcomes, facilitated by collectively identifying needs in supporting student agency in the design of school technology practices.</p>	<p>Increasingly expert and authoritative roles within:</p> <p>Discussions on how the design infrastructures should be built.</p> <p>The roles they were assigned in emerging design processes for the design of school technology practices, and within the broader school’s technology integration process.</p> <p>Their own self-perception of their importance and roles in designing school technology practices.</p>	<p>Broad, abstract theories of equity that already existed in the school, as well as those developed by the students gradually found concrete prototypes and strategies for implementation.</p> <p>Broad educational goals, and local theories of equity developed by teachers and students were jointly embodied in the design prototypes developed by students.</p> <p>The participatory design group had become a new source of knowledge (among others) around technology for the school site.</p>

Design Narrative 3: Student Learning through Participation in the Refinement, Implementation, and Scaling of E-Portfolio System

Design Narrative 3: Introduction

Design Narrative 3 slightly shifts the analytic foci from the previous two design narratives to center the participating students' development in relation to their participation in the refinement, implementation, and scaling of the school e-portfolio practices. In other words, this design narrative will primarily serve Research Question 2 that asks how students participated and learned in the context of the evolving collaborative design and implementation infrastructures, as the findings from this period contributed most to this question. Such an analysis was a vital part of this dissertation, as the research aimed to not only have students participate in the co-design efforts, but participate in ways that would support their agency and produce equitable outcomes. To better understand such dynamics, the experience of four students, who joined the e-portfolio implementation efforts a full academic year after the initial student group's conceptualization will be highlighted primarily through interviews conducted at the end of the collaboration. An overview section that provides a descriptive overview of the design and implementation work in this period will be followed by a section that highlights the experience of four individual students as they participated in the collaborative design effort. Finally, as with the other findings sections, a summary and discussion will address how the findings from this context inform each of the research questions.

The shift in analytic foci is informed by the extent to which the period of collaboration highlighted in this section contributed to new insights in relation to the research questions. While the design and implementation infrastructure continued to shift as it had been highlighted in

Design Narrative 1 and Design Narrative 2, barring the new focus on scaling and implementation of the e-portfolio in school contexts, which will be addressed in more detail, general themes related to the evolution of the design infrastructure remained the same (RQ1). Similarly, key shifts in the design and practices of the e-portfolio system can be viewed as further extensions of core themes in the design outcomes that have already been discussed. On the other hand, student interviews from this iteration of the design collaboration has allowed for deeper insights into the nature of student participation in the design of the e-portfolio practices, particularly the ways in which the students' existing assets, including their identity formation as immigrants, athletes, writers, and beyond mediated their participation, and how these assets were in turn leveraged and transformed through their participation in the collaborative effort. Therefore, this design narrative will enrich our understanding of how the design and infrastructure processes, and e-portfolio practices that were continuously developed over the course of the collaboration facilitated the project's goal of supporting student agency and learning.

Design Narrative 3: Overview

Need for an E-Portfolio Instructional Vision

In the fall of 2016, Mr. Lei, a high school math teacher, Dr. Hume, the school's research director, and I were developing a syllabus for a student elective seminar intended to be the small-scale trial implementation of the e-portfolio practices that were developed in the year following the aforementioned presentation of the student e-portfolio prototype. In the year following the student presentation, Jessica and I had responded to the teachers' request to develop resources that can help the teachers implement the e-portfolios, which primarily centered around the use of Google Sites as a resource to develop students' personal websites. This work was then "passed on" to Mr. Lei and another high school teacher over the following summer as part of the school's

“Summer R&D” projects supported by a small amount of funding the school allocates to teachers engaging in independent inquiry on a topic of professional interest. Through this summer work, Mr. Lei, along with another teacher, had added to Jessica’s prototype, in particular, adding tools to help students monitor their progress in graduation requirements. This updated prototype was shared with the whole middle and high school teaching staff, with the hopes that the teachers will take up the process of broader implementation and refinement. This proved to be a miscalculation, as we experienced a considerable pushback from teachers, who felt that while in theory the e-portfolio aligned with the school’s instructional goals, the proposal lacked the required specificity and planning around instructional practices, school-wide routines, and safety among other concerns. In response, Mr. Lei, who had participated in developing the latest iteration of the school e-portfolio system, Dr. Hume, who was an original member of the R&A committee that conceptualized e-portfolios as a local assessment system, and I decided to co-teach a class centered on students developing their own e-portfolios through the school's elective seminars program. The goal of the seminar class was to develop classroom-specific practices to support the implementation of the e-portfolio system and refine the practices based on student feedback. The seminar, *Digital Storytelling for Future Lives*, was initiated in the winter of 2017 with 12 students enrolled, four of whom would become core members of future e-portfolio design and implementation efforts.

Trialing and Refining Through Classroom Implementation

The educators and students enrolled in the class collectively addressed number of challenges that, in retrospect, were likely to arise in a class that had previously not been taught at the school site. These challenges mainly centered on defining the expectations for the class. For example, the syllabus had originally broadly suggested that the seminar:

Provides students with an opportunity to tell their own stories in ways that help them achieve their future goals, whether that is getting into a dream college program, applying for the perfect internship, contributing to an important cause, or finding a meaningful job. In this seminar, students will think deeply about a goal they feel passionate about, and create digital stories about themselves through film/photography, podcasts, web design, and more to show your network that your current passions, histories, and accomplishments have prepared you for the next phase of your life.

The potential deliverables that students needed to work on in this initial syllabus was left broad to leave open means of representation that students would feel most comfortable with. At this point, the educators were still unsure of what the best format for the e-portfolios would be, and were hoping to gain some insights by leaving the options open for the students. However, the openness to seemed to stifle the students' engagement and creativity rather than encouraging their initiative. Students expressed that they were unsure of what they were supposed to do. Furthermore, it had turned out that while seminar classes at the school were, in theory, electives that students choose based on their personal interests, classes were often assigned at random once the most popular classes were filled. The students who had been enrolled in the class, for the most part, had not expressed a strong interest in digital media production. Consequently, the educators initially spent a considerable amount of one-on-one time with the students to conceptualize their projects based on their stated interests and comfort level with design tools, a

move that was possible only because of the high student-to-educator ratio that was attained by chance.

The initial challenges with the implementation of the e-portfolio created opportunities to narrow and refine the boundaries of the class along with students. The students who were enrolled in the class had been told from the beginning that part of the class's goal was to trial the school's e-portfolio program, and that there were aspects of the class that would benefit from student input. As was the case in previous iterations, the students became important sources of insights into improving the e-portfolio practices, and engaged enthusiastically in the conversations that sought to refine the practices of the class. First, the students decided that they all wanted to focus their efforts on creating personal websites as their chosen format for e-portfolios. It was decided that the personal website format gave students opportunities to personally customize their portfolio designs while leveraging the design support and templates that the web design platform offered. In addition to the format of the class's deliverable, students played a significant role in shaping the evaluation of the deliverable. When the educators proposed to evaluate their participation in the class and deliverables through the *Student Standards* (ISTE, 2019) by the International Society for Technology in Education (ISTE), the students immediately responded that the standards did not provide enough guidance to frame their work, and the group immediately began creating a new rubric that would guide the students' construction of their e-portfolio, as well as the evaluation by the educators. The final rubric that was co-designed by the students and the educators provided much more specificity in how the students' e-portfolios should be designed, in more accessible language compared to the ISTE standards. In such manner, from early on in the seminar class, students had played significant roles in defining the format, content, and the evaluation of the class's deliverable.

Through these frameworks, students authored individually unique e-portfolios that primarily focused on their own identity development, which will be discussed in more detail below.

Students Take Key Roles in the Scaling and Dissemination of E-Portfolio Practices

The insider knowledge that students developed as they engaged in the refinement of classroom practices positioned them to take central roles in the scaling and dissemination of the e-portfolio practices that were designed over the years of co-design. In particular, the four students who are highlighted here were involved in almost every step of the design and implementation of the school e-portfolio practices until the project ended. Their involvement and increasing leadership in the implementation of the e-portfolio practices paralleled the broader scaling of the e-portfolio practices within the school. Their participation included:

- Continuing to refine the e-portfolio practices, in particular, how they will be implemented across the school (Michelle, Ray, Diego, Lareina).
- Presenting their e-portfolios at an undergraduate education course discussing the role of digital media in education, focusing on their e-portfolios and their participation in designing relevant practices (Michelle, Ray, Diego).
- Co-designing lessons with the teacher who was inheriting the e-portfolio seminar class from Mr. Lei (Michelle, Ray, Diego, Lareina).
- Mentoring students enrolled in the inherited new seminar class on their e-portfolio development (Michelle, Diego).
- Co-designing lessons with 9th grade English teacher and co-teaching introductory classes to implement e-portfolios across the whole grade level (Michelle, Ray, Diego, Lareina).

The previous sections had highlighted some of the ways in which students leveraged their assets to participate in the co-design efforts, as well as how the design infrastructures contributed to these processes. The following section will contextualize in greater depth the students' participation in the design and implementation of the e-portfolio system and their learning through their participation in relation to their lived experiences and goals outside of the co-design work.

Design Narrative 3: Student Narratives

Student Narratives Overview

This section will highlight key contributions, characteristics of participation, and developmental trajectories of four students who played key roles in the processes described above. Particular attention will be paid to the ways in which the assets that students brought to bear to the design and implementation process, viewed through Yosso's (2005) community cultural wealth framework, and Esteban-Guitart and Moll's (2014) concept of funds of identity, interacted with the design and implementation processes and influenced the development of students and the design outcomes. Each student's participation in the design and implementation process will be summarized, and the importance of these narratives to the research questions will be discussed.

Michelle: Developing a Designer Mindset Through His Connection to Community

Michelle's participation in the co-design efforts was built on an orientation towards social justice that drove him to care for students in the school community that he has been part of since a young age, his comfort with failure and visibility he developed through witnessing his mother's activism for immigrants and his own experience coming out as LGBTQ, and continued

development of his identities and aspirations as an artist and educator. Through these assets, Michelle saw himself as an increasingly central actor in the design and implementation efforts that could be improved by the types of mindsets and perspectives that he brought to bear. He also used his participation in the design and implementation of the e-portfolio as an opportunity to develop his own insights into the work of educators that he hoped to emulate in the future, and made his identity as an artist more visible within, and beyond the school context. He explained his participation in the design and implementation efforts in the following terms:

At first my role was just to be a lab rat. You (the educators) were like, “we’re gonna test a new seminar and you guys are gonna be the first.” Like, “oh sweet, I’m a lab rat!” I wasn’t offended or anything... But then I also saw myself as becoming more invested in evolving it... I can see that we were making changes with everything we would discuss... You guys were actually taking notes when we gave feedback... So, I also saw myself as kind of like a designer. Not the curriculum, but the concept of the e-portfolio and the website itself. And then the summer when we had the whole discussion with my mom and Lareina, I started seeing myself as like a... level up from a creative designer... Like a person that’s not only thinking about the design aspect but the educational aspect and the effect it would have later on. I was seeing more of a future instead of just what I can do right now to change the design of the website itself. I was looking at it as a third person like, “this is the thing, these are the people, so how will this affect the people?” So, I saw myself as someone who can change stuff.

Michelle's impetus to improve the experiences of his peers stemmed from his view of himself as an integral part of the surrounding community as well as the school, and a desire to contribute to its wellbeing. Since being born to Salvadorian parents in the neighborhood, as is the case with many students at the school site, he had lived "two blocks" from the school site for 15 years before moving to another neighborhood. In spite of the move, he stayed enrolled at the school site as he felt that the school provided a safe sanctuary for him to navigate his educational path. He explained:

I wanted to stay at this school after I moved. I felt like I would thrive here better than other schools... I struggle with mental health... The staff here are very understanding of that... It's become a safe space for me here. I talk to everyone here. I have friends here. So it's nice to see some of these places... It's always nice to see a friendly face... It makes it easy. There's no negative interactions that I've had.

This sense of belonging in the local community and familiarity with peers led Michelle to see the well-being of his peers as a central concern in his day-to-day life, and he had brought this orientation and wealth of experience working meaningfully to improve his peers' lives to the design efforts and critically examined what it meant to design a tool for his peers. Asked how he developed a mindset to consider the educational experience of his peers, Michelle explained:

I constantly think about this (how to improve the educational experience of his peers) ... I don't want to see my peers fail. It's sad. I think about things I can do as

a peer to help them. And not, “what can adults do?” It’s kind of out of my hands because those are adults and they’re gonna make their decisions. So, something I do... I talk to a lot of people so they know I’m taking them seriously. If they tell me something, I make sure they’re ok to talk about stuff. Sometimes it’s either they want to talk about it and they don’t and they cut you off and that’s it. So, when they do open up a bit, I make sure that they know they can do things. A lot of people forget that they can do things. So, I make sure they’re aware of their potential. And I ask them where they see themselves in the future and a lot of the times it’s, “I don’t know”, and at that point, I don’t know what to do other than be motivational, but I’m not sure what more I can do.... I feel like you would need an army of child development... or very well-developed peers. “What do they wish they had?” That’s a very complicated question.

Implicit in Michelle’s statement about how he tried to find ways to support his peers as they navigated high school, was a tendency to experiment and trial various approaches to solving problems that affected his peers, and a willingness to make himself vulnerable in the process. Michelle claimed that this was also a mindset he brought to the design and implementation process, attributing such a mindset to seeing his mother engage in activism as a child, as well as his own experience coming out as gay. He claimed:

No idea is a bad idea. Just put it out there. That’s what I think. I might as well say it. It’s not that I don’t care if it fails... I’m ok with learning if it fails. I guess it’s just my personality... I think it came from my mom. I remember very distinctly

she took me to a, “sí, se puede march” ... I think it was about raising wages for immigrant workers, and it wasn't as much what we were marching about, but it was just seeing my mom... she was a straight up thug. I love her so much. So, I was like, “ok, damn.” I think my mom always felt like an outsider, and I always felt like an outsider. I mean from a young age, knowing that I was gay and seeing other people disrespecting (me)... My mom reassured me... She would always just reassure me of being myself and not losing who I am. And then I came out and from there I can just be myself more and less afraid to sound dumb and look dumb. I don't really care anymore. If I look dumb that's 100% ok because I'll learn from it. Everything is a learning experience. In my head, everything is a learning experience.

Combining these orientations, Michelle participated in each step of the design and implementation processes following his participation in the seminar.

While the mindsets and the origin of those mindsets evidently helped Michelle participate in the iterative refinement of the e-portfolio practices and the scaling of the e-portfolio, they also combined with Michelle's enduring love for art to played a role in developing his own e-portfolio that was shared as a key artifact in the implementation and scaling process. For example, the introduction in his e-portfolio mirrored very closely the traits he identified about himself that contributed to his participation in design as a whole. He wrote in his introduction:

I loved going to parks and making friends, I was a very sociable kid and still am. I loved nature and I loved my sisters very much... Throughout my life as a child I

was mostly raised by strong women, and that's why to this day I love and admire powerful women in this world. As a child I loved art and creating things I loved upcycling (seemed to be) useless things and making them useful again. I also loved going to school! Helping my peers has always seemed to be something that I've liked doing... My current hobbies and interests are art, social justice, filmmaking, and helping my community out... I also love submerging myself in my Salvadorian culture, I learn new things about my culture every day.

In his introduction, Michelle wrote, much like in his interview, about the extent to which the women in his life inspired his own growth, his desire to help his peers, connection to the school and the broader community it is situated in, and his interest in art, which was reinforced further throughout the website, including by sharing his own photography.

His interests, experiences, and background had led Michelle to aspire to become an art educator, which, through his participation in the project, seemed to deepen in understanding and scope. Discussing how being positioned to see the thinking and design processes of teachers reinforced his aspirations to be an educator, Michelle explained:

I see myself as a future teacher. So, seeing teachers and how they operate. It's kind of like "oh that's how I'll be thinking." Just like, watching them communicate and talk to each other about class and curriculum and what they can do to change... As a student, I feel more comfortable about who I'm being taught by. I see it's a strong possibility that I can actually be a teacher. Now I think, "I

can totally do that.” I always wanted to be an art teacher but now I want to be an art teacher and a gender and sex professor.

He also added that seeing the inner-workings of educators allowed him to see how he can leverage his interests and skills in art to inform his eventual work as an educator, seeing the connection between the creativity he needs in art, with the creativity needed in professional fields:

I see myself as promoting further education. Teachers and people like you guys are creating stuff... When I was younger, I was like, if you graduate from college you go to a corporate job and that’s it... I realized, “oh you can create stuff even if it's not 100% art”, which is really cool.

These insights by Michelle make visible the through line between Michelle’s assets developed across a number of domains and the nature of his participation in the collaborative design efforts. Through his participation in the project, he was able to leverage his desire to help his peers navigate challenges, his love for art, and an orientation towards learning through challenges he developed as a result of seeing his mother’s activism into new insights and practices related to his aspirations to become an educator.

Ray: Centering Writer Identity Developed Across Multiple Sources

Ray, who was born in the Philippines and immigrated to the United States when she was 12 years old, participated in the e-portfolio co-design and implementation efforts by centering her aspirations as a writer. Like Michelle, Ray had participated in nearly all processes of the e-

portfolio design and implementation since joining the seminar, playing central roles in showing other students her own e-portfolio that was designed to highlight her growth as a writer. She designed her e-portfolio primarily to make visible her strong interest and aspirations in writing, and with one of the more functional e-portfolios to come out of the seminar class, used it as a guiding artifact to demonstrate the connection between the e-portfolio practices and students' interests and aspirations. In her words, the purpose of her website was to make visible her "writing process, favorite books, author encounters, and many more. The purpose of my site is to show what I'm interested in. Readers and aspiring writers are the intended audience of my site." Furthermore, she had contextualized e-portfolios centered on student interests within broader problems of practice within the school, explaining:

We have different identities. Teachers only know us as students... they don't try to get to know you. But through those portfolios, they can get a glimpse of who you are. What other interests you may have. Like when we did it with the 9th graders, I saw students have different conversations about what they want to do. It was new insight about who they are... One of the things that this school implements is that we're a community. We grow together. That's not really happening if we don't know the people around us. Yeah, we can say we grow together, but do we really? We have to get to know each other.

The centrality of her aspirations as a writer in her e-portfolio had meant that her participation in the design and implementation of the e-portfolio was directly connected to the spaces where she engaged in writing, including her out-of-school social networks that spanned

national borders, popular and social media, and in-school academics that facilitated her identity development as a writer. She described her development as a writer in the following terms:

I understood a few sentences in English when I first moved here as a 12-year-old... I hated reading when [teacher name] introduced me to fantasy and science fiction... I really started learning English in 9th grade by interacting with friends... I learned to love reading when I heard about a book called the *Princess Diaries* through the movie, and I kept reading until I finished the series. It was like romance, like a realistic fiction, and I thought, "I might like this genre..." From romance books, I thought it was amazing they can write such incredible things using their imagination. When I was in the Philippines, in 4th grade, I saw my friend write and she was saying "I'm trying to create this story", and got interested in writing. Then when I read the *Princess Diaries*, I thought I should try it myself... You can pretty much write about yourself, change the names and no one's gonna know it's about you. So, it's a way to tell a story... You know I don't have control in my life, so it's my way of controlling what's happening. I can make a character laugh or cry. I can do anything and my characters can do whatever they want... Since I'm a romance writer, and a lot of mine (romances) didn't work out in the past... I take that and extend it into an entire story... and sometimes I use stuff from my friends and my own imagination... I've been a member of Wattpad... it's a community of writers. You don't have to be an experienced writer. You can comment, share it, do whatever you want. If you get more reads, that's how you know you're good. Some people get like 75 million

reads, and if you get a lot of reads, the company notices you and publishes you. I don't have that many obviously, but I do have 3000 reads. It's an achievement. I never thought I would reach a 1000 actually. And my friend's sister writes on that website and she actually got published through the website... I try to get advice from my teachers too. Especially when we write fictional stories in class.

Ray's description of her development as a writer makes visible the range of assets that she brought to bear in her participation in the collaborative process. These assets included her access to social circles that introduced her to writing, her friends' experiences that she used as source material for her own writing, and a broader social circle she accessed through the online publishing platform Wattpad. She also leveraged media, such as what she read on Wattpad, as well as movies such as *Princess Diaries*. All of this combined to develop Ray's relationship with writing, which she saw as a subversive act that she has more agency over compared to her day-to-day life, and a domain in which she felt she had achieved some success in, leading to her continued learning in the domain inside and outside of school, and developed her aspirations to become a writer.

As Ray took on more responsibilities in the e-portfolio design and implementation process using her assets related to her identity as a writer, she had translated these assets into learning within new domains and a growing sense of confidence in her own place in designing school technology practices. She described her own growth within the collaborative effort as the following:

So, you know how we were kind of like the guinea pig for the e-portfolio? At first, I felt like a guinea pig. And you would ask us what is working and what isn't and I would be like, "well, let me tell you what's not working". Then we would talk and go around and Mr. Lei would add something. And I really liked being part of something. Especially with people who have high positions, I usually don't talk to them and wait for them to talk to me. I felt really honored to be part of something big in our school. You get to see them using the thing you decide. Now I see us as mentors. I don't see us as guinea pigs anymore. Even when we went to help the 9th graders, (teacher name) would ask how to do this, and he's a teacher, and it's weird when teachers ask you for help... but to have a teacher ask me for help when I should be the one asking for help, it was like, "wow, I'm actually helping these kids." Especially when they're 9th graders, they don't care about school as much, so when I presented my site, I told them that they need to start thinking about the future and what you want to do because you don't want to be in 12th grade and be lost like, "ok, I'm doing my college apps, but I have no idea what I'm doing." So, the e-portfolio is a great way to think about resumes, the *brag sheet* (collection of accomplishments students use for college applications), and what about you should be highlighted and what about you, you shouldn't show your employers. So, it's a way to say, "I'm eligible. I'm qualified," and it's a way to get them thinking about their future, which is what I told them...

Here, it is evident that as Ray took on greater responsibilities in the design and implementation of the e-portfolio, mentoring younger students through her own

experience creating an e-portfolio that highlighted her accomplishments as a writer, she was contributing to the knowledge base within the school about college going by sharing her strategies for college going. Not only that, but she had positioned herself as someone with significant accomplishments that “qualified” for college.

Diego: Findings New Domains to Apply His Mindsets and Insights

Diego, with a Honduran family background, participated in the e-portfolio co-design and implementation process on what he called a “growth mindset” that he cultivated through his participation in sports, working his way through his dyslexia, and navigating social contexts as a student, as well as insights that him and his peers had multifaceted identities that expressed themselves differently across a range of contexts. Diego observed that these two perspectives helped him sustain his engagement in the participatory design work, as well as make key contributions in the design of the evaluation rubric for the seminar class. His participation in almost all of the co-design processes led him to further strengthen these perspectives, as well as seeing their applications in new areas of growth.

Diego saw his participation in the co-design process as something that was built on what he described as a “growth mindset”, which was developed through his participation in sports, working with dyslexia and navigating his social world. He described this mindset, and his acquisition of it in the following terms:

Everyone has a different set of challenges but I believe mine is the way that I see things. You know this. I have a unique way of looking at things. That's very challenging to me because I see things differently from others. Sometimes it's hard to connect with that. Also, a challenge in school is trying to keep focused. I

have dyslexia so things are hard in that sense. But it's nothing I can't overcome. I believe that challenges are meant to be there. If you're strong you'll get through them... I learned to do this by myself. By playing sports. Especially when you're just running. It's just you and your mind. And mostly track and field or running in general... There's your physical being and your mental being. If you have a weak mental being, you're not going to be able to run long distance... If you keep pushing yourself you can go further even if your body is telling you to quit. I think that's helped me out a lot. What I learned in sports, I try to translate to my education.

He also suggested that his growth mindset played a role in his participation in the co-design efforts, in particular, attributing his continued engagement during the initial struggles of the class to this mindset:

The first few weeks, we were very confused with the class. I think the only reason I stayed there was because I couldn't change class. So, I was like oh well I'm here, might as well do the best. I'm not gonna let the challenge affect me or fail the class because I don't like it. But it turned out being ok.

Another key perspective that drove his participation and contribution to the design and implementation process was his insight that students lived with fluid identities that often shifted along the contexts they were in. He reached these insights both by reflecting on his own

relationship to his cultural background, community, and involvement in sports and academics, as well as observing his peers around him:

I see myself as a regular kid. Very outgoing. People say I'm athletic. Some people say I'm smart. In some cases, I agree, and in some cases, I don't. I'm also just open to helping people out. Sports excite me. And also getting a good grade in math... I talk to a lot of people. I have some friends that are amazing in class, but as soon as you take them out to a field, they can barely throw a ball or kick a ball, and then there are amazing people in sports, but as soon as you throw them in a classroom, it's a whole different world. I believe that every individual is different and unique and because of that, nobody is gonna have the same talents that you do. They might have similar talents, they might be in the similar level, but they're not you. I'm very different from other people. Might be similar, but there are still big differences. I'm my own person.

Diego explained that the insight that his own, as well as his peers' identities shift across contexts, and that each of his peers bring unique assets that deserve recognition, led Diego to suggest changes to the evaluative process of the e-portfolio. Specifically, he explained that this insight was what prompted him to refine the evaluation rubric to allow more individual variation:

I feel like I helped out a lot because I gave a lot of ideas. I was the one that launched the idea of, "everybody's unique in a different way, so why should we have this rubric that's not flexible to everybody?" So that came from my different

point of views... I believe that everybody has a sense of their creativeness and a sense of themselves that's wonderful, but if there's a strict rubric, how will they do that because they'll have to follow the guidelines?

Not only did Diego bring these perspectives to drive the participatory work forward, the insights were expanded, and given additional dimensions through his participation in the co-design efforts. For example, Diego explained that design conversations in class, as well as opportunities to present our work in front of college undergrads and educators made him aware that from an aspirational stand point, he had a somewhat "fixed mindset" that prevented him from seeing a pathway beyond joining the Marines. He explained that participating in the co-design process helped him see himself becoming more agentic within the academic domain, as he became more aware of how his own passions may be cultivated into college-going:

I believe our relationship has helped me out a lot. As you can remember I was really into just joining the Marines. "I'm not going to go to college..." Since I met you, my way of thinking has changed, so, I had a set mindset. I don't have a fixed mindset anymore. I have a growth mindset... We grow as a person. We grow mature... So, between our interactions, what helped me out were the small talks we had in class. And when we were going to present. And seeing and being able to present my work in a way to those two groups... The professor and undergrad class. That really helped me out a lot. Just knowing that you were there and you were passionate about it... I thought, "I'll give this guy some help", and it ended up helping me out... I was very focused physically. Getting a faster time...

Passing through on the academic side of things. If I bump into an obstacle, I just moved out of the way. From doing that, and passing a class with a C. As soon as I got in the class (the seminar), I was like, “oh, college”. I’ve been to colleges, but I felt like it was a waste of time. But when you presented yourself, I was like, “cool.” And Mr. Lei and Dr. Hume had a big impact on me. I was looking for my passions, I realized without college I wouldn't be able to do anything. And I realized that for me to be able to go to college, I needed to look for my passion, and the class helped me find that out. It might not stay the same, but it’s like a big loop and you're never stuck in the same loop.

In addition, Diego explained that he developed other critical skills that were built on his participation in the co-design and implementation process:

I found out that I'm a pretty good presenter now. I’m able to do that in class. Coming from me as a student and also presenting to a class of students, I know that it's difficult, and adding to the fact that school is hard for me in general, I like to put myself into students’ shows, ask them questions and clarify. I found that’s a very important step in leadership. I already had a color in leadership, but that color has many different tones now. I know how different things can be. “Ok you need this. I got you. you don't understand it? I can help you in a different way. You need me to rephrase it?” So just that has helped me out a lot. Being able to present has helped me out a lot. Being in the class during the school year has affected me, and added many different colors to the coloring box.

Therefore, for Diego, there was a circular relationship between his existing mindsets developed through his lived experience and his participation in the participatory design efforts. His existing perspectives allowed him to engage in the participatory design process through initial challenges, and offer critical insights into the design of e-portfolio practices. In return, he had found new domains in which he can apply some of these mindsets in, and a new set of tools that would help him navigate educational spaces.

Lareina

Lareina's participation in the co-design and implementation work was built on a process of integrating a wide range of identities she embodied that were at times in tension with one another, and making these identities visible as a means to encourage others to view their own identities from an asset-based perspective. These were processes that she engaged in prior to her participation in the co-design efforts that she continued to engage in through her participation in the co-design efforts. In her own words, the process of connecting her varied identities to the work of designing and implementing the e-portfolios was facilitated by the trust and routines for design dialogue that were built gradually within the seminar class:

I feel like first, we were closed... it changed because at first we were like wait what are we doing here? We didn't expect to do an e-portfolios or anything like that. We were like, "wait what are we doing? What the hell? What's going on?" And then we started to know each other and kids started being more open. And then later we had better communication. Instead of being shy we were being more

open about questions and feedback and strategies about what to do next in other classes.

These processes made Lareina's multiple identities more prominent in the participatory design process, which was particularly evident in the design of her e-portfolio, where she discussed her various identities through asset-based lenses such as her Chicana identity ("Mexico isn't just about people, but how Mexicans work so hard to achieve what they want. Its culture is my culture as a young Chicana"), the community she has built through organized dancing ("I have learned how to work in teams because in dance we have to work with parents, female and male. We depend on each other and help each other when we need to correct a step or any movement. Representing our many cultures and transmitting stories and ideas made me be confident of who I am"), and her training as a police cadet ("As a young girl I had a bad perspective on cops, but being in this program I learned and heard from cops... I learned about academic stress, dating drama, parent communication, peer pressure, bullying and so much more. I understood and developed leadership skills").

For Lareina, making her identities visible in her e-portfolio was a result of sustained sense-making she engaged in over the course of her life, and understanding her own processes and the challenges that some of her peers may face in making their own identities more visible. Therefore, by making her own identities visible, she had hoped to encourage other students to be confident in their own backgrounds and pursue opportunities that built on their own assets. She explained:

I come from a family of entrepreneurs. We sell hotdogs, chips, Gatorade outside of parades, marathons... I'm a Chicana. I've worked in Mexico. We don't go for vacation. We don't live a normal life like other kids. I've had to work under the sun with my siblings... I'm proud of my Mexican parents for... their dream of having a better future. It just means I feel like I'm more involved... when it comes to Mexico and people in my family... (Being Chicana) means I'm Mexican but I'm also American. My identity is all over the place because being in the (police) cadet you work with police officers... But when you get out of that station, I'm an entrepreneur and I need to sell outside of the of official documents, and I'm brown so at times people think I don't speak English. And White people come and they translate at times what their kid wants. And they're like, "oh you know English". It reflects the complexion of my skin.

At first, (designing the e-portfolio) was hard because I didn't know what to put on the site. Like am I Mexican or am I American? So, it had to do with what I could put or couldn't put, but at the end I put everything on there and who I am. When some people ask who I am now I'm not ashamed. So, it's helped me have a better communication. Just bring everything out instead of them pressuring me and me not having a specific... need to change who you are. In my website, I put like, all these identities and all these things I need to go through. I'm a daughter, sister, cadet. Now I have a website that anyone can see, and hopefully they can learn about it and make them want to do an e-portfolio. We don't know so much of them. Maybe one or two things, but they don't share at all who they are, where

they come from. Maybe I wanted to do it because I wanted other people to be more open and have more confidence in them and where they came from.

Lareina pointed to the difficulties she has experienced validating what she considered to be her assets that were at times viewed as deficits from dominant perspectives, and at other times seemingly in tension with one another, including the work she did as a food vendor, her work as a police cadet, and her ethnicity. Consequently, she had similar difficulties constructing an integrated narrative for her e-portfolio, which she overcame by choosing to show all pertinent identities she carried rather than being selective. She stated that this process helped her further validate her own identities, and also drove her to engage in the participatory design work to help others feel more confident about their own backgrounds.

Design Narrative 3: Summary and Discussion

RQ 1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?

The core thematic frames that were identified in previous findings sections remained consistent moving into the design and implementation phase described here, with the only key difference being that the focus of student participation in this period was on the implementation and scaling of e-portfolios. Student agency in relation to the co-design process remained informed by the school's community-based approach to design, inquiry, and equity. The school's culture and practices around local inquiry and design mediate the flexibility in which Jessica's original e-portfolio prototype travelled and was refined across a number of spaces, including the teachers inheriting the e-portfolio prototype from Jessica to add elements that were valuable to teachers and presenting it to the broader teaching staff for feedback, the seminar class, and finally,

broader implementation across 9th grade classes, all with the assumption that the practices were continuously under construction and refinement. Students who participated in the seminar, to varying degrees, also spoke of the sense of belonging they felt to the school, peers, and local community, or the need to cultivate stronger community within the school, suggesting the school's broader mission to build a strong community that was linked to its locale was being successfully implemented, or at the very least, invested in by the students.

Furthermore, the design and implementation process also continued to find increasingly concrete embodiments of the e-portfolio practices, especially as they practices were scaled to an increasing number of classrooms. The prototype that Jessica had left for the teachers to take over from was supplemented with tools that teachers envisioned using for their own professional work, such as individual students' college requirement trackers, and that was then supplemented by evaluation tools such as the rubric co-developed with students, and pedagogical practices such as drawing from students' interests and identity that were developed in the seminar space. Finally, as the e-portfolios were implemented across 9th grade classrooms, specific lesson plans, templates, and timelines for implementation were developed and shared with the wider school community for implementation. In this way, tools and practices that students had played central roles in developing became an increasingly visible part of the school practices.

Finally, much like in previous design iterations, the co-design efforts with students became a knowledge hub for the school on e-portfolio and participatory design practices. Each iteration of the design process in which students participated in all led to the students playing key roles in documenting, disseminating, and consulting educators based on what was learned in the design process. These led to students taking on roles that were typically unavailable to them in other settings, and unique perspectives that are available to those roles.

RQ 2 + 3: How did students participate and learn in the context of these design infrastructures?

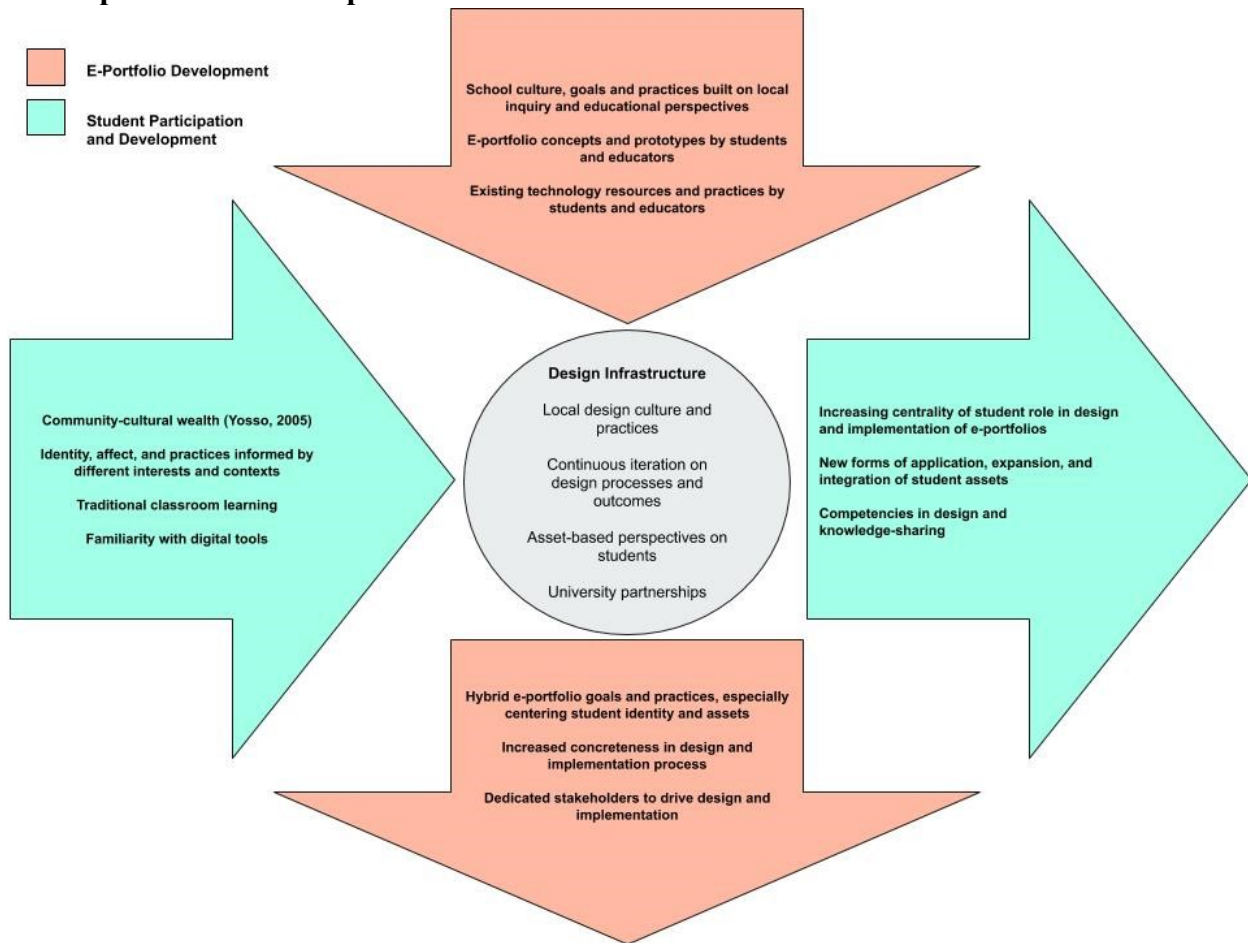
How did the design infrastructures mediate the process and outcomes of the school's technology practices?

Students' participation in the design and implementation process, which included creating their own e-portfolio in the seminar context, collaboratively improving the instructional practices which were mediated by assets that students brought to bear from outside of the school and co-design context, were closely linked to the students' e-portfolio production and implementation. As such, RQ 2 and RQ 3 will be addressed together in this instance. As mentioned previously, student assets were viewed in this writing through concepts of Community Cultural Wealth (Yosso, 2005) and Funds of Knowledge (Gonzalez et al., 2006), which both recognize practices, knowledge, and forms of capital of marginalized groups that are developed and acquired at home and out-of-school contexts, as well as Funds of Identity (Esteban-Guitart & Moll, 2014), which places particular importance on students' recognition and appropriation of the aforementioned assets on an individual level. For simplicity, students' assets were discussed through the seven forms of capital articulated by Yosso (2005) that include familial capital, social capital, navigational capital, resistant capital, linguistic capital, cultural capital, and aspirational capital. Design Narrative 3 provided unique insights on how assets viewed through these frameworks were leveraged and, at times, activated and converted (Rios-Aguilar et al., 2011) to other forms of capital and equity, particularly as they related to the students' aspirations and identities. Student assets and their participation in the co-design and implementation process intersected in the following ways:

- Student assets informed their sustained engagement in co-design and implementation process.
- Student assets were used in the design and implementation of school e-portfolio practices.
- Student assets were activated and converted into other forms of capital through participation in co-design and implementation (Rios-Aguilar et al., 2011).

Each of these themes will be discussed below. Diagram 4.7 provides an overview of how the design and implementation of the e-portfolio intersected with the participation and development of students involved in the process, mediated by key features of the design infrastructure.

Diagram 4.7: Intersection of E-Portfolio Design and Implementation, and Student Participation and Development



In many instances during the participatory design processes, students were faced with a number of challenges to their sustained engagement stemming from limitations in the design process facilitation by me as the researcher, the need to shift mindsets and practices from traditional classroom structures, and the complexity of the task of designing the e-portfolio. Students discussed overcoming these challenges because of various forms of assets helped them address these challenges and constraints towards productive outcomes. Michelle’s example stands out in this case, where he was able to sustain his engagement with the design and implementation process through his commitment and practices to better his immediate community, which he cultivated through a sense of belonging in the school and immediate

community, his mother's social justice activism, and his own sustained efforts to help his peers through various associated with. Furthermore, Michelle discussed how his lived experiences, such as seeing his mother's activism and his own experience coming out as gay has helped him develop a level of comfort with making himself visible. These identities that Michelle brought to bear mediated his engagement with the e-portfolio design and implementation processes by framing his purpose of engagement and developing a willingness to make his work open to critique and open-ended.

Students also drew from their identities to develop and implement the e-portfolio practices. The four students highlighted here have developed e-portfolios that highlighted various aspects of their identities, including as writers, photographers, Chicanas, aspiring Marines, family members, and students. The diversity of their e-portfolios were, at least in part, informed by the work by students, as described by Diego, to broaden the boundaries of content that would be available on the e-portfolios, which was, in Diego's case, a need identified through his observations that the peers within his social circle embodied diverse assets themselves. These particular e-portfolio designs that were built on students' lived experiences, then served as key artifacts that the students utilized, in various moments, as evidence for persuading others of the utility of the e-portfolios, guiding artifact for others to reference during their own e-portfolio creation, and ongoing prototypes that were always being improved upon.

A process that was hinted at in the description of student assets informing the design and implementation of the e-portfolio, were the ways in which the students' participation in the processes built on their own assets had the effect of expanding and reinforcing the participating students' assets on an individual level, as well as create equity for the broader student population. From the individual perspective, this was evident in all four students whose

participation was highlighted here. Michelle, for example, described how through his participation in the participatory design process, his aspirations to become an educator took on new elements, including having better insights into the kind of work and thinking he will engage in as an educator by seeing the backend work that his own teachers engage in, and better understanding how his creative talents and interests might be leveraged in his work as an eventual educator. Ray, on the other hand, focused on her identity as a writer in developing her e-portfolio, and explored ways to expand her supportive network, have her work be critiqued, and make her assets more visible, which she had done successfully on multiple occasions. As the students developed and improved their abilities to make their work visible, and work with and disseminate their work to an increasing number of other students and stakeholders, they had in turn, helped other students develop e-portfolios modeled after their own, help educators at the school site implement the e-portfolio practices, and share knowledge to the broader community of educators about the value of the tools they had helped design as well as the process it took to do so.

Chapter 5: Conclusions, Implications, Limitations and Future Research

Chapter 5 Overview

This chapter provides a summary of the findings in a conclusions section that is organized by each research question. The following section discusses the implications of this study both for the practice and research on the affordances of participatory design for the design and implementation of school technology practices, for building local participatory design infrastructures, and more broadly the how building participatory design processes in schools, particularly those that involve students, support local equity work. This will be followed by recommendations for educational practices around technology use and local, school-based design practices. Finally, the limitations of the study will be discussed along with future studies that should be pursued.

Summary and Discussion of Findings

Research Question 1: How did infrastructure for design evolve to facilitate student participation and agency in the design of school technology practices?

This study found that the existing school culture and practices based on the university-assisted community school model (Harkavy & Hartley, 2009) contributed greatly to the initial formation and ongoing refinement of the participatory design infrastructure. The school was built on the principle of school-level agency, especially for teachers, to engage in the development of local theories of education and practices that corresponded to them, and had the district-level support to build the school on such principles. The school was committed to producing equity for the local community, and its asset-based perspective of the surrounding community was already visible in a number of core elements such as its school vision. The school had also built a

significant level of infrastructure to support the ongoing improvement, refinement, and expansions of educational practices that aligned with its local vision for educational equity that helped the school and educators organize themselves around emerging problems of practice and respond to them. The e-portfolio system, which had already been a stated need by the educators was developed within these structures. It was a combination of these practices and broader school culture that made it possible for educators at the school and I to find common areas of interest and access the necessary resources to initiate the participatory design work with students. The school site's localized design and inquiry practices continued to compliment the joint work with the students, as they allowed for the student groups to collaborate with teacher on an ongoing basis to refine and implement the e-portfolios over four years.

As soon as the participatory design collaboration between the students and me was initiated, students became central architects of the design infrastructure. This work started with the students articulating the object of the joint activity, identifying their design goals as shared in *Table 4.2: Year 1 Student Educational Goals*. This was immediately followed by the students articulating how they thought the design process should be organized (help them develop skills that will be useful in college and careers, like discussion skills and presentation skills). Throughout the partnership, student remained the final decision-makers on how the design process would unfold, with decisions such as splitting into groups to work on diverse prototypes, present their findings to teachers, and present at university lectures were all their decisions. These kinds of discussions that supported students in articulating their goals and refining the design process to meet those goals were heavily facilitated through my own experience in supporting student inquiry that was developed over my years as a teacher. For the rest of the partnership, there was diversity in the ways students and adult educators would

collaborate. Much like what Kirshner (2008) had found regarding variations of adult and youth roles across student activism efforts, the variation in the ways adults educator collaborated with students were driven by the pragmatic needs of specific tasks and level of student expertise, but they always centered students' stated goals as the driver of decision-making. In this way, students remained central figures in building the local infrastructure for participatory design.

As the design group continued to build local infrastructures to support the co-design efforts, the group continued building on artifacts and insights that were developed internally, expanded the local theories on what kind of design practices can most effectively support student participation and agency in these efforts, and concretely implemented the design practices. This reflected what Sannino and colleagues (2016) identified as a process of ascending from the abstract to concrete, where local stakeholders of social interventions exert agency in local contexts through their critical analyses of local activity, developing local theories of change and operationalizing them. In this study, such processes seemed to have feedback effects, where the students' active participation in building design practices reinforced their agency in the broader work of developing and operationalizing local technology practices. For example, as students identified their broad educational goals as summarized in *Table 4.2: Year 1 Student Educational Goals* and also conjectured that using the co-design process as a space to develop key discussion and presentation skills, the group was able to envision a process of developing prototypes of Schoology use (*Table 4.4: Year 1 Student Schoology Use Design Foci and Processes*), which led them to develop concrete prototypes that were shared with teachers for further implementation and refinement through getting in contact with the teachers' own vision and goals to develop a school-wide e-portfolio system (*Table 4.5: Design Group Outcomes and Educator Partnerships*). In this way, student agency in design infrastructure was made more concrete and reinforced

through ongoing refinements and expansion of the design infrastructure over time. The activity system of student design was being built to expand (Engeström, 2001).

Research Question 2: How did students participate and learn in the context of these design infrastructures?

Student participation and learning in the context of design infrastructures that were jointly built with students increasingly positioned students in more meaningful roles within the design and implementation of the e-portfolio, and found expanding avenues within the broader educational context to make use of their lived experiences and assets. Students participating in co-design in these design infrastructures were increasingly positioned in expert and authoritative roles in relation to the design process, the design domain of technology practices at the school, and in their own self-identification. In many ways, it was as if students' roles were expanding along with the expanding design infrastructure. As hinted at above, in relation to the design infrastructure, students were consistently practicing more agency in how the collaboration would unfold. Whereas at the onset of the collaboration, students were best described as skeptical participants in a project that was conceptualized by me as the researcher and several adult educators, their roles almost immediately shifted to contributing to the overall organization of the partnership. They actively participated in the articulation of the goals and methods of design, decided how teachers at the school will be reached out to, and even as the participating students shifted to a new set of students, they were actively involved in how they wanted to participate in the implementation of the e-portfolio across the school. Similarly, their relationship to the design domain, technology practices at school, shifted as well. From having a "layman" knowledge of school technology practices and unspecified ideas of what role technology should play in schools, their knowledge and expertise of the domain became more disciplined and took on an

“insider” perspective as they engaged in data collection through the design of school-wide surveys, conceptually guided the design of the e-portfolio, and became active in disseminating their perspectives both inside and outside of the school. Finally, it was evident that their views of themselves was shifting as well, as they frequently reasoned that others needed to be informed of their own insights and designs, and that their support in implementing the e-portfolio practices would add value to the overall efforts. In this way, student participation in the design efforts increasingly exhibited their agency (Engeström, 2001), as they took on more authoritative roles within the collaboration and took on identities that had not been available previously. In other words, consistent with sociocultural perspectives on identity development, the new situated activity systems that were being developed offered resources for students to construct expanded identities (e.g. Barton & Tan, 2010; Penuel & Wertsch, 1995).

Following an abundance of existing research (e.g. Barton & Tan, 2010; Kirshner, 2009; Schwartz, 2015), the ways students participated in this design effort suggested that building educational activity from asset-based perspectives of students allows students in leveraging those assets to build capital for their community and their own. This process is best illustrated in *Diagram 4.7: Intersection of E-Portfolio Design and Implementation, and Student Participation and Development*. In building the design infrastructure and technology practices, and taking increasingly meaningful roles in implementing the designs and sharing their knowledge of the process, students were found to use a range of assets, including much of what can be categorized as community cultural wealth (Yosso, 2005), funds of knowledge (Moll et al., 1992), and other forms of interest-driven, technology-related, and/or academic practices developed in and outside of school. These assets, through their participation in co-design, were converted into capital through processes that Rios-Aguilar and colleagues (2011) have identified

as *recognition, transmission, conversion, and activation/mobilization*. In other words, participatory design created “exchange value” for student assets that may not have been valued in typical schools and helped them access new forms of capital by developing important skills and knowledge, changing their educational environments and immediate circumstances to fit their needs and goals, and building educational practices that can help other students in the immediate educational context do the same. The example of Michelle, highlighted in the third section in the findings chapter demonstrated this point poignantly, as his existing assets rooted in his familial immigrant background, as well as his personal interests in photography and art were used as central resources in his participation in the design process. By leveraging these assets through his participation in co-design, he played critical roles in expanding the design of the e-portfolio to make visible student interests, supported other students in the development of their own e-portfolios in classrooms, and re-imagined his career trajectory to consider how his creativity might inform a career in gender studies.

Research Question 3: How did the design infrastructures mediate the process and outcomes of the school’s technology practices?

Student participation in the design of school technology practices, framed by the design infrastructure they had a central role in building, helped develop technology practices at the local school site that had previously not been available prior to the study. The participatory design group examined the school context through the eyes of students, and was able to identify areas of technology use that were both gaps in practice, and opportunities for growth. Prior to the study, the school had already laid a fertile ground for the design of locally meaningful technology practices through its commitment to social justice and local inquiry. These efforts had led to local-level conjectures on how the school vision, articulated through the 4CCs, might be

supported by the affordances of digital technologies. One of such conjectures was the idea that student e-portfolios, where student academic work is shared, can support students in their self-assessment and reflections around their academic progress. Yet, due to concerns over a lack of training, concrete design, and explicit plan for implementation, the local theory for improvement had not been operationalized. Furthermore, technology practices at the school prior to the partnership were designed unidirectionally, meaning teachers and administrators made the key decisions about use, while students simply participated in the practices developed by educators. In contrast, students expressed experiencing a lot more agency in technology use outside of school than they did within it. While this last point is not inherently a problem, given the many risks associated with technology use and the need to train students on use, students had already demonstrated that they had a considerable level of expertise in the domain that were not being leveraged within the school. The participatory design work with students served to address some of these gaps.

While the co-design work did not fully address all the gaps for implementation (nor was it intended to), the design collaboration did develop key resources that would aid the continued design and implementation of a version of the e-portfolio that was expanded from the initial conceptualization to include student goals. The development of the e-portfolio practices closely mirrored that of the design infrastructure and the student participation within it, in that the e-portfolio practices grew gradually from an abstract concept into something that was informed by both the teachers' and students' independent educational goals, prototypes that sought to integrate both of these perspectives, and collaboratively implemented across the school with students and teachers working together. As the design infrastructure grew to position students as experts in the original presentation of the prototype to teachers, and then was trialed and refined

through the seminar class, eventually positioning students from the seminar class to lead the broader classroom implementation, the e-portfolio practices were increasingly supported by concrete prototypes and examples, an accumulating knowledge base, implementation plans that spanned several years, and instructional practices and resources that can support broader implementation. While the design of the e-portfolios shifted in their focus over time, the final version that was implemented in 9th grade classrooms were designed to make visible the development of students' in-school and out-of-school lives, including their academic work, personal interests, and college aspirations, with design features originating both in the work of teachers and students. This made the e-portfolio a hybrid practice that crossed several boundaries of activity (Akkerman & Bakker, 2011; Gutiérrez et al., 1999) and featured components of knowledge developed in multiple spaces, including the students' home life, different national origins, and interest-based communities. Furthermore, as the eventual design of the e-portfolio was designed to make students' holistic identities more visible and use those representations as resources for further academic and counseling support. In this sense, student participation in the design of school technology practices had developed a localized "connected learning" practice (Ito et al., 2013) that built on student interests to broaden their participation in civic, political, and economic life.

Implications

Building Participatory Design Infrastructures on Existing Assets

The most important implications of this study pertains to the ways in which democratic practices in schools can be developed and adapted to fit the local context rather than simply having a model of democracy "helicoptered" into a setting. "Development" is a key word here as, in many

cases, democratic practices that support the participation of nondominant communities in the design of key school practices are limited and must be supported. Even for schools that already have a strong foundation for such work, as was the case at this study's school site, emerging needs and changing broader social contexts, such as increased student access to the internet and institutional investments in new technologies, require schools to continuously examine whether these emerging domains of practice are being developed through the equitable participation of key stakeholders. While a school context that is supportive of such work is indispensable, this study found that the ongoing efforts to build social activity to support student participation in design (Le Dantec & Disalvo, 2013) helped students find increasingly agentic roles within the design domain. Furthermore, through their increasingly central participation in the co-design, students created opportunities to leverage their community assets (e.g. González et al., 2006; Yosso, 2005) and expand the boundaries of the joint work as well as the design outcomes. As such, this study contributes to an understanding of participatory democratic practices as situated and illustrates how such situatedness must be tended to through ongoing refinements to the design infrastructure to support the agency of participating stakeholders.

The findings from the study suggests that part of recognizing and responding to the situatedness of democratic processes is to identify the existing organizational assets that can support the construction of democratic processes. Throughout the partnership described in this study, the school's organizational assets, including its educational culture and practices, such as its flexible schedules, played an important role in expanding the local infrastructure for stakeholders to engage in collaborative design. As described in the previous section *Summary of Findings* in more detail, these assets included an educational vision that focused on issues of equity, organizational practices that encouraged research partnerships with university partners,

and class schedules that were friendly towards experimentation. In addition to these somewhat progressive characteristics, many traditional school practices contributed meaningfully to the construction of the partnership infrastructure as well. For example, the role of adults as the primary authority figure in educational spaces was leveraged throughout the partnership to help facilitate the co-design process and scale the emerging designs. This work demonstrates that developing processes, within the school, to map out the school's institutional culture and practices that can support democratic participatory design would be a useful first step in building school-based democracy. Furthermore, it would serve those building these infrastructures to consider how existing, typically more hierarchical organizational structures in schools may be productively leveraged in service of building more democratic practices.

Ultimately, the most critical asset in the construction of participatory design infrastructures at the school cite were the students. The analyses of students' contribution to the infrastructuring for participatory design and the design outcomes emerging from this situated design infrastructure point to the extent to which building a participatory design infrastructure for local context, including the needs of local stakeholders create opportunities for participating stakeholders to express their agency in the design outcomes. As described in the findings section and the above summary, at various stages, the student participants in this collaboration meaningfully contributed to the construction of the participatory design infrastructure by articulating their goals for participation on an ongoing basis, and reorganizing the collaborative processes to align with these goals. Consequently, the design and implementation processes increasingly positioned students in more agentic and authoritative roles, and the design outcomes made visible the very assets that students leveraged to engage in the co-design process. This suggests an important relationship between student assets, the infrastructure for design, and the

design outcomes themselves. First, participatory design processes help develop instructional practices that make nondominant student assets recognized, transmitted, converted, and activated (Rios-Aguilar et al., 2011). In this participatory design work, these assets were also leveraged in conceptualizing the very instructional practices that made these assets visible. Finally, the study showed that such student assets can play a central role in constructing the very design processes that facilitate students' use of their assets for design. Therefore, the study suggests that there is a level of reciprocity between the extent to which design stakeholders participate in design work through their existing assets, and the extent to which the design outcomes are responsive to these assets.

Affordances of Participatory Design: Learning, Technology, and Local Capital

This study highlighted some significant affordances of participatory design that have implications for a) the use of participatory design as a tool for organizational and individual learning built on local assets, b) technology use in schools, particularly in ways that respond to local equity goals, and c) for its role in building capital in nondominant communities. In this section, I will discuss how the study points to the affordances of participatory design in these three domains in more detail.

One of the key affordances of participatory design that was observed was the way in which it facilitated learning both for the school organization and for students who participated in the design work, suggesting that participatory design can be utilized as a form of pedagogy to support learning at multiple levels. This follows Voogt and her colleagues' (2015) findings that co-design with teachers led to both individual, team, and institutional shifts in practice. In this case at the organizational level, the participatory design work served as an explicit activity system (Engeström, 2001) in which its general purpose was to act as a knowledge hub where e-

portfolio design prototypes were developed, implementation was strategized, and other stakeholders were supported in the use of the designs. The work of the group was consistently disseminated to broader audiences, and within the participatory design group, while the members changed, there was continuation in the core approaches to design and implementation, suggesting the development of a sustained group culture. At the individual level, students were afforded opportunities to participate in the co-design process by leveraging their core assets. As mentioned above, not only were these assets made visible in the design process, but they were activated, transmitted, and converted (Rios-Aguilar et al., 2011) as valuable capital through the participatory design work. More specifically, students leveraged their assets was to find new ways of participating in complex design work considered to have broader applications, such as collaborating with diverse stakeholders, presenting in front of academic audiences, and facilitating the learning of peers. Students' self-identification also shifted as they increasingly saw themselves as experts within the design domain. As such, participatory design served as a learning hub at multiple levels, and could be considered a productive approach to organizational development as well as personal learning that build assets at each level of the school ecology.

The organizational and individual learning that was facilitated through the participatory design process contributed to the design and implementation of technology practices that embodied local educational equity goals, suggesting that such design processes are useful tools in addressing the challenges associated with school technology use (e.g. Cuban et al., 2001). As described in the findings chapter, while the school had a strong commitment to building educational equity for the students and local community, it had not implemented any school-wide technology practices that embodied these equity goals. While the participatory design work certainly did not achieve a level of implementation we aimed for, it introduced technology

practices to the school that were aligned with teachers *and* students' educational goals, facilitated the refinement of these practices through ongoing trial and inquiry, and positioned students to support the implementation of the e-portfolio practices in classrooms. Then, processes like participatory design where diverse stakeholders play a role in critically analyzing local goals, problems of practice, and available technology, can play a meaningful role in introducing new technological tools in schools. In particular, such processes inherently raise questions on whether the technology practices at local sites meaningfully reflect the needs of key stakeholders and how they may be refined to do so with more fidelity, what the key local assets are in designing and implementing the technology and how they may be best leveraged, and ensuring that the designs support the user's agency. Participatory design can be seen as a key process that does justice to the complex contexts in which technologies are introduced into.

Finally, the study suggests that participatory design can serve as a process in which local assets are "reinvested" in the communities in which they come from. This view follows scholars who have applied metaphors of "capital" to the myriad assets that nondominant communities embody and access but are often unrecognized in educational spaces (Rios-Aguilar et al., 2011; Yosso, 2005). While an economic metaphor may at times be too reductive of a way to view these assets built over complex histories intertwined with oppression, it is a useful metaphor to consider how and where these assets are utilized in given interactions. When viewed through the lens of community assets and capital, many educational spaces, including technologies and research endeavors, can be seen as extractive, where the assets of nondominant stakeholders and users are used for the gains of those outside of the community. Applying this metaphor to participatory design, participatory design infrastructures can be seen as "exchanges" where nondominant stakeholders can participate in the process of "investing" their assets in

particular endeavors with agency. The study demonstrated the ways in which through their engagement with participatory design processes, students drew from their assets to build a practice which they theorized would benefit their own, and their peers' educational experiences. Regardless of the ends participants in participatory design processes choose to apply their assets to, it is difficult to conceive a scenario in which their assets are not at some level, reinvested in themselves and their immediate community through the learning and designs that follow.

Limitations

This study was limited by the fact that the analytic focus shifted as the collaboration evolved over the course of four years. While such a shift was very much integral to the process, some data points from the latter half of the study that became core foci of the final analysis were not always supported by comparable data points from the beginning. This difference occurred because in the beginning, my analytic lens was still very much focused on student participation in school technology integration processes, while in the latter part of the collaboration, I had expanded my analytic lens to consider the ways in which students participated in the formation of democratic participatory design infrastructures. Because of this shift, I was not able to ask more targeted questions regarding how the earlier participants saw the connection between their assets developed outside of school and their engagement with the co-design process (although those students were asked how their lives outside of school may have informed the design outcomes themselves). However, as illustrated in the findings section, some of these assets were made visible in the design observations and outcomes regardless, and the methods for the study were always going to shift along the way given the nature of participatory design.

Another issue with the study was its inability to study disengagement. This analysis, to connect the refinements in design processes with design outcomes focused primarily on students who engaged with the design process meaningfully and contributed to the technology practice design and implementation. This meant that the analysis did not focus as deeply on a number of students who were less engaged in the design process. Unfortunately, these students were not asked deeply about their disengagement with the design process, and therefore, the study was not able to gain important insight into what mediated students' disengagement from the process. It is important to note here that while there were students who were generally disengaged with the process, it still held true that as the design processes were refined through student input, the overall level of engagement by students in the design process continued to improve. However, the lack of voices representing disengagement remains a critical limitation of the study due to its implication for democratic participation.

Finally, it is important here to also critique some of the assumptions that were embedded in the study to ensure that the claims made in this study are not over-generalized. The assumption that requires the most critique is the idea that the students who had participated in this study represented particular "communities", such as students, youth, students of color, immigrants, and so on. I use this space to recognize the tension raised by scholars such as Philip and colleagues (2013) who made visible the ways in which educators' conceptualization and use of what counts as "community" has significant consequences in the ways educational practices are formed. What these scholars highlight is the need to tease apart the relationship between how conceptions of ideas such as "community" and relatedly, "participation" and "voice", and the ideology of the educational work that is being conducted. Even among those who are explicitly committed to educational equity in their work can benefit greatly from thinking deeply about

how notions of student participation interacts with assumptions about community and diverse conceptions of social justice (North, 2006). The purpose of this discussion is not necessarily to evaluate the extent to which the participatory design processes described in this study met a standard of representation, but rather, to caution against using processes described in this study as a one-size-fits-all process of generating equitable stakeholder participation school design.

Future Research and Conclusions

The primary objective of this study was to ask how schools can develop the infrastructures – systems, tools, practices, and common objectives – to facilitate the participation of students in a school’s broader drive to root its educational practices in the community and its needs. To understand, the study focused on one school’s efforts to develop these infrastructures.

While, as the discussion immediately above points out, such an effort is inherently contestable and complex, the study and the participatory design methods it utilized attempted to address some of these issues by positioning such equity work as an ongoing process of critical reflection and learning. As such, the main function of the infrastructuring described in this study was to support the agency of students in the design of school practices by uncovering local theories on how this participatory process can be improved, and putting into action these theories in the design of school technology practices. The production of more generalizable knowledge followed insights gained from these processes (Edelson, 2002). Given that the infrastructuring for participatory design is an ongoing process, the study leaves a number of possible, related areas of inquiry that can contribute meaningfully to the broader objective of the study.

One analysis that can be conducted immediately is one that focuses more explicitly on the limitations of student agency in the design process. While this study, did not report details of significant roadblocks associated with the school-wide implementation of e-portfolios at the school. This occurred because a teacher heavily involved in the implementation process transitioning out of his role at the school. Consequently, the e-portfolio design group struggled to find another teacher who was positioned to support the implementation to the same extent the previous teacher was, and without a concrete commitment from teachers, the e-portfolio implementation process had stalled. This suggests that a more targeted analysis of how design outcomes from participatory design efforts travel within the broader school context, and how student agency interacts with existing power structures at schools can benefit the broader goal of democratizing school practices. Relatedly, the field can benefit from a study that more intentionally involves broader stakeholder groups in the participatory design process. In particular, such a study will help in better understanding how some of the roadblocks experienced by this participatory group, particularly those mediated by powered relationships and gaps in knowledge between stakeholder groups may be addressed. Finally, there remain questions around how these types of participatory design processes can be scaled at more macro levels. While such scaling almost seems contrary to the foundational assumptions of this type of work, broader knowledge needs to be developed regarding the type of expertise, training, and systems that the field of education need to develop more democratic practices at schools. My hope is that this study will contribute to the legacy of educators – practitioners, researchers, and designers who over the past almost 100 years – beginning with Dewey (1927) viewed schools as a key piece of infrastructure for democracy. The study sought to build knowledge that can help operationalize this vision in current educational contexts where inequity and deficit-

views on nondominant students facilitate the exclusion of such students from the construction of school practices. The study found that a key component in reversing such trends was involving students in the formation of emerging participatory practices at schools. Such work was built on existing assets at multiple levels of the school ecology, including the school's organizational practices and culture, research-practice partnerships, classroom-level practices, and student-level assets that often intersected with community-level assets. When these assets were leveraged to critically reflect on, and build new design practices along with partner students, school technology practices that privileged student goals and assets were designed and implemented, while the students who were central to this process had gained new skills and roles within the school. Consequently, the school had gained new tools, practices, and knowledge that were used to implement practice that expanded on existing approaches to educational equity. As with most situated, highly contextualized empirical efforts, the extent to which such processes may be replicated or scaled, is unclear. However, asking whether, and how, schools can practice local democracy may be a productive first step in building the infrastructure to do so

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