Title
Learning to Teach with Technology: Interest Convergence, Identity, and Designing for Novice Teacher Critical Technology Literacy

Author
Gravell, Jamie Dara

Publication Date
2020

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

Los Angeles

Learning to Teach with Technology: Interest Convergence, Identity, and Designing for Novice Teacher Critical Technology Literacy

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

By

Jamie Dara Gravell

2020

ABSTRACT OF THE DISSERTATION

Learning to Teach with Technology: Interest Convergence, Identity, and Designing for Novice Teacher Critical Technology Literacy

by

Jamie Dara Gravell

Doctor of Philosophy in Education

University of California, Los Angeles

Professor Noel D. Enyedy, Chair

Abstract

Working from a Critical Race Theory framework, in the article entitled "Educational Technology as Interest Convergence: Who is really served by technology in urban schools?", I apply the theory of interest convergence (Bell, 1980) to understand the current educational technology landscape in urban schools serving majority Black and Latinx children. Educational technology policy is both morally unconscionable, practically inadequate, and undermining the democratic purpose of public schooling in the service of corporate interests to the detriment of students of color. I argue that technology, similar to the law, is built by fallible humans and cannot be understood or improved without a race conscious perspective (Benjamin, 2019; Nakamura & Chow-White, 2013), especially in urban schools. If teachers are going to attempt to use technology to further their social justice goals, then they need to be aware of the potential

negative outcomes that come from relying on interest convergence to drive social transformation. This theoretical paper creates the basis upon which further work can be done to design teacher education contexts which counter the detrimental effects of policies made within the structure of interest convergence while also taking advantage of the historic moment in educational technology for the needs of students and their communities.

Article two entitled "Developing Teacher Candidate Critical Technology Identity in an Urban Teacher Residency" is an analysis of the written work of the teacher candidates involved in the residency program. To design for an educational context in which marginalized youth in urban schools are provided with the space and chance to utilize technologies to transform not only their learning, but also their communities and worlds for a more just future, we can start with understanding how teachers own experiences, identities, and ideologies mediate their learning and vision of technology use in the classroom.

To understand how teachers come to adapt their practices in the classroom which utilize technology, and any changes to that practice we might hope to encourage, we must understand the current identities teachers have already developed around technology use both in and outside of school. In the course of this paper, I focused on the educational histories, goals, and narratives of technological experience to build a framework for how teachers begin their process of learning to teach with technology. We must understand those historical narratives that make up the identities which have been both imposed upon new teachers (digital native, social media obsessed, technology reliant) and those to which they ascribe (gamer, skeptic, efficiency oriented). Those identities are deeply consequential for how they approach technology integration and support in their teacher education programs, in their field placements, and in their own classrooms in the early years of their teaching

Based on the theoretical framing of Article I and the findings of Article II, the third paper entitled “Designing for Complexity: Critical Technology Literacies in Teacher Education” describes four design principles that will be useful for other teacher education programs when designing for critical technology literacies. First, technology courses should encourage playful enactment with the goal of productive failure; meaning that our work should focus on getting teacher candidates comfortable enough with each other and their own histories with technology for them to engage with new digital tools in ‘badly structured’ (Kapur & Bielaczyc, 2012) manner with plenty of opportunities to have digital tools fail. The opportunity to have tools fail without catastrophic outcomes in front of their own students helps teachers see creative uses for digital tools rather than static steps to follow – similar to the power of productive failure for learning mathematics. Related to this is the design expectation that personal and professional technology identities mediate what teachers take up from readings and learning activities in the class. Because of the need for playful enactment and complex intersections between identity, classroom context, and digital tool availability, it is important to structure teacher learning around critical practices rather than some particular list of tools. And finally, most importantly, it is necessary to design structures in teacher learning contexts where they are expected to engage with one another in accountable talk to make connections between the digital and social justice realms.

The dissertation of Jamie Dara Gravell is approved.

Tyrone Howard

Ananda Marin

Jan Reiff

Megan Franke, Committee Co-Chair

Noel Enyedy, Committee Co-Chair

University of California, Los Angeles

2020

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Acknowledgements

This dissertation is in honor of all the strong, smart women who taught me to never give up and that I can do anything for which I am willing to work hard enough. and the students and teachers at Woodrow Wilson High School in Washington, D.C. who taught me that nothing matters more than creating a caring community in your classroom. Thank you for teaching me the power of being taught and loved by a warm demander (Ross et al., 2008) is in knowing you can do anything you put your mind to, and there will always be someone there to catch you even if you fall to help you rise again.

Thank you to my parents, Mark and Fay Josephson, who worked their whole lives to make sure I had everything I needed to be successful, and never accepted anything other than my best. To the Wolffs and Gravells for providing all the childcare and support we could ask for so our family made it through two back surgeries, a preemie baby, and a pandemic well cared for in Los Angeles.

Thank you to the educators who taught me, from kindergarten through graduate school, what it means to care for your students and support your colleagues in mind and spirit.

To my committee members who have stuck with me through so many obstacles, you teach me what I hope to be as a scholar. Dr. Franke, thank you for reminding me it is OK to be a teacher, scholar, and mom all at the same time. Dr. Marin, thank you for believing in me and my scholarship. Dr. Howard, thank you for always having my back and pushing me to be faithful to the philosophy of CRT. Dr. Reiff, thank you for taking a chance on me and bringing your practical knowledge of educational technology to bear on this work. Dr. Enyedy, thank you for sticking with me and the hours of Zoom calls it took to get me to the finish line. I appreciate you all more than I can ever express.

To the fiercest women I know, who both hold me up and call me out when I need it, thank you for supporting me through the past 7 years of wild ride. Team Tripod: Dr. Monica Moran & Dr. Tiera Tanksley—we did it! All three of us are doctors now! Dr. Juliet Lee: thank you for taking me under your wing as a baby MA student, reminding me of home and being my partner in snark. Dr. Rebecca Cooper-Geller: thank you for understanding it all, from social studies, to anxiety and motherhood, you are a rockstar and a forever friend. To my Glitter Gang: Kate Stasik, Stephanie d'Otreppe, Amy Liedy, Caitlin Ward, and Christy Mancuso—I would have given up long ago if not for your support and love, thank you for being my sisters and the best of friends—here's to 10 more years of friendship!

To Chris, thank you for being the best of husbands and the best of friends. I would never have made it this far without you. You are my person for life.

To Benjamin Joseph Gravell, you have made finishing this dissertation quite an adventure, but I wouldn't have it any other way. I love you, little one.

Jamie D. Gravell

2008	Bachelor of Arts in Political Science & Secondary Education American University, Washington, D.C. Clear Credential for Social Studies grades 7 – 12
2008-2009	Coordinator of Afterschool & Credit Recovery Wilson High School, DC Public Schools
2009-2012	Social Studies Teacher, World History & AP US History Wilson High School, DC Public Schools
2012	Highly Effective Teacher Award, DC Public Schools
2012	Teacher Fellow, Common Core Literacy Design Collaborative, DC Public Schools & Center for Inspired Teaching
2012 - 2014	Research Assistant & Group Leader, Council of Youth Research Institute for Democracy, Education, and Access, UCLA
2013	Master of Arts in Race & Ethnic Studies in Education University of California, Los Angeles
2014	Regents Fellowship, University of California, Los Angeles
2014 - 2017	Research Assistant, UCLA CONNECT (STEP) Science through Technology Enhanced Play - NSF #1323767 The Cybermural Project - NSF #1256227
2014 - 2020	Research Assistant, UCLA Center X IMPACT Urban Teacher Residency
2015 - 2016	Research and Instructional Technology Consultant Center for Digital Humanities, UCLA
2016 - 2018	Editorial Assistant, *Cognition & Instruction* University of California, Los Angeles
2018-2020	CA Teacher Education Research Improvement Network Fellow
2018 - 2019	Research Assistant, Civic Education Research Group University of California, Riverside
2019 - 2020	Research Assistant, Data for Democracy Centennial Project Institute for Democracy, Education, and Access

SELECT PUBLICATIONS AND PRESENTATIONS

Gravell, J. (under review) Educational Technology as Interest Convergence: Who is Really Served by Technology in Urban Schools?

Gravell, J. (November 2019) Civics in STEM? Teacher Candidate Sense-making in an Urban Teacher Residency. Roundtable titled "Social Studies Research Within and Across Disciplines." College and University Faculty Assembly of the National Council of Social Studies. Austin, TX.

Gravell, J. (November 2018) Iterative Digital Art Making as Community Civic Engagement. College and University Faculty Assembly of the National Council of Social Studies. Chicago, IL.

Gravell, J. (October 2018). Critical Digital Teacher Education: Novice Teachers Making Sense of Their Ideologies in Practices. Learning Sciences Graduate Student Conference. Vanderbilt University.

Gravell, J. (May 2018). *Edtech as Interest Convergence: Who is Really Served by One-to-One Tech Programs in Urban Schools?* Visions of Justice and Liberation Symposium by the Center for Critical Race Studies. University of California, Los Angeles.

Gravell, J. (April 2017). *Designing for Critical Technology Literacy in an Urban Teacher Residency: Practice-Based Identity Development.* Symposia paper in a session titled: Advancing Equitable Student Learning Through Teacher Preparation and Professional Development Innovations that Leverage Learning Technologies. American Educational Research Association Annual Conference. San Antonio, TX.

Dahn, M., Lee, C., Enyedy, N., Gravell, J., Burke, J., Illum, R., Avetisian, H., Paul, L., Gomez, T., & Torres, R. (April 2016). *The Cybermural Project: Digital Learning for Early Childhood Science Inquiry.* American Educational Research Association Annual Meeting. Washington, D.C.

The Miseducation of Technology

New technologies, whether freely available printed books, instructional radio, or distance learning via television, have been promoted as the silver bullet for multiple educational problems through history. Not only is that promotion often related more to economic interests than educational needs (Cuban, 1986), but it ignores the integral nature of the teaching force for any sort of consistent implementation of a structural change (Cuban, 2013). As the authors of the U.S. Department of Education's National Educational Technology Plan (Cullatta, 2016) found, there is therefore a serious digital divide in how digital technologies of the current age – hardware, software, internet access, and applications – are utilized in schools depending on their socioeconomic context. This *digital use divide* is one that is directly related to the adults in charge of classrooms – from district leaders to school administrators and teachers in schools. The vignette below is an example of two schools that have similar access to digital tools but utilize them in very different ways for vastly different purposes:

> *On a main street on the west side of Los Angeles, in a mixed community of working and middle-class families, there are two schools only 3 blocks apart - West LA Middle School and The Beachside School. WLAMS is an LAUSD comprehensive middle school with a STEM magnet program, and Beachside is a private school serving grades 6-12 with a tuition of $40,000 per year. WLAMS is a respected community school serving a majority student of color school body and has a partnership with a nearby university professional development program to support their teachers. This program was established when it was released to the student families that only 45% are considered highly qualified in the subject they teach according to the measurements of federal legislation. WLAMS rolled out a one-to-one iPad program through the district last year and teachers are excited about using the iPads and apps provided by the district.*
>
> *Down the street, Beachside is not one of the biggest or most well-known private schools in Los Angeles, but has a fast-growing student body with 28% of the school identifying as*

students of color. 75% of teachers at Beachside have their MA or PhD. Scholarship students are provided a Chromebook if needed, but Beachside is mostly set up as a bring-your-own-device (BYOD) program with multiple iMacs and high-powered PCs available for student use in the Innovation Center (makerspace), which is staffed by two full time specialists in digital technology and pedagogy. Beachside also hosts a monthly meetup of Playdate LA where teachers and administrators across the city come to 'play' with new digital tools and collaborate across locations on projects aimed at 'innovative education for the new knowledge economy'.

While their hardware might be different, students in both schools have access to hardware and internet access required for digital literacy. So why are Beachside's 8th grade students collaborating across their courses with peers in Haiti and Canada to design solutions to the potable water shortage in Puerto Rico after Hurrican Maria while WLAMS students are using the LA Times app to do close readings and individual reaction logs of editorials on the hurricane response? At first glance, the differences in pedagogy and digital technology in these schools might be attributed to demographics or resource allocation--and while it's true that WLAMS is more likely to be forced to debate whether they should spend money on copy or toilet paper in their weekly administrative team meeting--when it comes down to basic technology they both provide one device per child. Both schools also have a staff full of teachers who care about issues of social justice and want to integrate critical perspectives in their curriculum and instruction.

The way these two schools actually use digital tools and how they frame technology within their larger educational goals differ dramatically. At Beachside and WLAMS, respectively, the 7th grade team met in their weekly co-planning time on an early dismissal day in early October, and during reflection many of the team members noticed that students were absorbed in and worried about the children experiencing recent catastrophic storms in the Caribbean. Students reported that the storms destroyed portions of Puerto Rico and made access to clean water and power are rare. Both groups of educators decided to nurture this interest in their early Spring units around this topic, but the manner in which they used technology to facilitate the units varied widely.

First, at WLAMS, the 7th grade team's focus was on the apps available to them on their devices that would have standards- driven content the teachers could relate back to current events surrounding Puerto Rico. The earth science teacher was excited to utilize a great set of videos from the Pearson created textbook app to connect NGSS core practices students learned in 6th grade with this content on erosion, sediment, and weather. Both the math teacher and English teacher brainstormed ideas of where to find data visualization and non-fiction text to build data literacy and close reading skills in their respective classes using the same topics – it was just a bonus that these skills are also tested on the district wide standardized test as well. The social studies teacher wasn't sure how he could participate because his content unit was focused on imperialism and the industrial revolution, which he didn't think connected to natural disasters, but he did create a weekly current events routine with his students in response to their interest. Students at WLAMS were excited to be able to talk about current events, but one group of students was heard leaving science class two weeks into this new unit focused around the textbook's video app, saying, "It's just the same as reading a textbook, only the pictures move sometimes...I just want to DO something to help."

In contrast, at Beachside the complete focus of the school from gym class to English class is on inquiry and experiential learning; this unit could be no different. The 7th grade team wanted to focus on what their students could make or do in support of those affected by Hurricane Maria, and based on the New York Times headline the day of their team meeting -- "PUERTO RICO OUT OF WATER BY END OF THE MONTH" – they decided to focus on creating a cross-curricular design challenge to provide potable water for a town of 100 families. The social studies teacher reached out to a colleague in Haiti she was connected to through a social media platform after a previous professional learning and asked to bring her in via Skype as an expert on the lived experience of natural disaster recovery. Based on the research questions developed by students after this Skype conversation, the 7th grade teacher team divided the questions by content area connections and planned to have an information sharing fair in two weeks' time in order to create design trials based on the information. In science class, students were focused on issues regarding

groundwater availability, terrain and sediment related to transport, infectious diseases in water, and the physics of water transport. The students divided into small groups with each one focused on one of these issues – first, one group used multiple online simulations to understand the way groundwater worked, while another started with Wikipedia to research the multiple infectious diseases related to clean water. As they developed an understanding of the issues in their small groups, they utilized a single shared Google doc among the whole class to have a repository of information on the issue. Each group also did daily quick report outs to the class on what they found. When they started having ideas about how to solve the problems they found, each group did a quick prototype design in Sketchup to try out their ideas or built a rough model in Minecraft to see if it made sense in reality rather than just in their heads. When one of the groups had an idea that was able to convince the rest of the class of its efficacy, they created a working prototype in TinkerCAD and printed a 3D model to use in their presentation to the whole grade during the design challenge. In each of the other classes, students researched, practiced written and speaking skills, shared knowledge, and created solutions to a real-life problem using a variety of digital tools to support that process.

These two examples of technology integration show the difference between using digital tools for passive consumption of knowledge and using digital tools in active ways to engage students in realistic team-based learning and creating necessary in public and private enterprise. The hardware students at Beachside and WLAMS use is similar, so we can clearly see access to tools is necessary but not sufficient for an exemplary education. The differences in classroom experience rest substantially in the pedagogies of the teachers and in the ways in which they integrate their critical perspectives, theories of active learning, and student-driven use of technology.

One place where the faculty of these schools differ is in their access to teacher education or professional development programs that scaffold the integration of those three aspects of a 21st century classroom. This is not a new problem: despite prophesies of drastic educational change with each technological development from the pencil, to the radio, to the internet, a clear change in education has not necessarily followed on any efficient

timeline (Cuban, 2009; 1986). In fact, the U.S Department of Education's most recent National Educational Technology Plan (NETP, 2016) calls for a recommitment to more effective and equitable technology integration in public schools across the nation because of the finding that the "digital divide" between haves and have nots in private and public schools is actually a "digital use divide" (NETP, 2016, p.5) between students who are given an opportunity to use digital tools for active, engaged learning experiences versus those who are tasked with passive consumption of digital material during the school day.

Integration with Educational Philosophy

The vignette above makes it clear that novice teachers need specific methods training in how to integrate technology into their daily practice. Technology is intended to be a tool in the service of their larger educational goals, but too often technology is seen as a neutral tool to deliver content in an efficient manner. However, teachers' educational goals go well beyond the delivery of content and they need to attend to how technology fits, supports, or is in tension with the entire range of their educational goals. Of particular importance is for teachers to consider how technology fits with their vision of social justice.

What is missing from both of the examples above is a sense of how their use of digital tools is connected to the teachers' espoused social justice ideals. Access to tools without critical, creative pedagogy and curriculum can in fact lead to retrenchment of oppressive education under the guise of technology integration. Philip and colleagues (2016) found that without explicit training in racial literacy and sensemaking around its relationship to digital tools, even an experiential mobile data collection curriculum focused on students lived experiences resulted in re-inscription of racial stereotypes and unexamined bias on the part of students and teachers alike. In addition, even curriculum and tools that are built to promote critique and relevance for students while learning standard school subjects like statistics can require ongoing in-the-moment negotiation of curricular and instructional practices to serve the needs of students even

within the same digital tool (Enyedy, Danish & Fields, 2011). Teachers and students alike must have opportunities to examine the ideologies and histories upon which digital tools are built, and how those can mediate and shape the use of those tools. Teachers deserve the opportunity to make sense of how to use technology as a tool in service of educational equity, rather than merely a tool of expediency of efficiency. Unfortunately, these are not the issues with which teachers are taught to wrestle with in their teacher education programs (Warschauer, 2007).

As with many issues of learning and schooling, educational technology is one of the places where the macro issues of society--racism, misogyny, poverty, homophobia--come to rest against the micro issues of learning in the classroom. Unfortunately, teacher education programs have mixed results when their mission is to develop and support transformational educators who are prepared to serve our most vulnerable children (Cochran-Smith et al., 2015, 2016). Those programs which are considered to do an adequate job of preparation for digital technology in the current context (Thomas, 2016) are not concerned with the issues of power, privilege, equity and transformation that have been shown to be integral to learning over the past 20-plus years (Collective, 2017).

Across the country there was a movement supported by federal Teacher Quality grants to prepare teachers to serve the most marginalized communities. The manner in which that is accomplished varies, but there was a special focus on grants to fund residency programs which provide a more integrated experience between the field and the classroom. One example of such a program is housed at UCLA Center X, which was a research-practice center founded as a response of local scholars, administrators, and educators to the 1992 South LA Uprisings. Center X was the instantiation of a vision for building a home focused exclusively on supporting new and developing teachers to serve in otherwise under resourced communities and provide

excellent teachers for communities of color. By establishing this center at the largest public university in California, the founders dedicated themselves and the future work of the Center to serving the public interest. Center X continues to be an exemplar to universities around the country which hope to support new and developing teachers in their quest to become social justice educators.

In the Center X teacher education program pre-service teachers are already explicit about their desire to and belief in their ability to disrupt the very real problems of education. Unfortunately, they and many other teachers could be unknowingly reinforcing the status quo if their understandings of ideologies and practices of educational technology are not adequate to the challenge of aligning the digital tools available to them, their digital practices, and their deeply held ideologies of social justice in learning and schooling. For example, a teacher who is deeply committed to building relationships with students and their families might see benefits to be taken in by the communication aspect of a free app like Class Dojo, which was founded as a reward and demerit system that eventually added more qualitative feedback and communication tools. The built-in competition and public shaming aspects of Class Dojo might not be readily visible to the teacher, much less the fact that the venture capitalist funders of this and other apps have been critiqued for the ways they utilize the aggregate data from these apps in ways that is not oriented towards social justice.

Goals of this Dissertation

To support future teachers in this program and others, I studied teacher education students' sensemaking around educational technology, primarily over the course of a 10-week quarter-long Critical Media and Technology Literacies course. I focused on investigating how novice teachers make sense of their own experiences with technology at home and in school, and

how those experiences mediate their experiences of technology in their student teaching and imagined future in their own classrooms. I also look for ways their social justice ideologies and their pedagogical choices regarding digital tools in their classrooms are or are not aligned in both narrative and technical writing (e.g. reflections and lesson plans respectively). I am interested in how their own digital identities and familiarity with respective digital tools influence instructional choices.

Teacher education is an area ripe for this work because it introduces future educators to new ways of thinking and being and is a space which allows for developing the theoretical and practical knowledge necessary for being successful in the more institutionally- constrained school sites where in-service teachers must function once they are the teacher of record (McDonald et al., 2014). Critical technology literacy—an understanding of how to interrogate the purposes and beliefs inherent in software, hardware, big data and social networking—and opportunities to put those literate practices into action are absent from the current teacher education program's curriculum. While it is true that teacher education experiences do not automatically result in a change in teacher classroom practices, we will definitely continue to fail to prepare teachers to address issues of equity and social justice when we don't prepare them to interact with current technology integration policies in any strategic way.

Chapter 2 Overview - Article I

Working from a Critical Race Theory framework, in the article entitled "Educational Technology as Interest Convergence: Who is really served by technology in urban schools?", I apply the theory of interest convergence (Bell, 1980) to understand the current educational technology landscape in urban schools serving majority Black and Latinx children. Educational technology policy is both morally unconscionable, practically inadequate, and undermining the

democratic purpose of public schooling in the service of corporate interests to the detriment of students of color. I argue that technology, similar to the law, is built by fallible humans and cannot be understood or improved without a race conscious perspective (Benjamin, 2019; Nakamura & Chow-White, 2013), especially in urban schools.

Using a comparison between the Brown v. Board of education case and the implementation of one-to-one iPads in the Los Angeles Unified School District, I explicate how educational technology represents the a similar convergence of the interests of white elites – namely workforce development, and the Black and Latinx communities dedication to the best education possible for their children. This understanding of current implementations of educational technology in urban schools serving children of color is necessary if teacher educators are going to have a chance to prepare teacher candidates to strategically engage with the technology landscape they are entering while also staying true to their espoused social justice goals. If teachers are going to attempt to use technology to further their social justice goals then they need to be aware of the potential negative outcomes that come from relying on interest convergence to drive social transformation. This theoretical paper creates the basis upon which further work can be done to design teacher education contexts which counter the detrimental effects of policies made within the structure of interest convergence while also taking advantage of the historic moment in educational technology for the needs of students and their communities.

Chapter 3 Overview - Article II

Article two entitled "Developing Teacher Candidate Critical Technology Identity in an Urban Teacher Residency" is an analysis of the written work of the teacher candidates involved in the residency program. To design for an educational context in which marginalized youth in

urban schools are provided with the space and chance to utilize technologies to transform not only their learning, but also their communities and worlds for a more just future, we can start with understanding how teachers own experiences, identities, and ideologies mediate their learning and vision of technology use in the classroom. As Walkoe and Luna (2020) point out, the study of teacher learning, particularly to develop and clarify learning theory, has been neglected in recent scholarship. We have clear evidence learning is more than the mere acquisition of knowledge by rote or by exposure and should more accurately be understood as changes in identity marked by shifting goals and the uptake of roles within a particular context as mediated by tools available (Halverson, 2009; Nasir, 2002). Learning can thereby be marked by shifting identity as reflected in narratives told about oneself and recognition by others of membership in a particular identity group (Sfard & Prusak, 2005).

While some identities are more 'sticky' due to social stratification and structural inequalities, group identities are not singular or separate from one another, but rather intersect to create particular opportunities and constraints for learning and being in the world (Collins & Bilge, 2020; Covarrubias, 2011; Crenshaw, 1991; Ryoo et al., 2019; Ryoo et al., 2020). In the case of learning to teach with technology, a popular narrative (Lei, 2009) exists that the current generation of teacher candidates are so-called 'digital natives' with the implication that they require little to no formal learning in utilizing technology in the classroom. In reality Generation Z is fluent in tools for media consumption and sometimes production while their exposure and comfort with tools for knowledge building, collaboration, and research vary widely.

To understand how teachers come to adapt their practices in the classroom which utilize technology, and any changes to that practice we might hope to encourage, we must understand the current identities teachers have already developed around technology use both in and outside

of school. In the course of this paper, I focused on the educational histories, goals, and narratives of technological experience to build a framework for how teachers begin their process of learning to teach with technology. We must understand those historical narratives that make up the identities which have been both imposed upon new teachers (digital native, social media obsessed, technology reliant) and those to which they ascribe (gamer, skeptic, efficiency oriented). Those identities are deeply consequential for how they approach technology integration and support in their teacher education programs, in their field placements, and in their own classrooms in the early years of their teaching. It may even impact how they continue to evolve as teachers in a continuously changing technology context, especially with recent turns toward online and hybrid instruction due to the COVID-19 virus.

Chapter 4 Overview - Article III

Based on the theoretical framing of Article I and the findings of Article II, this paper entitled "Designing for Complexity: Critical Technology Literacies in Teacher Education" describes four design principles that will be useful for other teacher education programs when designing for critical technology literacies. First, technology courses should encourage playful enactment with the goal of productive failure; meaning that our work should focus on getting teacher candidates comfortable enough with each other and their own histories with technology for them to engage with new digital tools in 'badly structured' (Kapur & Bielaczyc, 2012) manner with plenty of opportunities to have digital tools fail. The opportunity to have tools fail without catastrophic outcomes in front of their own students helps teachers see creative uses for digital tools rather than static steps to follow – similar to the power of productive failure for learning mathematics. Related to this is the design expectation that personal and professional technology identities mediate what teachers take up from readings and learning activities in the

class. Because of the need for playful enactment and complex intersections between identity, classroom context, and digital tool availability, it is important to structure teacher learning around critical practices rather than some particular list of tools. And finally, most importantly, it is necessary to design structures in teacher learning contexts where they are expected to engage with one another in accountable talk to make connections between the digital and social justice realms.

Chapter 2: Article I

Educational Technology as Interest Convergence:

Who is Really Served by Technology in Urban Schools?

Abstract: Working from a Critical Race Theory framework, I apply the theory of interest convergence (Bell, 1980) to understand the current educational technology landscape in urban schools serving majority Black and Latinx children. Educational technology policy is both morally unconscionable, practically inadequate, and undermining the democratic purpose of public schooling in the service of corporate interests to the detriment of students of color. I argue that technology, similar to the law, is built by fallible humans and cannot be understood or improved without a race conscious perspective (Benjamin, 2019), especially in urban schools.

One of the early proponents of computers, Seymour Papert (1980) said computers would be "carriers of powerful ideas and the seeds of cultural change...help[ing] people form new relationships with knowledge that cut across the traditional lines separating humanities from science and knowledge of self from both of these...challeng[ing] current beliefs about who can understand what and at what age." But the transformation of learning and shifting power inherent in such a changing knowledge structure is not the driving force behind a common way schools are implementing one-to-one technology plans. Instead, the interests of corporations—job training and customer development—take center stage in many of the rollouts of educational technology in schools that serve marginalized students, most of whom are Black and Latinx. Take for example, the 2013 rollout of a one-to-one iPad project for every student in Los Angeles Unified School District: at first there was a lot of excitement from students and families, but by the end of September there were clearly problems. Multiple headlines in the Los Angeles Times were popping up: on September 25, 2013 on of the top headlines read "LAUSD halts home use of iPads for students after devices hacked" with this and other articles pointing out Roosevelt High School in East Los Angeles as the focal point of so-called "hacker" activity. When students deleted their user profiles on the devices in order to stream music, use social media, and access sites needed for their homework the district punished them for violating district acceptable use policy. When students took it into their own hands to subvert the iPads—that were presented as tools of only economic efficiency, testing, and curricular regimentation—and turn them into tools of transformation and access the district removed those tools from their hands

I argue that LAUSD's rollout and subsequent pullback is a classic case of interest convergence, which unless explicitly attended to and acknowledged will play out again and again in many district's attempts to integrate technology into the curriculum often leaving students

worse off than before technology was introduced. Interest convergence is the idea that the powerful will only support the needs of the minority when their interests align rather than out of a moral change of heart. It was first exemplified in the literature by Bell's (1980) analysis of the U.S. Supreme Court case of Brown v. Board of Education. Over 50 years prior to the LAUSD iPad rollout and halfway across the country, Brown v. Board of Education of Topeka, 347 U.S. 483 (1954) was decided by the U.S. Supreme Court in favor of school desegregation on the basis of detrimental psychological effects upon Black children found to be violating the equal protection clause. The case overturned the "separate is never equal" precedent set by Plessy v. Ferguson over 50 years prior. The interests of both Black communities and white elites supported this change: when white politicians only came into alignment to protect the reputation of America abroad against communist propaganda which was critical of Jim Crow laws inside and outside of schools is one of the most famous examples of interest convergence (D. A. Bell, 1980). This interest convergence was both temporary and incomplete, and arguably more damaging than productive for Black students and families. The temporary and incomplete nature of interest convergence is due to the tendency for systems and individuals to protect the privileges and practices of whiteness as if whiteness is personal property; property rights are the foundation upon which the United States legal and government systems are built (Gloria Ladson-Billings, 1998; Tate, 1997). The same interest convergence and resulting detrimental effects seen in school desegregation are also evident in educational technology implementation in urban public schools. In Brown v. Board, the interest was in protecting U.S. reputation abroad; in today's educational technology context, the interest is in protecting economic strength of corporations.

My interest in this work comes from my own experience as a student, teacher, and teacher educator. Growing up in a diverse urban rim public school district in New Jersey in the 1990s and early 2000s, I barely had access to a computer in school and only wrote one research paper in high school. I am a white woman raised in a working-class community where the majority of students I graduated high school with did not pursue higher education. I was one of less than 25% of my graduating class to attend a four-year university after graduation, and when I attended a liberal arts college on scholarship, I was the only student on my dorm floor freshman year without a laptop. When I began teaching high school social studies in a D.C. public school blocks away from that dorm room a few years later, my classroom had not been updated in almost 50 years and all three desktop computers were at least five years old and plugged in to multiple power strips from the single electrical outlet in the room. My own educational technology experiences as a student and teacher are always surprising to friends and colleagues who attended suburban public schools or received an elite private K-12 education. Clearly, their experiences with technology were very different.

When there was a sudden expansion of educational technology in urban schools in the 2010s, I wondered what changed. Why were our students suddenly worth investing in? Where was the money and political drive for these one-to-one laptop and tablet programs coming from? And what would the use of these new tools look like in urban schools? From what we have seen in the past 10 years in educational technology district implementation in urban schools, I argue here that we should have spent more time learning from the failures of school integration since Brown v. Board of Education to build educational technology programs and practices truly committed to equity and liberation. To be clear, the failure here is not just one of delay in access to technology, which creates its own ever-widening experience gap, but the more important

effect is in the differences in how Black and Latinx children are being introduced to and able to utilize digital technologies in their schools, and how those lower quality experiences are deepening inequities and cutting off students of color from the transformative possibilities of technology in their hands.

In this essay, using the classic example of school desegregation, I show how interest convergence created a morally unconscionable and practically inadequate situation in American public schools since the Brown and Brown II Supreme Court decisions in the 1950s. I then apply those frameworks to understand how interest convergence also created the current educational technology landscape in urban schools. Using Critical Race Theory, I explain how such an example of interest convergence destroys the civic purpose of public education by supporting oligarchy rather than democracy. Critical Race Theory was borne out of the necessity of a racial framework for understanding law, building on critical legal theory of the 1980s, to understand how a race-neutral approach was not adequate to understand the experiences of Black Americans and other people of color. The same is true for understanding technology; much like the legal system, technologies are built by fallible humans, are not neutral and cannot be understood or improved without a race conscious perspective (Benjamin, 2019; Nakamura & Chow-White, 2013).

Critical Race Theory in Law

One of the major influences on the establishment of Critical Race Theory in the law was the implementation – or more accurately, the lack thereof - of the Brown v. Board of Education decision. The 1954 decision by the U.S. Supreme Court found the separate but equal precedent of Plessy v. Ferguson unconstitutional was heralded by legal scholars, media and organizers as marking the swing of the modern legal system towards civil rights for all. By the 1970s,

however, the promise of Brown was not evident in practice, despite the 1955 Brown II decision to implement integrated education "with all deliberate speed." In response to this, and other failures of the legal system in the face of growing demand for equal civil rights, the legal arguments known now as Critical Race Theory (CRT) began to take shape (Bell, 1989; Delgado & Stefancic, 2012; Matsuda et al., 1993).

Interest convergence, a central proposition of CRT, asserts that marginalized group's interests are only advanced in the law when they coincide with the interests of the white majority. Based on the work of Derrick Bell (1989; 1980; 1992), Milner (2008) defines interest convergence as the idea "that racial equality and equity for people of color will be pursued and advanced when they converge with the interests, needs, expectations, and ideologies of Whites." (p.333) Early work on this concept came from Bell's analysis of the Brown v. Board of Education decision whereby he argued that the decision of the court was related more to a desire for the appearance of a just and democratic American society in the face of international socialist movements than to a sense of equity (Bell, 1979). In the same manner that there was a change in government policy on the issue of school integration when it served the larger propaganda needs of white elites in international relations, there continues to be a lack of movement on many issues affecting marginalized groups until the issue becomes salient for the dominant social group and would stand to benefit them as well as the marginalized. Only then do they engage in the fight or advocate for policy change. Policies created in the vestiges of interest convergence are bound to fail--those interests are never completely nor permanently aligned and result in morally bankrupt solutions while the temporary nature of even an incomplete alignment leads to insufficient political will necessary for any truly liberatory possibilities in education. This was true in 1954 for segregated schools and it is true in 2020 for educational technology.

Critical Race Theory in Education

In the late 1990s, CRT began being applied to analyze issues of race and racism in education policy and practice. CRT in Education began by focusing on the disparate educational outcomes for People of Color, and eventually was applied to all levels of educational research including curriculum, discipline policies, and the higher education pipeline (Bernal & Villalpando, 2002; Crenshaw, 1991; Huber, 2009; Kohli, 2009; Gloria Ladson-Billings, 1998, 2010; Solorzano & Yosso, 2001) to name just a few. The ever increasing racial and ethnic diversity in American schools today, the system of racism upon which American history rests, and the intersections of those interests in the public sphere continue to be especially evident in the public education system today. With recent public and political focus on the disparate educational outcomes for People of Color, whether it be called the Achievement Gap (Delpit, 2012; Gregory et al., 2010) the Opportunity Gap (Carter & Welner, 2013; Flores, 2007; H Richard Milner, 2010), or the Educational Debt (Ladson-Billings, 2006) there is a renewed use of CRT in Education to understand these issues and move away from the failed color-blind approach (Bonilla-Silva & Dietrich, 2011) to education. The latter restrains both theoretical and practical understandings of current education problems and the possible designs available for remedy.

This essay builds expands the work of Critical Race Theory on the moral and practical failures of school desegregation to show how that same failure is carried forward into modern educational technology policy and implementation. Identifying the problem from this perspective is necessary to avoid further expansion of policies which only result in incomplete or temporary solutions that led to the failure of desegregation in the latter 20th century. In order to design an equitable and liberatory future for education, and educational technology policies and practices

as part of that future, scholars must first understand the problem from an appropriately critical perspective.

Solórzano (1997) and Yosso (2002)outline five tenets of CRT in education that "form its basic perspectives, research methods, and pedagogy" (p. 6-7) including the centrality of race and racism, a challenge to dominant ideology, a commitment to social justice, the centrality of experiential knowledge, and the transdisciplinary perspective. Interest convergence is shaped by the centrality of race and racism and the need to challenge dominant ideology by recognizing the impossibility of a neutral legal system due to the "layers of subornation based on race, gender, class, immigration status, surname, phenotype, accent, and sexuality" (p. 25) which intersect to transform life experience (Crenshaw). By challenging scholars to rethink the existence of objectivity, meritocracy, color blindness, race neutrality, and equal opportunity as fact, Critical Race Theory removes the idea that policies or practices in education at all levels, from federal policies down to classroom instructional choices, could ever be neutral. The public commitment to social justice in Critical Race Theory exists despite the contradictory nature of educational institutions in their "potential to emancipate and empower" (p. 26) and their location as an area of resistance to power in many forms.

In Critical Race Theory, transdisciplinary perspectives and experiential knowledge are key to understanding the racialized experience of students of color in schools. To expose "deficit-informed research and methods that silence and distort the experiences of people of color" (p.26) scholars must instead focus on the wealth of knowledge held by People of Color through methodologies such as storytelling, testimonio, and narrative. CRT in Education does just that and exposes the wealth of strength and resistance in their current and past educational experiences. For example, the LAUSD iPads program research referenced above was conducted

by youth from the community that were being criticized for so-called hacking. In research conducted by student participatory researchers in the UCLA Council of Youth Research along with their mentor Dr. Elexia Reyes-McGovern found that despite students engaging in the same practice of deleting user profiles to access blocked sites at other more affluent schools like Westchester High and the Valley Academy of Arts and Sciences in Granada Hills, Roosevelt High School in East Los Angeles, a poor and working class community, were repeatedly the center of district and media stories on the failure of the iPad rollout (Schwartz, 2015). Students in the Council of Youth Research from Roosevelt were the first to point out that the media reporting on the iPad rollout was different for them than schools where there were less marginalized Latinx and Black youth.

The students' participatory action research, utilizing methods from traditional qualitative interviews, quantitative survey design, and media analysis informed by scholars such as Hall (1996) and Gramsci (2000) combined with experiential knowledge shifted the analysis of the situation from a deficit framing of the youth to finding that although there had been some use of music streaming and social media, the driving force behind the first students deleting user profiles on the devices was a desire to complete their assigned homework in an advanced course. The students created *testimonio* – creative forms of life stories— (Bernal et al., 2012; Huber, 2009) to get their research based and personal stories pushing back against the media coverage. Some who follow educational technology agreed, with well-known educational technology journalism Audrey Watters writing in The Atlantic (2013) that we should be telling these students "good for them" because the limitations built into school filters and the restriction to using only Pearson textbook-provided resources destroys the possibilities of educational technology. Without the combination of experiential knowledge and a transdisciplinary

perspective, our analysis of the "hacking" incidents might have been restricted to only the perspective of those in power.

Interest Convergence and School Desegregation: Morally Bankrupt

Access to and control of political capital is restricted and controlled depending on what interests serve the protection of the power of whiteness (Lipsitz, 2006; 2005). In Critical Race Theory analysis, the relationship between democratic ideals and the system of capitalism will always skew in favor of a protection of whiteness as a form of private property. This argument was borne out in both in the case of public-school desegregation in the 1950s as exemplified by the temporary and incomplete alignment of white and Black interests. Derrick Bell introduced this argument in 1987 with a focus on the Amicus Brief filed by the Department of Justice which called on desegregation to be required. This was not for any moral purpose, but rather to improve America's representation abroad during the Cold War with countries recently independent from colonial rule. Those countries were in danger of falling to communism because they were losing faith in American democracy due to extensive racial segregation and discrimination. Bell argued that government interests in fighting communism and promoting a positive view of democracy abroad aligned with the desire of Black Americans to have an equal opportunity for education at that moment in time.

When Brown v. Board of education was decided in 1954, it was the first case to utilize disparate psychological impacts of school segregation as support for the Court's decision. Brown was a major shift in precedent because, in a rare unanimous decision, the Court decided that even a "tangibly equal" segregated school setting was "inherently unequal" due to the long term psychological effects of inferiority tied to race bred into the "hearts and minds" of young children that could never be undone (347 US 483, 1954) A year later in Brown II (349 US 294,

1955), the court reaffirmed the need to implement desegregation "with all deliberate speed," but did not provide guidance for how or what that would look like. This lack of guidance, and the failure of lower courts to require particular methods of integration quickly led to the unraveling of the interest convergence and in the end resulted in detrimental effects for Black Americans, both youth and the Black teachers that had served them in segregated schools (Fairclough, 2004; Milner & Howard, 2004). These "practically inadequate" effects will be explored further in the subsequent section. In fact, it showed both the temporary and incomplete alignment of those interests, which exemplify that although interest convergence may result in some advancements, the possessive investment and protection of whiteness will succeed in the end because interest convergence is not only morally bankrupt but also practically inadequate.

Interest Convergence and School Desegregation: Practically Inadequate

The alignment of white and Black interests was quite short, and in fact led to worse outcomes on the whole for Black communities in the 50 years since Brown due to the incomplete nature of the interest alignment. Since white interests were primarily focused on international relations and perception, the legal remedy was enough to fulfill those needs but did not require truly emancipatory solutions. Instead, desegregation led to increased school tracking, including forcing Black students into vocational tracks (Anyon, 1981; Oakes, 2005), the loss of large numbers of Black educational leaders and teachers (Walker, 2009, 2018), ensuing lowered expectations for Black students (Ladson-Billings, 2006; Milner, 2010), and the pathologizing of Black families and the ensuing creation of the academic achievement gap as a concept (Ladson-Billings, 2006). Bell (1980) argues that Black Americans would have been better off without Brown in the long run. Milner (2008) shows us that this same possessive investment in whiteness is built into even the ways we prepare teachers for classrooms--including forcing Black and other

teachers of color into practices and evaluation processes that measure their alignment with whiteness rather than their ability to teach an increasingly diverse student body. Take for example the Danielson framework (2013), the most commonly used evaluation instrument for teachers nationwide (Salazar, 2018) which fails to include any mention of cultural relevancy, responsiveness, or equity in any way; the framework is only focused on alignment to specific instructional practices, no matter if they are working for the students teachers are serving, only focusing on compliance.

The final outcomes of school desegregation have been the expansion of de facto segregation driven by failed bussing programs, weak desegregation plans and traditional institutions of civic engagement such as town hall meetings, local political parties and civic business organizations like Rotary-lead fights against desegregation, encouragement of white families' opportunity hoarding (Calarco, 2018), and so-called school-choice or voucher program which lead to the disinvestment in traditional public schools, especially in metropolitan areas (Boyd, 2007; Lipman, 2011). Such drastic reverberations in response to desegregation shows the strong investment in the protection of whiteness as property—if all children have access to the same educational opportunities, the value of whiteness is lessened and subsequently the physical property value of homes and communities is as well.

Not only did school desegregation fail from a practical standpoint—schools are more segregated today than they were in 1950 (B. J. Love, 2004)—but, because Black interests were focused on equitable and supportive learning environments while white interests were focused on public perception and protecting the American ideal to fight communism, interest convergence may provide a perception of advancing marginalized interests, but because those interests are never fully aligned (which would require systematic destruction of whiteness as property and

reparations for two centuries of white supremacist policies and practices) and always temporary, the outcomes are often worse than they would be had marginalized groups continued in an adversarial position to whiteness. This reality is still apparent today, in the new "civil rights issue of our time" – the digital divide (Carvin, 2000).

Interest Convergence and Educational Technology

In the same manner that school integration moved forward when it served the larger needs of white America, a similar interest convergence is occurring in policies and practices of technology integration in public schools today. Although computers have been an expected resource in suburban schools since the early 2000s, it has only recently been a priority to get all students, including those in urban public schools, consistent access to computers and other digital tools. This is an admirable goal, but as with all policy implementation, the details are where problems arise. From internet access to hardware and software each example of interest convergence is both temporary and incomplete and leads to negative outcomes for students of color. I focus particularly on Black and Latinx students in urban schools here, but there is an extensive impact on rural students as well (Howley et al., 2011; Howley & Howley, 1995).

E-rate Program—Funding School Technology from the Internet Up

In the funding category, e-rate subsidies—which subsidized the building of a technological infrastructure but did not, until recently, adequately regulate the quality of the services provided nor what companies could charge for these services—serve to expand internet access but also continue to pad corporate profit margins without supplying the necessary bandwidth for marginalized students--an incomplete interest alignment. Corporations are also engaged in acquiring hardware and software contracts with districts, and utilize multiple less-than-forthright avenues to acquire those contracts, customer bases, and valuable student data--a

temporary interest alignment with long term positives for corporations and short-term increased access for marginalized students but long-term downsides for these same students. In the curricular category, three examples stand out: computerized standardized tests, personalized instruction, and preparation for rote rather than creative endeavors. All of these factors come together to result in the expansion of a technocratic oligarchy supported by a false front of altruistic expansion of technology in schools.

E-rate subsidies from the federal government are the largest driver of internet access in the United States because those subsidies provide local school districts funds to make connecting to the internet feasible. The program is funded by the Universal Service Fee charged to all telecommunications companies to provide a base level of service to all homes in the United States. In 1996 the FCC created a program to expand that funding to provide internet service to schools and libraries.

The major stumbling block now is getting the high-speed broadband service necessary for using video and modern interactive websites and programs. By 2013, only 30% of classrooms had high speed broadband access. In 2014, the second major funding for the E-rate program was introduced to expand that percentage, and now 88% of schools provide 1000 kbps per student--a marker of adequate broadband (Education Superhighway, 2019). Unfortunately, telecommunications companies like AT&T have been found to be charging up to 325% higher rates to school districts for internet services than they do for similar government buildings and budgets (Gerth, 2012). The E-Rate funding is also meant to go to support those districts with the most students in need of internet access, but the logistics, savvy, and funding for end-user materials such as computers and routers necessary to get the E-Rate funding is sometimes prohibitive for the most marginalized districts. While 35% or more of students in a district must

be eligible for Free and Reduced lunch to qualify for E-Rate, the cost of end-user hardware and other requirements on the district means those districts which have the tightest budgets and the most students in need are not always able to avail themselves of this subsidy.

Unfortunately, 11.6 million students still do not have the broadband and WIFI capabilities necessary for adequate access to internet speeds necessary for "a 21st century education" (Education Superhighway, 2019, p. 14). Experts recommend that the need is not necessarily in the expansion of hardware or infrastructure, but rather the reduction in cost of broadband services to districts by providing more bandwidth for the same costs districts and states are already spending on Internet services. Here is the first instance in which the interests of corporations, namely their profit margins, are detrimental to the needs of marginalized students in urban and particularly rural contexts. Not only do corporate elites continue to profit from services which should be freely available to all children in school, but the time it takes to get 100% broadband connectivity in schools that serve Black, Indigenous, Latinx, and other children of color only serves to deepen digital redlining.

Digital Redlining

Digital redlining as a concept has been applied to multiple aspects of the question of access to digital resources, all based on historical redlining which is a practice by the Homeowners Loan Corporation in the 1930s that surrounded "undesirable" neighborhoods in red on maps which were then used to decide where mortgages were available with subsidy from the Federal Housing Administration (Bryson, 2015; Hillier, 2003). Those undesirable neighborhoods were always those with large Black and immigrant populations, leading to negligible opportunity for those groups to acquire the generational wealth associated with home ownership. Similarly, digital redlining is associated with restriction of access to technology resources, whether physical

hardware, internet access, or ephemeral filters on that internet. Similarly to restricted mortgage access for 20+ years for Black Americans and the detrimental effects on generational wealth (Pearcy, 2020) the delay in acquiring internet access through E-Rate for urban and rural schools creates a time gap in which the children of (mostly) white elites in suburban public and private schools had unrestricted access to the internet and computer skills while marginalized youth--at least an entire generation's worth--were held back from reaching their full potential without the tools they needed to flourish.

Internet access and funding was discussed above, and here I move toward understanding the effects of the filters required in the E-Rate legislation funding framework. The Children's Internet Protection Act (CIPA) of 2000 requires that schools receiving E-Rate funding protect minors from having access to pornography or materials which can be damaging to them, and both of these requirements are applied in drastically variable ways. In the case of the LAUSD students who deleted their user profiles to access social media, Calculus homework, and music streaming, they had been blocked from those previously by the filter installed to protect them. But these filters do not only block applications that could be considered of questionable value, but they also block search content that an algorithm associates with something inappropriate. Gilliard and Culik (2016) define this form of digital redlining as being "walled off from information based on the IT policies of [the educational] institution" and mark these policies as "not a renaming of the digital divide" but rather a "set of education policies, investment decisions, and IT practices that actively create and maintain class boundaries through strictures that discriminate against specific [working class and poor students of color] groups." These community college instructors of writing are particularly passionate about these digital delineations that disproportionately affect their students -- the same students that are served by

marginalized K-12 urban school districts -- because it is an active exclusion of their students. Not only does this keep students from equitable access, but it also reduces opportunities for marginalized students to develop critical media literacy skills necessary for conducting research and being informed citizens (Hodgin, 2016; McGrew et al., 2018). In the same way the Homeowners Loan Corporation redlining was a way to "protect" whiteness by providing subsidized mortgages to white families, digital redlining provides far more access to transformative experiences for white children as compared to Black and Latinx children.

iPads, Personalized Instruction, and Standardized Tests

The temporary nature of interest convergence results in a focus on using personalized instruction, instead of more innovative and transformative uses of educational technology. Personalized instruction, with its emphasis on facts and procedures, only serves to create entry level service workers. Rather than providing full access to the expansive possibilities of learning, it instead contributes to international deskilling and the loss of creative educational options. This interest convergence is also bound up in the desire of corporations to corner the market for the hardware and software used in education by making it the only readily available tools to which young people are exposed (Ames, 2019).

In the case of many urban school districts access to technology is controlled more by corporate partners than by educational institutions. In the example case of LAUSD iPad program, emails obtained by the KPCC Los Angeles investigative reporting (see timeline of major iPad program events(*LAUSD IPads*, n.d.) the estimated $1.3 billion dollar project between Apple, Pearson and LAUSD, using bonds approved by Los Angeles residents for school infrastructure building, has been investigated by the Securities and Exchange Commission and resulted in a request for a $22 million dollar refund from Apple for the unusable software.

These scandals are disappointing and frustrating, for taxpayers, students, teachers, and families, but they miss some of the more insidious results of these hardware and software contracts. Not only is there ongoing corruption, and the normalization of teacher professional development being controlled by corporations (see Apple Certified and Google Certified Educator and other teacher ambassador programs), but the end result is a generation of children and their families who are now lifelong consumers of a product like Apple. Not only did the company make millions of dollars off the seemingly no-bid contract, but they also now have a built-in consumer base in one of the largest metropolitan areas in the United States. This compounds with the phenomena of "personalized instruction"—explored in the next section—in which corporate interests from fast food, oil change chains, and other service providers also now have a workforce trained in pushing buttons on touch screens and completing rote tasks within a predetermined path in an application.

If such programs were truly in the interest of young people, the goal would be providing the most options and exposure to transformational ideas rather than offloading basic technology skills job training responsibility from companies to schools. This focus entirely on the economic purpose of schooling with ever increasing cuts to social studies and civic education due to so-called achievement gaps results in a student populace which is prepared to press buttons on a Pearson-filled iPad for rote learning, but isn't prepared to develop and execute a complicated community outreach or political campaign using evidence to support their claims nor protest inhumane conditions in their communities or schools.

Personalized Instruction

It can be argued that the primary driver of educational policy since the 1983 "A Nation at Risk: The Imperative for Education Reform" report has been economic and international

dominance. This includes a focus on "gaps" among different race, gender, and socioeconomic groups within the U.S. on standardized tests like the National Assessment of Educational Progress (NAEP), and between the U.S. and other countries on the Organisation for Economic Co-operation and Development run Programme for International Student Assessment (PISA). To ameliorate these achievement gaps, more testing was required by the U.S. Department of Education to prove growth in student achievement data across groups disaggregated by race, socioeconomic class, and gender. In response, many states and school districts look to computerized instruction, usually framed as 'personalized instruction' which may come in the form of online video lectures, regular automated quizzes, computerized tutors, and other software programs.

While the U.S. public education system purports to prepare children for high-paying jobs, it is rare that instructional technology policies follow from that goal in urban districts. Philip and Garcia (2014) point out that while the "proximal benefits" of technology are said to be improving engagement levels and increasing student attention for learning, the "distal benefits" are in fact related to preparing underserved students to the skills necessary for the current workforce. Knowledge workers are the most highly sought-after employees in today's global marketplace, and their value comes from divergent thinking (Weber, 2009)– processing large quantities of information at a quick pace with a creative flare for transformational outcomes; this is not something you build by following a predetermined path set out by a software algorithm such as those used in personalized instruction (Bowles & Gintis, 2011; Knight & Marciano, 2013). Students graduating from school in this context are prepared to do entry-level or service industry positions, but not to succeed in college (Enyedy, 2014a; Knight & Marciano, 2013). Unfortunately, the general focus of economy building in technocratic capitalist nations has

focused on the notion of "deskilling," a process whereby technology is used to transform highly skilled jobs into that which can be completed by unskilled workers, resulting in human labor's loss of bargaining power to management based on who controls technology (Weber, 2009). Personalized instruction may have small benefits for improving student test scores (Enyedy, 2014a) but does not prepare them for success in college, the growing need for knowledge workers, or any productive contribution to civic society. Divergent thinking skills are not something you build by following a predetermined path set out by a software algorithm such as those used in personalized instruction (Enyedy, 2014). In the knowledge economy of today, young people must be taught to utilize multiple sources of information to make arguments that serve both academic subject-related professional practices and the necessary skills for membership in a civic society. The democratic imperative of American education, and the collaborative nature of the growth sectors of the economy, both service and technological, require schooling to engage young people in learning that goes deeper than rote regurgitation of the facts of math, science, language arts and history.

Additionally, the premise of an achievement gap is suspect because the historical lack of access to equitable education for large portions of the American populace due to enslavement and educational exclusion is not a passive gap which implies a problem for those who cannot bridge it, but rather an educational debt. Ladson-Billings (2006) points out this educational debt is owed to all marginalized students, but particularly Black students who continue to be failed by the educational system at appalling rates. While Personalized Instruction has an admirable stated goal – utilizing digital technology to make education a process that serves the needs of students rather than students serving the needs of education—this goal is complicated by the dual purposes of American public education: to support the sustenance of a democratic citizenry, and

to train a globally competitive workforce. Personalized Instruction only serves the latter, and does so only if our idea of a globally competitive workforce is built on the backs of unskilled labor. By shifting entry level job training responsibilities from corporations to public schools, economic elites further widen the educational debt.

Personalized instruction is not a source of curriculum in elite private and suburban public schools, but more likely to be marketed to and adopted in districts and schools that serve a majority of students of color, particularly from working class and poor families. Compare a suburban district whose teachers choose to and are funded to attend professional development to learn to engage children in design thinking, or building makerspaces, and participate in a district-wide plan to implement multidisciplinary problem and project-based learning units. While in a nearby urban school district teachers are being taught the logistics of Khan Academy in the online district mandated certification course that will be followed up by random walk throughs where teachers will be reprimanded officially if they do not use the software on which they were trained. Digital tools are created and exist within particular power structures and ideologies, and may be used to re-inscribe old power structures and introduce new power structures for expediency or convenience which are then used to control and surveil (Hall et al., 1996). Not only are the students in urban schools relegated to individual computers clicking through a video lecture with quizzes every few minutes with no opportunity for sensemaking or conceptual understanding, but they are also missing out on the integral collaboration and argumentation skills built by the suburban students in their interdisciplinary problem based units.

While much of technology integration in schools is touted as an alternative to the factory model of schooling (i.e. inputting similar age students, exposing them to the same information, and spitting out a product of adequately educated workers), the usual tools available in the

Personalized Instruction model actually do little to modify such a factory except to branch the assembly line off at predetermined points and make the journey longer for some while all try to meet the same endpoint. One lesson to be learned from any connection between the factory model and schooling is from before the assembly line even existed.

Luddites, a term now associated with generations who are anti-technology, were actually radical craftsman of the English textile industry in the 1810s. As an early union of workers, they fought back against the automation of their weaving, believing it would destroy the quality of fabric and skills of the weavers resulting in a loss of jobs, intellectual expertise of skilled craftspeople, and an overall reduction in quality of life for the artisans, their families, and the fabric customers. They argued that the wealthy would still have fine handwoven cloth available for them, but that the working class and poor of England would only be able to afford a lesser quality product in machine woven cloth while also making more money for the elites--an early example of industrial economic inequality.

Teachers who make similar arguments against the automation of education in the form of so-called personalized instruction are tagged with the title of Luddite. Both the historical and current Luddites had valid concerns. Much like the wealthy would always have access to fine handwoven artisan cloth, wealthy children will always have access to small group instruction that builds on their interests and passions to build leadership and critical thinking. Wealthy children will never be forced to learn sitting alone in front of a computer clicking through an automated tutoring program for 'remediation', much like young children in the early 19th century were "educated" in the numeracy and literacy necessary only to operate machines in the textile mills. Today, working, poor, and middle-class children, primarily Black and Latinx, will similarly be funneled into learning that is only enough to spend a lifetime pushing buttons.

They'll get the basic skills of digital tools necessary for entry level service industries but will never be given an opportunity to design those tools much less an imagine a transformative future for themselves and their communities.

The drastic push back that online learning, mostly in the form of so-called personalized instruction, has received from elite families during the COVID19 Pandemic illuminates this interest convergence even more clearly. When white elite's children are forced to use the same personalized learning software that Black and Latinx children have been forced to use for years, elites are no longer touting the power of these tools. Instead, they are forming small "pods" of five or so children from their same socioeconomic community (The LA Times Editorial Board, 2020) led by a dedicated teacher who either assists with so-called "personalized" digital instruction, or provides an actually personalized small-group instruction curriculum for just those students. Clicking through a pre-determined path was in an app was an acceptable instructional tool until their own children were detrimentally affected; just one more example of the temporary nature of interest convergence, and why it does not ultimately serve to promote the interests of Black and Latinx communities.

Teaching for Technocratic Oligarchy

The incomplete alignment of white interests with those of marginalized students and families also leads to the loss of more complex instruction and connection to the civic purpose of public schooling (Glass & Nygreen, 2011; Kahne et al., 2008; Kahne & Bowyer, 2017; Noddings, 2011). The temporary and incomplete nature is inherent in interest convergence—a feature, not a bug—because the purpose of reforms accomplished through interest convergence are only implemented until their results begin to challenge whiteness. This is curricular redlining—Black children got access to white schools after Brown v. Board of Education, but

they are not offered equal access to Advanced Placement courses (Boaler, 2011; Oakes, 1990) and school leadership opportunities (Bertrand, 2018) Latinx kids might get to use iPads in high school ten years after their white contemporaries got them in elementary schools—widening the digital divide in the form of skills and facility with tools—and yet they are still not allowed to use them for their own interests or passion projects.

Students of color are only able to access what is allowable within the parameters set forth by elite corporate funders and government restrictions that serve the possessive investment in whiteness. They may be prepared to do entry-level or service industry positions but not to succeed in college. Interest convergence in this sector has the long-term result of an ever-expanding technocratic oligarchy with undue influence on curriculum and instruction. Instead of a public education system for and by democratic means there now exists digital, physical, and intellectual divides which serve to not only re-inscribe and support white supremacy, but also produce workers who serve American hegemonic interests (Philip et al., 2017; Vakil, 2020; Vossoughi & Vakil, 2018).

Seeing is Only the First Step

The story of interest convergence in American education, law, and policy extends across time from Brown v. Board of Education to iPads in the second largest school district in the country. There are benefits to children and communities that are present as a result of this so-called progress, but the "unintended" consequences are equally or more destructive in the long run. This reality is only exasperated by the lack of knowledge and training provided for teachers and administrators to critically examine the purposes and practices of educational technology (Cullatta, 2016) in their districts and schools. Without that preparation, individuals are not prepared to counter the interests of corporations with huge advertising and sales budgets.

I do not propose a solution here, but rather only explicate the problem from a Critical Race Theory framework. For any form of solution to work, it must center the racialized reality of teachers, students, families, and communities in history and present, both in regard to schooling and technologies. Bell advises us that race and structural racism are permanent and inescapable (1992), but does not conclude this reality to be depressing but rather realistic and affirming of Black experience in America. That reality must be addressed on a daily basis in all work we do in the world, and the work of utilizing educational technology in schools is no different.

Chapter 3 – Article II

Teacher Candidate Technology Identity in an Urban Teacher Residency

Abstract: To design for equity, one place to begin is within the context of teacher education. In particular, educational technologies may be used to transform not only student learning, but also communities and worlds for a more just future. To understand how teachers come to adapt their practices in the classroom which utilize technology, and any changes to that practice we might hope to encourage, we must understand the current identities teachers have already developed around technology use both in and outside of school. By focusing on the educational histories, goals, and narratives of technological experience, I build a framework for how teachers begin their process of learning to teach with technology. We must understand those historical narratives that make up the identities which have been both imposed upon new teachers (digital native, social media obsessed, technology reliant) and those to which they ascribe (gamer, skeptic, efficiency oriented). Those identities are deeply consequential for how they approach technology integration and support in their teacher education programs, in their field placements, and in their own classrooms in the early years of their teaching.

1 in 5 young people in the U.S. do not have a high-speed internet connection at home and 25% of teens in homes with a household income below $30,000 report regularly being unable to complete homework due to lack of reliable internet or computer at home (M. Anderson & Perrin, 2018). But as of 2017, 98% of school districts do have high speed internet access in classrooms with 88% having WIFI available throughout their schools (Herold, 2017). This rapid increase in digital access is laudable, but how teachers learn to use those digital tools to achieve their pedagogical goals remains severely understudied. Digital technologies may be a tool for equity if teachers move beyond a neutral stance by understanding digital tools and education from a socio-political perspective (Philip et al., 2018), but unless it is integrated into their professional identity and practice (Beauchamp & Thomas, 2009) there is little evidence that access to the internet and computers alone supports equitable learning outcomes. Even less scholarship exists regarding teacher learning about, adapting, and integrating technology with an explicit eye towards transforming education to better serve youth who have been marginalized.

Access is only the beginning of excellence. Transformative education is led by teachers who are excellent designers of learning experiences, instructors of established skills and content, and committed to breaking down structural inequity within the education system to create a better world alongside marginalized community. Technology can both retrench established tracking within public schools and reinforce divides between under resourced public schools and elite private schools. In elite schools students are participating in team based technology enhanced project based learning or Google's famous 10% time passion projects (Cullatta, 2016; Will, 2019, p. 20). In urban schools, however, the technology tools marketed to and used there can exacerbate "back to the basics" approach to remediation—forcing children to click through so-called personalized learning programs or digital tutors, which are neither able to establish

collaborative, creative learning nor reliably show student outcome improvements (Enyedy, 2014a).

Although it seems logical that what teachers learn in teacher education should have an impact on how they teach, there is not always fidelity between teacher education curriculum and teacher professional practice. Similarly, we know children do not learn just because we teach and neither do adult learners automatically implement that which they have been exposed to or required to do. Instead, they make sense of their training and policy expectations to create a syncretic contextual implementation (Allen & Penuel, 2015; Horn, 2005). To account for this, educators of all ages can explore the underlying assumptions and understandings youth and adults bring to any topic and engage them in hands-on exploration of phenomena to create long lasting changes in understanding and practice for true learning.

To design for an educational context in which marginalized youth in urban schools are provided with the space and chance to utilize technologies to transform not only their learning, but also their communities and worlds for a more just future, we can start with understanding how teachers own experiences, identities, and ideologies mediate their learning and vision of technology use in the classroom. As Walkoe and Luna (2020) point out, the study of teacher learning, particularly to develop and clarify learning theory, has been neglected in recent scholarship. We have clear evidence learning is more than the mere acquisition of knowledge by rote or by exposure and should more accurately be understood as changes in identity marked by shifting goals and the uptake of roles within a particular context as mediated by tools available (Halverson, 2009; Nasir, 2002). Learning can thereby be marked by shifting identity as reflected in narratives told about oneself and recognition by others of membership in a particular identity group (Sfard & Prusak, 2005).

While some identities are more 'sticky' due to social stratification and structural inequalities, group identities are not singular or separate from one another, but rather intersect to create particular opportunities and constraints for learning and being in the world (Collins & Bilge, 2020; Covarrubias, 2011; Crenshaw, 1991; Ryoo et al., 2019; Ryoo et al., 2020). In the case of learning to teach with technology, a popular narrative (Lei, 2009) exists that the current generation of teacher candidates are so-called 'digital natives' with the implication that they require little to no formal learning in utilizing technology in the classroom. In reality Generation Z is fluent in tools for media consumption and sometimes production while their exposure and comfort with tools for knowledge building, collaboration, and research vary widely. To understand how teachers come to adapt their practices in the classroom which utilize technology, and any changes to that practice we might hope to encourage, we must understand the current identities teachers have already developed around technology use both in and outside of school.

For example, a young woman in her early twenties who identifies as an immigrant Asian American is in the midst of a teacher education program that includes a course on Critical Media and Technology Literacy. She describes herself as spending a good portion of her teen years as an addict to an online role-playing game. That experience shapes her own perspective and beliefs about the use, value, and risks of technology in general and it carries over to what she can imagine to be the utility of technology for transformative learning experiences for her students. Her experiences are also shaped by the expectations her colleagues and students have of her based on one aspect of the model minority myth (Museus & Kiang, 2009; Wing, 2007) of Asian American students as experts with math and technology. Another teacher candidate who identifies as a queer woman of color has a different narrative regarding her exclusion from

computer science that leads her to advocate for CS education for all students regardless of prior exposure or achievement.

This paper addresses: How do pre-service teachers in an urban teacher residency narrate their experiences, practices, identities and goals related to technology? How might these personal and educational histories mediate teachers develop goals and practices technology integration in their classrooms? Using written reflections from a required Critical Media and Technology course in an Urban Teacher Residency program, I provide a model for the interaction among out-of-school identities, school-based identities, and teacher professional identity with regards to their use of technologies from graphing calculators, personal computers and projectors to interactive whiteboards, "personalized instruction" digital tutors, and digital storytelling tools.

Building a New Vision for Educational Technology Integration

Despite the field of teacher education's increased focus on equity and inclusion in teacher recruitment and professional training in the past 20 years, disparate educational and societal outcomes for Black, Latinx, Indigenous, and other students of color continue (Carter & Welner, 2013; Howard, 2015; G. Ladson-Billings, 2006; Noguera, 2001). On the technology side teacher education varies in the manner of incorporating technology in their credential programs, from a single course for the technology requirement, a project in every course utilizing technology, or creating collaborative professional learning communities both in person and remotely via platforms like Twitter for building pre-service teacher capacity for integrating technology (Krutka et al., 2016; Trust et al., 2016). There is still little evidence of preparation of preservice teachers to serve students in urban communities (Cullatta, 2016) in a transformative manner with digital tools.

Ubiquitous but Not Neutral

Multiple perspectives on the value of digital technologies in urban schools exist with those views tending to mirror beliefs about the purpose of schooling as an economic, civic, or transformative project. One may argue that access to, familiarity with, and ability to learn with digital technologies is necessary for any chance at economic success for today's children. Another perspective proposes that the previously in-person public square is now almost entirely online (Kahne & Bowyer, 2017) and youth who are consistently underserved by political and social institutions deserve access to and experience advocating with digital technologies. Suad Nasir and Kirchner (2003) also identify the ways access to civic organizing is integral for adolescent development while much of that organizing is done in the digital realm (Kirshner & Middaugh, 2014). Lastly, the transformative power of technology for youth engagement with social justice can be exponential in comparison to that of an entirely analog context (Garcia et al., 2015; Garcia & Morrell, 2013).

These digital contexts are not neutral, and even the simplest digital tool like Google search (Noble, 2013) is increasingly recognized for reflecting the structural racism and sexism of American society. Digital tools are created by people and exist within particular power structures and ideologies, and therefore can be used to re-inscribe old power structures and even introduce new power structures for expediency or convenience which are then used to control and surveil (Hall et al., 1996). In the case of Los Angeles Unified School District, one of the first large urban district to attempt a district-wide one-to-one laptop/iPad program, the district did so with apps and programs that provide students experience with basic digital skills, but rarely encourage or even allow engagement in self-directed or divergent thinking. Students graduating from school in this context are prepared to do entry-level or service industry positions, but not to succeed in

college. This is interest convergence, defined by Bell and Milner (D. A. Bell, 1980; H. R. Milner, 2008) as giving in to organizing by marginalized communities for equity only to make sure that the implementation of said equity re-inscribes established power dynamics that benefit whites. Educational technology integration in schools that serve a majority of Black and Latinx students has thus far focused on access to laptops and internet service (Warschauer, 2004), rote instruction in the guise of personalized instruction (Enyedy, 2014a), and surveillance facilitated compliance (Crooks, 2018).

Access vs. Transformation

When describing social justice education, multiple definitions and descriptions exist in the literature including examples from critical race theory (Gloria Ladson-Billings et al., 1995; H. R. Milner, 2008; Solorzano & Yosso, 2000; T J Yosso & Solorzano, 2005); culturally relevant pedagogy (Gloria Ladson-Billings, 1995), culturally responsive teaching (Gay, 2010), culturally sustaining pedagogies (Paris & Alim, 2014; Gloria Ladson-Billings, 2014), critical care (Noddings, 2002, 2011, 2015), democratic classrooms (Dewey, 1923; Gathercoal, 1997), reciprocal participation structures (Au, 1980; Carpenter, 2016; Erickson & Mohatt, 1977), and critical pedagogy (Duncan-Andrade & Morrell, 2008; Freire, 1965; Leonardo, 2005; Scorza et al., 2013; Vossoughi & Gutiérrez, 2016). One way to categorize these various frameworks is to identify whether the outcome goal is about equitable access to the current educational system or transformation of the system as a whole. Of course, there are many which bridge this dichotomy, but in the context of technology the access as social justice argument is very prevalent. Early educational technology programs like One-Laptop-One-Child (Ames, 2019) framed educational justice as access to computer hardware. Scholars and practitioners also frame digital tools as the means of teaching content in a manner that is more engaging than traditional lecture-based

instruction, or is more successful than open-ended inquiry. Digital software, coding, or graphic design projects designed specifically to engage students in modeling their ideas about science and math concepts (Buechley et al., 2008; Gebre & Polman, 2016; Wilkerson-Jerde et al., 2013) builds in active engagement with conceptual learning, but does not explicitly address issues of social justice or equity in content, or in the ways race, gender, and power might interact with the tool implementation. In the case of humanities, access to the internet provides an extraordinary supply of historical primary sources and freely available literature in the form of e-books, but if those tools are only used to teach the same canonical texts and historical figures (Salinas et al., 2016; Shear, 2016) then access to the digital realm is necessary not sufficient, and a truly transformational approach is needed like those explored as part of ethnic studies curriculums (de los Ríos et al., 2015; Kwon & de los Ríos, 2019).

Technology *Can* Be an Agent of Transformative Justice

On the other hand, some scholars study the use of digital tools chosen explicitly to focus on teaching explicitly about issues of social justice. Enyedy and colleagues (Enyedy & Mukhopadhyay, 2007; Rogers et al., 2007) utilized a digital mapping tool with student-researchers who were investigating educational justice in their city as part of a summer youth research program. The authors were interested in the power of this data visualization to teach core statistical concepts. They found that mathematical norms were mediated by norms of social justice. For example, social justice norms value lived experience as of paramount importance, which the authors found to sometimes come at the expense of developing evidence-based claims based on valid statistics. Another example of digital tool used with the goal of affecting change for social justice is in the combination of critical mathematics and place-based education by Rubel and colleagues (2016) creation of the Local Lotto which creates an app for mobile data

gathering and mapping. These community-based maps were designed to be utilized by participants to make an argument for spatial justice at the local and higher political contexts. In an out-of-school example, Headrick Taylor and Hall (2013) engaged youth in both physical and digital mapping of their neighborhoods to make space for youth input on city planning decisions around bike paths and lanes. This project used digital tools to move the collection, ownership, and use of data and digital technologies from those already invested with structural power to the young people who are marginalized by schools and have little to no voice in their use in other spaces.

Unfortunately, for the most part, technology and social justice are separate conversations in education. Teachers are rarely provided an opportunity or expectation to consider them together. The imperative here is to understand best how to prepare novice teachers for the "affordances of technology…[to] reimagine the teacher-student dynamic for an increase in empowerment rather than increasing the oppressive nature of school." (Lankshear et al., 1996, p. 151) One aspect of this work that must be taken in to account is the varied identities that make up individuals who become teachers, and how those different parts of teacher's self can interact with the professional vision they develop and implement in their classrooms regarding the use of technology in the classroom. Much like the established scholarship (Barton & Tan, 2010; Brown et al., 2005; Kang & Battey, 2017; Naidoo, 2017; Nasir, 2002) on development of math or science identity being salient for both learners and teachers in math and science, the same logic applies to teacher identification and narrative history of using technology or thinking of themselves as a "techy" person inside or outside of school.

How Teachers Learn: Identity and the Adoption of New Goals

In teacher education it is especially important to remind ourselves of the imperative to prepare novice teachers for the "affordances of technology…[to] reimagine the teacher-student dynamic for an increase in empowerment rather than increasing the oppressive nature of school." (Lankshear et al., 1996, p. 151) The dual imperative of American education, preparing participants for civic society and economic viability, combined with the collaborative nature of the growth sectors of the economy, both service and technological, require schooling to engage young people in learning that goes deeper than rote regurgitation of the facts of math, science, English and social studies. To lead with vision in this changing environment, teacher education must have a plan that includes not only preparing pre-service teachers for dealing with the structural implementation of technology, but also the ideological context of the digital tools available for their instructional use. To design that plan, we must understand how personal and educational experiences mediate tech identity and classroom instructional goals -- if we are to support modifying those identity influenced goals and encourage more transformational goals, we must study the tools or means of achieving them and the community in which a teacher might develop an identification as competent and transformative with technology.

Core research in the learning sciences, social psychology, and communication studies builds a foundation to understand the ways identity, goals, and practices interact in the learning process. In Nasir's (2002, p. 219) influential framework for understanding student identity in practice, she defines identity as "a fluid construct, one that both shapes and is shaped by the social context...not purely an individual's property, nor can it be completely attributed to social settings." In the case of technology, access to technology, transformative experience with digital tools and trajectories available for becoming expert in technology are mediated by social class.

As well established in the literature (Anyon, 1981; Ladson-Billings & Tate, 2000; Oakes, 1990) class is deeply intertwined with race and educational access. This interaction is also present in the surveys of technology use by young people disaggregated by race according to Pew Research (Perrin & Turner, 2019)

Nasir's (2002) synthesis of the work of Wenger (1998) and Holland and colleagues (2001) comes together with a critical focus on,

> how learning settings afford ways of becoming or not becoming something or someone is central to understanding culture, race, and learning, particularly given the multiple ways that race (and social class) can influence both the kinds of practices within which one can become and the trajectories available in those practices. (p. 219)

Within a community of practice, such as a classroom, there are three modes of belonging according to Wenger (1998) -- engagement, imagination, and alignment -- or modes of participation in a community (central, peripheral, active disengagement or distancing), connection to the wider community of that practice (the broader world of teachers rather than just those in your teacher education program), and the community's orientation to a shared goal (in the case of this teacher education program, social justice education in the urban context, serving mostly Latinx and Black children and families). Wenger (1998) also makes clear that this identity construction happens both through identification, or investment in a particular community, and the negotiation of one's own role within and participation in that community at a particular time.

This importance of culture, race, and class in the understanding of learning within the sociocultural tradition is directly tied to the "Vygotskian notion that to truly understand something, one needs to understand its developmental course, as knowledge of the developmental process offers indications of the true nature of a phenomenon(Nasir, 2002, p. 220)

If the trajectories available within a community are restricted by the influences of structural inequities which are entwined with race and class, then those socially constructed groupings are integral to understanding the phenomenon of teacher learning, and in particular the development of technology identity due to the gendered and racialized nature of STEM subjects across learning contexts (Collins et al., 2020; Collins & Bilge, 2020; Fields & Enyedy, 2013; Noble, 2013; Vakil et al., 2016).

Nasir's (2002) work on math identity in the context of young Black students playing the game of dominos parses out the developmental progression from playing to keep the game moving, to playing to score, and then into keeping others in the game from scoring while protecting one's own ability to score. This increasing complexity of student's game play behaviors is built on both an increased facility with the math skills necessary for play (the technical aspects) and a growing comfort with the social practices integral to game play. In the case of teacher learning, the development of a teacher's professional technology identity is a complex interwoven socio-genesis. While the external motivation for technology integration may come from a required course or administrative edict, the teacher's engagement with that external requirement is shaped by their own decisions to engage in the social practice of learning along with their socially supported identity as a social justice educator.

Much like the decision to engage in playing dominos, the teachers who engage with learning to use technology in pursuit of social justice learn the theoretical and technical practicalities of digital tools similarly to the math skills necessary for playing dominos. The technology literacy skills are the technical facility with tools (dominos or laptops) that builds over time, through a developmental progress of added complexity via the social practices of cooperative discussion, mentor and instructor feedback, reflection, planning and implementation.

Much like a child's goals change from being able to stay in the social experience by keeping domino game play going, the teacher candidates engage with using technology because it is required to pursue a desired goal of social justice teaching. But their own experiences and micro-interactions with the course instructor and other classmates shape the way digital tools are used to reach the emergent goals both during the course and in imagined future classrooms.

Also important to this development of professional identity is the stories people tell about themselves, the stories told about them in media and society, and in the intersections of personal, digital, and teacher identities. Building on the critical work of Sfard and Prusik (2005) which calls for the definition of identity to be operationalized as the narratives one tells about oneself and those which are told by society. In their framework, identity is made up of stories which are reifying, significant and endorsable. In this structure, learning is thought of as moving from actual identity to designated identity. This means that identity is constructed through self-narration (thinking) of repetitive experiences which one identifies with and which are significant to how one sees oneself and others see you. These are regularly used to "imply one's memberships in, or exclusions from, various communities." (p.17). Important in this theory of learning is the idea that these are not immutable but rather "presents them as discursive counterparts of one's lived experiences" (p.17) so the interest of the researcher is in the learner's activity of identifying with a narrative, and "the complex dialectic between identity-building and other human activities." (p.17)

In this case, I am interested in the narrative of a professional identity but recognize and embrace that professional narratives are not isolated from the other identities that make up the individuals or a community of practice as a whole. I argue that identities are the stories that people tell about the practices they are able to engage in within micro and macro structures.

Therefore, in the process of those interactions within the activity, the new professional identity of the participants is changing and shifting in relation to one another, the course materials and assignments, established narrative identities which are reified, endorsable and significant in their lives in the course of their sociogenetic history, and the availability of particular identities due to systemic and structural inequalities in society.

The construction of teachers' professional identities as technology users and facilitators is also mediated by the nonlinearity of cultural time. For example, prolepsis is the understanding that the imagined future has an impact on development in the present. This concept has been applied to child development (Cole, 2007; Vygotsky, 1980) and even development of national identity and policy based on an imagined collective past (Luna, 2017). In this case, participants' own experiences with technology informed the way they imagine powerful social justice education to utilize technology in their future classrooms. By engaging in reflection and experience in the course, a new critical technology literacy space was created in which pre-service teachers can develop new imagined futures based on their shared teacher education classroom experiences.

This study interrogates the ways teachers own identities related to technology, education, and the combination of the two both inside and outside of school influences what they imagine to be possible in their own classrooms. Narratives of identity are powerful mediators of learning for both students and teachers and should be examined in relation to the development of a critical technology integration practice and social justice teacher identity. By first understanding the development of an emerging identity in this study, we can further build on that work in the future regarding the impact of multiple identities on teacher professional vision and classroom practice.

Participants and Program Context

Data for this study was collected as a part of the multiple research projects conducted during the 10-yearlong federally funded Urban Teacher Residency program. The UTR is a partnership between a large public research university in one of the largest urban districts in the United States. The residency was designed in collaboration with multiple community organizations dedicated to arts integration and preparing and supporting social justice minded community teachers. Residency programs (Berry et al., 2008) are focused on bringing pre-service teachers in to the classroom as early as possible for as long as possible before they are teachers of record completely in charge of their own classroom. The residency is an 18-month program, with a cohort of novices who begin their MA in Education with intensive coursework during July and August before being paired with a mentor teacher that they work with from the first day of the public school academic year onwards. The cohort members complete their graduate coursework three nights and one afternoon a week, including innovative courses that teach content methods all year long in collaboration with mentor teachers.

I was a member of the research team researching the residency program for over 5 years and redesigned and co-taught the course in which data was collected. The focal (10-week, 3 credit unit) Critical Media and Technology Literacy (CMTL) course is taught during the third quarter of the first year of the program. I define CMTL as being focused on the critical interrogation of the structure and function of not only popular media but also the hardware and software used to create that media and everyday interactions in classrooms, from google search to Class Dojo management program, or the use of tablets vs. laptops in a particular district.

The participants are 32 Novices, evenly divided between those pursuing single-subject (secondary) or multiple-subject (elementary) credentials, all of whom will also complete a MA

thesis and graduate with a master's degree at the end of 18 months of intense study and field work. At the time of data collection, elementary novices were a few weeks into their second placement for the year but had been in their first placement classrooms every day from the first day of the district calendar. Secondary candidates stayed with the same placement the entire duration of the school year and were in the last two months with those students and mentor teacher.

Each group - elementary and secondary - are part of a team of 18 novices led by one faculty advisor who serves as both their field placement supervisor and instructor of multiple courses. Novices also take courses throughout the year on the university campus in the afternoons and evenings with about ⅓ being enrolled in a bilingual authorization program concurrently. The cohorts have worked closely together throughout the program and meet at least twice quarterly as a large group but have not previously taken an entire course altogether before the one in which data for this paper was collected.

Within the cohort of 32 novice teachers, the participants self-identified by race and gender as part of a larger study of the teacher education program. Twenty-one of those participants identify as women with nine of the women identifying as Latinx, five as white, four as Asian American, two as Latinx and white, and one as Black. Of the eleven men, five identify as Asian American, two as Latinx, and one each of Black and white, Latinx and white, American Indian and white, and Asian American and white. In total, 27 participants identify as teachers of color with fourteen considering themselves Latinx, ten Asian American, two Black and one American Indian. All of the five participants who identify as white also identify as women.

All residency placements are purposefully chosen for their supportive and social justice-oriented partner teachers within district partner schools. This UTR group is more racially and

socioeconomically diverse than the current teaching force, and more closely represents the demographics of urban schools (see Figure 1). For myself, as a middle-class white woman who previously was a high school social studies teacher in an urban school district, I more closely reflect the current teaching force and made sure to directly address this dynamic in the first class meeting and on an ongoing basis when reflecting during the data analysis process. My own history with utilizing technology in ways that reinforce established systemic inequities and carceral pedagogies (B. L. Love, 2019) drew me to understand how those learning to teach make sense of their own histories with technology, race, class, and gender, and how those histories mediate enacted and imagined classroom practices.

The CMTL course studied here is an example of a course design aimed at building a road bridging theoretical commitments and pedagogies of enactment by providing opportunities to engage with reviewing, re-designing, and enacting practices with digital tools. In the course, I explicitly encouraged participants to integrate their espoused social justice ideologies with the use of educational technology as the co-designer and co-instructor of the course. Although all of the participants identified as social justice educators, they were varied in their connection to the identity of "techy teacher," or one who utilizes technology as part of their teacher identity.

Data Collection

During the course of this residency program, the 32 students in the cohort were participants in multiple research studies and by the time of data collection were intimately familiar with the informed consent process. Students were asked at enrollment in the residency program to consent to the study of their written course work, survey responses, state credential exams, and video recordings of class discussions. Additionally, both during a seminar visit the quarter before this course was to be taught and on the first day of class I introduced myself to all

of the 32 participants and reviewed my plans for data collection and the purpose of this study. Participants were welcome to withdraw from the study at any time without my knowledge by contacting the teacher education program director and no data analysis occurred during instruction until assent by default was secured at the end of the course when no one withdrew their consent.

In this paper, I utilize data collected during the Critical Media and Technology Literacy course in the form of two major assignments: a digital autobiography assignment and a multimedia VoiceThread recording. Although detailed analysis is not included in this paper, all small group discussions in the course were also recorded via student-controlled GoPro cameras, participants completed pre and post class written reflections and an end-of-course unit plan and reflection. I also have access to the essays that participants wrote for their application to the teacher education program. All data analysis was completed after the course was done, grades were submitted, and participants were no longer students of myself or the co-instructor.

In the digital autobiography assignment, participants were asked to explore their experiences with technologies and digital tools in writing, including experiences as children, students, family members, and teachers. They were asked to reflect on the following questions:

> What did you learn about technology growing up? What's the first time you remember using a digital tool? At home? At school? Who were the instrumental people in your exposure to technology? What are your favorite parts about using digital tools? What is the most annoying or worst part? What specific experiences do you remember from your childhood related to technology? What do you think the purpose of technology in schools is? What should it be? How do your teaching practices reflect this purpose?

In the VoiceThread assignment, participants were asked to reflect on media representations of their own identities of "teacher" or particular racial or ethnic groups, and on the utility of VoiceThread in their classrooms. My analysis in this paper focuses on the ways

participants made sense of the use of the digital tool in relation to their own and their students' learner identities.

Each of these tasks was focused on illuminating the connections between personal and professional identities and the practices of technology use in the K-12 classroom. In the first, childhood personal and educational practices with technology were discussed with prompts focused on personal memory and the affective aspects of using digital technologies. In the second prompt, participants are asked to utilize a digital tool to verbalize connecting their own identities to concepts of critical media literacy they were learning in the course, and then evaluate the utility of such a tool in their own classrooms. This served to connect personal identity and representations of identity with digital tools and to relevance in their classrooms.

Data Analysis

After the course meetings were complete and grades were submitted, I re-read each source of data and briefly summarized the contents in a content log. Based on that content log, I highlighted recurring topics across participants as potential codes for further qualitative analysis including childhood and current home vs. school access to technology, family socioeconomic status, mentions of race and gender, specific use cases of technology focused upon in reflection, espoused social or institutional identities, and generalized vs. specific technology examples. Upon a second reading of the data corpus, I identified three major purposes participants identify in their personal and professional experiences with technology both inside and outside of school: gaming, work, or social/media consumption.

To get a more granular understanding of their perspectives, and how those experiences around technology influenced their ideas about what digital tools can be used for in the classroom I constructed individual portraits of each participant. Based on the portraiture work of

Sara Lawrence-Lightfoot and colleagues (2004; 2005; 1981) I developed a narrative of each participant summarizing their personal and professional identities as reflected in two course assignments that focused on these issues, along with some details filled in from application essays, field notes, finals projects, and personal communication with participants.

From these portraits I mapped the way their childhood experiences with and access to technology at home and in school mediate their vision for the use of technology in their classrooms. In mapping the ways participants narrate their personal and childhood educational experiences with technology as positive or negative experiences led me to reflect on the ways this narrative mirrors the ways research on mathematics learning and teaching integrates which utilize sociocultural theories of learning as changes in identity by means of changing practices and goals. I then returned to the data corpus to further code for those frameworks by identifying individual technology use goals, existing relationship to technology, the bigger goals for social justice education, and the ensuing affordances and problems reflected in the alignment or misalignment between the participant's own technology identity and vision of social justice education. By engaging in this iterative process, I was able to check any assumptions or personal biases that edged their way into my portraits when I went back to the data collected from each participant. I compared each portrait summary with the original narratives and assignments of the emerging teachers to clarify or revise how their own words reflect the thematic findings. This process helped me identify two major themes in the participants' histories with technology along with two perspectives on social justice which mediate those histories to result in particular orientations and practices for using technology in the classroom. The participants below were chosen to explore in depth to show the diversity of ways participants' historical connections to technology were consequential for their teaching identity and practice.

Findings

In participants' own histories both inside and outside of school there were two large categories of technology use: entertainment (games, social media, video) and work (schoolwork, family business, parent use of technology). You can see in Figure1 where participants fall within that framework when adding the dimension of their social justice orientation as well. Those historical associations mediate their views on the purposes and practices of technology use along with participant's commitment to social justice in education. Social justice is a central tenet of the teacher education program in which they are enrolled and this study was conducted. This tenet is not one of lip service but rather an active component of every part of the program from coursework to field supervision and partner teachers and schools (Kawasaki et al., 2018), but is not clearly defined to be exclusively an access-based conception of educational justice or a transformational vision for a radical change in the process and practices of schooling. What that social justice commitment looks like in practice, and how access or transformation is prioritized in the implementation of that justice orientation varies among participants. This variation in transformation or access-oriented vision of social justice intersects with the technology histories participants bring to the Critical Media and Technology course to influence the goals that participants have for technology integration in their classrooms. These views also reflect experiences in their residency classrooms. Participant's plans for when they have their own classroom do not necessarily mirror their own histories, and often do the opposite; many of the novice teachers described here choose to become teachers to counteract the negative experiences they had as young people and their use of technology is no different.

Social Justice Orientation	History with Technology	
	Entertainment	***(School) Work***
Access	*Kevin * Lixue Ryan Jane Ezekial Chris Brittany	*Poppy *Andres James Jenna Rosa Violet Azul Melissa Elizabeth Jonathan Jae Lindsay
Transformation	*Edward *Xi Eddie Liam Kaitlyn Tiana	*Adrí *Lilia Victoria Carrie Alison Gina

Figure 1: Personal History with Technology and Social Justice Orientation

* indicates case detailed below

A History of Technology for Entertainment

Out of the 32 participants, thirteen clearly articulated their main use of technology in their own childhood being related to games, gaming, and entertainment as a whole. Established scholarship identifies the value and values inherent in both digital (Gee & Hayes, 2011; Gilbert, 2019) and analog gaming (Garcia, 2017) as mechanisms of community and identity building, both for internal gaming skills and externally relevant skills that are transferable such as critical thinking, spatial reasoning, storytelling structure, and more. Within those studies there is also a clearly articulated connection of `game play to community building and friendship development by way of the networks built within a particular gaming world (i.e. World of Warcraft, Assassin's Creed, or Dungeons and Dragons) in the form of in person console gaming or online role play games, and among gamers as a social group designation. Some of the participants more

clearly identified themselves as a "gamer" versus just someone who played games with family and friends as a young person.

In the case of gamer novice teachers, how might a gamer identity and the related history / comfort with technology that comes alongside such identification affect how they see technology as a tool for teaching? What about as a tool for teaching for social justice? Within the group of teachers with a gamer history, I detail below 4 participant profiles enumerating what possibilities arise in how gamer identity intersects with an access oriented social justice orientation and results in particular trends in classroom technology integration: community building, engagement, and efficiency orientations.

Kevin - Community and Access

Kevin was born in Hong Kong and raised in the United States and centers being Christian in his identity. He also taught English in Beijing before joining this teacher education program in the US. Kevin works as a middle school integrated science novice teacher and is clearly comfortable using digital tools in the classroom, but says in his digital autobiography he doesn't "think technology could ever replace instruction from another human being but I do believe it has the potential to enhance it."

When reflecting on his own experiences with technology, Kevin focuses on two things: social media and gaming. For the former, his use of AOL instant messenger, Xanga online journal, Tumblr multimedia social site, and now Facebook are all ways that he stayed connected to his friends he made at church and did not attend school with. In his digital autobiography assignment Kevin says "As an introvert, I was much more comfortable and felt safer sharing my thoughts through an email or a private blog than in person." He does, however, identify sitting in person with his friends playing console games as a big part of his childhood, and a way that he

learned “valuable character traits such as losing with dignity, being persistent...attention to detail and strategic thinking.” Console games were even a way that he built background knowledge and usable skills for real life, like knowing how to kayak before ever stepping foot in a boat from playing Mario Party mini-games as a kid. Kevin describes himself as “addicted” to first person shooter games for most of high school and college. He has now given them up completely to move on with his life. In school, Kevin explains he “was captivated by it [computer lab] and found great enjoyment in learning how to use this technology.” Later in the same digital autobiography assignment, Kevin writes that when he was teaching kindergarten in China after college, “I valued technology even more during this time because they became tools for me to learn the language and eventually navigate my environment” for example “I was able to use Google Translate to help me recognize and translate the meanings of words I didn’t know.”

Consistent with the meaning he made of his own experience with technology, Kevin’s goals for the role of technology in his middle school science classroom is meant to develop social collaboration, build character, and deepen understanding—but not as a replacement for in person human connection. In his digital autobiography draws a comparison between the U.S. and China in the ways technology is used as a replacement for teacher interaction in the States while apprenticeship and extensive lesson planning time is a mark of the value given to teaching as a skill in China. He says, “...using technology within the classroom shouldn’t simply be fun but it should also be challenging.” For example, during a unit on chemical reactions he says, “We lacked the expensive technology that would allow for that to happen so instead we used a simulation model instead.” He also shares an experience having students work together in Google Slides to do research and “decide together what information would be best for their

project" which he marks as being "able to give my students a glimpse of the benefits of social collaboration."

Inspired by his Christian faith to be in service to others, Kevin frames his social justice orientation "to affect change in the lives of others" in his program application essay by referring to the example his parents set by "serving [others] lovingly and intentionally investing in the relationship you share with them." He also emphasizes his lived experience with being English language learner (in the U.S, and a Cantonese speaker learning Mandarin when he taught in Beijing) as part of his dedication to serving those who are emerging multilingual students in his school district.

Although not explicitly named as such in his own words, Kevin leans more toward an access-oriented conceptualization of social justice -- he focuses on teaching science in an engaging and content rich manner so all children have access to knowledge of science content and practices. This is aligned with the ways he uses technology to provide access to viewing a chemical reaction they wouldn't have been able to see otherwise and experience using a collaboration tool for presenting research. Kevin continues to focus on the collaborative and interactional nature of technology, mirroring the ways he used games and social media as a young person and as an adult--access to otherwise absent information and to build social connection.

Lixue - Fear, Efficiency, and Engagement

Lixue came to the United States in 2008 and then eventually transferred to UCLA from community college. Prior to that, she spent the first half of her life living and going to school in Korea. In elementary school, Lixue had a teacher who was pregnant and wore a large protective apron anytime she used a computer because she believed it would protect her from

electromagnetic waves that she believed were dangerous to health, which Lixue explains in her digital autobiography made her "afraid of using technological tools" despite knowing not it was an inaccurate comment. This is something that Lixue holds with her into adulthood, a deep skepticism of the safety of digital tools. She points out though that this perspective did not stop her from becoming "addicted" to a Massive Multiplayer Online Role-Playing Game (MMORPG) which she played for 10+ hours a day as a teen. In addition, Lixue experienced teachers who used videos as a way to abdicate responsibility for teaching and ultimately made her generally distrustful of the use of technology in schools. Despite this distrust, she reminds us in the last line of her digital autobiography that "one thing that needs to be mindful is to educate students about what information is shown repeatedly and how to obtain the information that is not biased."

Despite wanting to be a teacher from a young age Lixue said in her application letter that she didn't see learning as anything more than a "transference of knowledge" prior to working at the University Community School as a teacher's assistant (TA). As she has spent more time in schools as a TA and community liaison, she came to reflect on the meaning of the term teacher in Korean. Teacher can be translated to seonsang or susung. Lixue explains in her VoiceThread identity assignment that, "*seonsang* means someone who has lived life before us, who passed down the knowledge..." but *susung* is a person who gives enlightenment through education." She goes on to explain "a *seonsang* is a person who teaches mainly letters and scholarship at the school, [but] the *susung* is a person who teaches the principle and the precepts...in the moral way….I definitely want to be the person who not only teaches the scholarships to my students but really teaches them how to life a life and really encourage them to see how the society works and to be able to really navigate through the society." This perspective is how Lixue defines her

social justice commitments--helping elementary age young people navigate society by seeing how it works so they can have access to it. She may be starting to get into the transformation of society by wanting to help her students live a more moral life, but does not make it all the way to a transformation oriented conception of social justice.

Lixue's story is one that so powerfully represents both the power of fear and that of interest when it comes to technology utility in schools. While she still describes herself as having a fear of technology 'taking over' classrooms and the influence biased sources can have in discussion, she became an expert on technology for English language learners in her internship at the University Community School. Lixue was asked by administrators to present on using a digital tool called Quizlet for use by students in English Language Development classes. She focuses her explanations of using technology in the classroom to examples which engage students through videos and presentations, or provide more efficient ways to learn content, like Quizlet for vocabulary for ELL students. None of these uses are necessarily negative, but they do not necessarily advance her goal of being *susung* for students. Her goals and thoughts for technology and social justice remain segregated. Further, she is another example of someone many would consider a supposed digital native who has not yet found a way to use digital tools in pursuit of transformational social justice education.

Edward - Transformative Community Building

When thinking about Edward's participation style in class or recordings of his contributions to conversations it is really easy to lose sight of his critical perspective in light of his laid-back interactional style. In his VoiceThread professional identity reflection, Edward explains that while he identifies as Mexican American from his father's Mexican origin, he visually presents more like his white mother so his students rarely believe him when he identifies

himself. He goes on to say he "felt like you weren't Mexican enough for the Mexicans, and weren't American enough for the Americans" and not "hav[ing] any discernible Mexican features" meant that he lived in mostly white friendship circles until college. He talks about becoming more socially conscious and justice oriented after joining Mexican American student groups in college which he attended in Maryland.

Edward opens his Digital Autobiography by comparing his parents approach to technologies in their home growing up: his father who he says grew up poor in Mexico loves technology for the status associated with owning it but "might not always know how to use them" while his mother is a "self-proclaimed luddite who resents all technology past the 80s." But Edward is a pretty serious World of Warcraft (an MMORPG) gamer and has even built his own computer from parts in order to participate in this complex game and other content creation hobbies. He talks about how playing WoW allowed "having more hours to learn about someone strengthen friendship...the opportunity to meet people from across the country and learn about their stories, interests, and experiences...I was becoming a part of a close knit community that I felt safe and supported to be myself in." You might expect him to also be an avowed advocate of technology in the classroom as well, but his perspective is more complicated.

In his application essay, Edward says he wants to join the teacher education program because it will provide him with the "tools and abilities to help disenfranchised students reach…moments of understanding" and support that work after graduation. He is also deeply connected to the idea of learning for the sake of it rather than learning for grades and outside affirmation — there seems to be a parallel between his own story of self-awareness in college and his desire for students to experience gaining confidence in themselves as learners rather than working only for a letter grade. He is also reticent of technology being used only as a way to

"improve students and their test scores," which is one more piece of evidence that lends me to believe his framework for social justice in education is focused less on access to the established knowledge base and more on the transformation of learning for self-empowerment.

When Edward talks about using technology in his middle school science classroom, he connects that desire to the use of a tool like VoiceThread being used as therapeutic space for intellectual reflection and self-tracking of growth. He also points out "technology has the potential for empowerment but is beginning to be used to misinform and reaffirm the power structures of American society." He is worried about technology being "used as a way to continue the structures and systems already present in society" and "raises many people and groups up but does not do it equally" which can put certain groups at an advantage while disadvantaging those without similar access. In his own classroom, Daniel focuses on using technology to research questions they have identified rather than those he gives them, while "also giving them a space to connect and share ideas…" He wants his students to "see the internet as a resource to understand the world around them." This focus on using digital tools for understanding the power structures present in the world, building connections with classmates and communities, and providing opportunities for introspection and personal growth exemplifies one way a transformational social justice orientation can intersect with a personal history of gaming to result in an emergent framework for technology integration in the classroom.

Ted- Technology Cannot Realize Change Alone

Ted is the child of two humanities professors who were "taken aback" by his interest in science. In his application essay, he describes falling in love with science as an escape "from turbulence at home and at school." He further explains that things were not easy moving to a predominantly white town in Oregon for middle school and a quirky teacher helped him use

science to understand the world around him. He got involved with the Asian American Resource Center in college and volunteered tutoring at a local high school with underserved students. Through that experience, he saw that while the model minority narrative was racializing him in a favorable light, he did not have any control over the narrative told about him. Working with Latinx students and hearing when they "expressed they would never be 'good at science'" he realized they were citing the same racial framework that had once given me comfort in the field." From this experience and "disillusionment with the absence of needed social impact in the sciences" he decided to abandon plans of pursuing a doctorate program and instead turned to community work and eventually applying to the urban teacher residency.

According to his digital autobiography, Art's history with technology also begins around age 6 when he was given a Gameboy color and began playing Pokémon regularly. His father purchased Mac computers for both Ted and the family and mediated much of Art's use of the digital tool, but Ted did not share with him just how often that hardware was used for gaming. He describes his early game playing as utilizing technology on an individual basis as an agentic tool acting out "fantasies in 8-bit worlds," and sometimes looking up cheat codes online. Ted clarifies that he found information online but never posted or "speaking to anyone online, for fear of my relationships online slipping dangerously into real life' which did not change until the popularity of Facebook when he was in high school. Although he says he overcame the fear associated with his online social connections, he still kept "things a secret from my dad" despite his "gaming also shift[ing] to be more about friendship."

As a middle school science teacher, Ted "recognize[s] that technology is a powerful part of youth culture…" and has utilized Snapchat, Fortnite and other platforms "into classroom education to increase buy-in and build on student cultural capital" because technology can be

useful to make more rote classroom tasks more engaging. He mentions shifting the context in which learning occurs but does not elaborate on that point in further reflections. He also points out in this digital autobiography that "creating tech-based resources and materials is labor intensive and not always as re-usable or easily adjustable as [he] would hope." This is because, in his words, "technology also continues to be an equity issue" due to unreliable access to the internet at home and not being able to plan on having Chromebook or iPad carts in school with "hav[ing] to jockey with other classes for access." In the end he calls for using technology in classrooms that way it is used in "everyday lives" to "augment existing social relationships while also offering possibilities for creating new ones" and opening up options for augmenting teaching rather than replicating or replacing.

Ted frames his goals for the teacher education program in his application essay as learning to create a "student centered and community-oriented education" in secondary schools with "socially conscious, student-driven science." He clearly articulates that what he wants out of this teacher education program:

> to affirm for students that race as biology has been scientifically disproven and that black [sic] and brown students are not predisposed against scientific study. I want to teach a science that excites students' visions of possibility, and that values the knowledge they already possess...to address the social conditions that preclude them from engaging in scientific fields.

This focus on possibility and addressing social conditions through science reflects a transformational approach to social justice in education. In fact, Ted ends his application essay with the hope "that IMPACT will be the program that best prepares me for a practice of transformative science education."

In his teaching, Ted sees technology as something that can be useful but should not be an end in and of itself. In the context of unequal distribution of digital technology, like exists in LAUSD/public schools, he thinks the focus should be on critical consciousness and interrogation

of inequities rather than investment in technology because it is a tool that will not fully realize change on its own. He calls on teachers to help students see how "the power of technology and media have in the lives we and our students live" and that we are not "in full control...of digital personas and identities." He is especially worried that issues like the Cambridge Analytica Facebook data release will most dangerously affect "the most vulnerable...those already subjected to marginalization and oppression" like the students he serves. This perspective seems to be a few steps further along a path for not using technology to further oppressive systems, but not reaching the level of utilizing technology to directly provide the distinctive tools for transformation.

Technology as a Tool of [School]Work

Sixteen of the participants focused their explanations of technology in their own childhood as part of the 'work' of schooling, including discussions of typing essays, playing math games for school, or accessing online research sources, or as tied to the work that their families engaged in whether it was a family operated business or outside employment of their parents or themselves. When looking at the ways members of that group envision the purpose and practices of digital technologies in the classroom, there are three ways that experience mediates their professional vision. First, there are those who focus on the logistics of technology use in the classroom, with an eye towards an efficiency argument for technology integration. Another group's practices and vision are more explicitly focused on the lack of access to technology in their own or their student's experiences which mediates the ability to complete the work required or to compete with others who had more resources when faced with new contexts in secondary or higher education. Another group focuses on a community building orientation

for digital tools with a healthy level of skepticism regarding the benefits of digital tools for the youth they serve.

This paper is not meant to propose a simplistic framework focused on teacher personal experience with technology being a direct parallel to a particular practice of technology integration in the classroom, but rather a nuanced framework for understanding the ways personal narratives and professional practices intersect in the realm of social justice and technology.

Andres - Access Information, Access Success

Andres is from Inglewood and a product of the local public school system. He came to UCLA as an undergraduate to study science "with the dream to become the doctor and make the world a better place by saving one life at a time." (application essay) When he took a Chicano Studies class and "finally" saw a huge classroom full of "nothing but different shades of brown" he wondered where those students were in his science classes. He identifies as Latino and wants to continue to teach in the Los Angeles area schools "to empower students by instilling self-confidence and the desire to want to pursue a higher education."

In his digital autobiography, Andres also identifies as a gamer and mentions that he was around 5 years old when he got access to his first computer at home and started playing Pokémon with his older brother. He reflects on gaming as a source of social connection by playing multiplayer PlayStation games like Call of Duty with friends in middle and high school. Unfortunately, in school he only really learned to type and use Word, Excel, and PowerPoint. He also remembers getting "the first piece of technology I interact with each morning as it wakes me up…," a cell phone, in 2009 in 8th grade.

As a high school science teacher builds more on his experiences with technology in school than his experiences as a gamer, with his goals for technology centering on conveying information efficiently. Andres points out that technology should not replace substance and activities but can be used for videos, research, and utilizing apps which enhance lessons to be more engaging. He identifies technology as a useful entry point for gaining student attention, interest, and engagement to improve participation in class, to bridge language gaps between students and instruction, or even as a novelty to catch students' attention. In his reflective writing, Andres also identifies his own use of technology in the classroom is not as a tool of pseudo-teaching or replacing a teacher but rather for efficiency, time management and organization and pacing of one's own instruction using tools like PowerPoint to organize a lesson. When using technology, he makes sure to ask himself the question "Is tech adding to the substance or is it replacing...some other teaching strategy I can use?"

Consistent with his views on the role of technology as providing access to information, Andres frames his social justice orientation as focused on providing equitable access to education as his driving force. For example, he uses the metaphor of "roses from the concrete" from Tupac Shakur's poem of the same name to talk how he imagines both himself and his students, as "...not supposed to be there. We weren't supposed to do anything or become anything, but yet somehow we rose up to become something beautiful despite our obstacles." His perspective lends itself to the access orientation of using any tool available to grow through the concrete without the expressed goal of using technology to turn the sidewalk into a garden.

Adrí – Ambivalence to Critical Technology Consciousness

Adrí comes to the teacher education program as a graduate of a liberal arts college in northern California with a major in Sociology and minor in Urban Education. She grew up and

attended community college in southern California near the location of the teacher education program studied here. She explains in her application essay that she also served as a volunteer teacher's assistant at a community-based charter school near her college where she was mentored by a graduate of our teacher education program. She credits her commitments to community responsive education (Tintiangco-Cubales et al., 2015) on her background "as a low-income first-generation Latina" with a "K-12 schooling experience [that] can be encapsulated by what Dr. Angela Valenzuela refers to as subtractive schooling." She credits her experience after transferring from community college to the liberal arts college with exposing her to "the type of education that would help me to develop a deeper understanding of the problems in [her] community." She explains that she does not view those problems as an inditement of the community, but rather of the "structural violence" that created educational inequalities and a leaky college going pipeline where she was able to succeed but her cousin was not because she had to work full time while in college. Her goal of becoming an elementary multi-subject credentialed teacher is aimed at "creat[ing] powerful learning opportunities inside and outside of the classroom that nurture hope and healing" and "create more humanizing spaces for students like my cousin...and countless others, who are pushed out through various leakage points throughout the educational pipeline."

When assigned the Digital Autobiography assignment, Adrí describes herself as "ambivalent" about technology and credits her lack of ownership of technology/hardware as a child and young adult with her reticence. She describes her family as low income and gives multiple examples of not being able to afford technology that was available to other students in her school. While others had computers at home for their own use, Adrí mostly used the one computer lab in her elementary school and then the family desktop they acquired when she

entered middle school in the mid-2000s. She gives the examples that she did not own her own computer until she transferred from community college to 4-year university and credits her slow typing speed with her lack of access or exposure in school to such experiences.

She admits to not thinking about technology much except for "as a tool for communication" through Google Docs or PowerPoint, or perhaps the effect on her and her student's attention spans prior to this course. She had some interest in issues of social media privacy, which combined with media focus on Net Neutrality at the beginning of our class aligned and the relationship between technology and her justice-oriented perspective were foregrounded for her for the first time. Adrí reflects in digital autobiography that she wants to be cautious and critical of apps, because no matter how much more convenient an app might be for finding a "perfect" reading for each student, she has no idea who wrote those readings, what possible deficit perspectives on her students they bring with them or whether they represent the rich experiences and communities her students bring to the classroom. Adrí's perspective on the purposes and practices of technology is focused on the needs of youth who she supports, viewing teaching as an opportunity to "interrupt systems of oppression by [supporting youth] becoming agents of change in their own communities."

In the course of my work with the teacher education program and in our local school district, I've connected with Adrí regarding her continued use of technology. She continues to apply the critical lens she came into our program with but had never applied to digital tools previously. She continues to build on her critical narrative exemplified in her identity VoiceThread where she talks about the dual role "of maintaining hope but also fostering the critical nature of our students..." She struggles with the way this hope is represented by many in urban education as,

> …if we teach our kids to hope and to dream they'll be able to make it out...I don't think there's anything wrong for dreaming for a better life, but I think there's something wrong when that is at, kind of dissing the community that the students come from and not also recognizing the beauty, and the complicated...how special their community is as well. Even though it doesn't fit into this like, idealistic white suburban community ideal that America has necessarily raised upon.

Adrí rightly points out that if the goal of STEM and school in general is always framed as escaping the community, then how will they support the community with the tools they need to thrive? She makes an additional point that the digital tools she hopes to use will provide an opportunity to "foster maybe more of a critical thought and...allow students to run with their thoughts more..." rather than being constrained by writing or typing skills. This case brings to the forefront an interesting opportunity – if a teacher candidate has minimal experience utilizing digital tools in their own educational history, the framing for their exposure within the teacher education program can be an opportunity for connecting theoretical commitments to transformational educational justice with digital tools that may support that mission.

Poppy - Opportunities for Transformation

In her application statement for the teacher education program Poppy declares that teaching was what she was born to do as shown by a story of her trying to lead a class in daycare before she had even turned one. She majored in Education and Human Development at an Ivy League college in the northeast United States and continued into the teacher education program at this large west coast university in order to have a teaching credential in her home state. She explains that in college rugby was the place where she, identifying as a queer Latinx woman of color, found a multi-racial, multi-ethnic, first generation community to be a part of at the elite undergraduate institution that did not reflect her own background. Poppy exhibited strong leadership qualities in both high school and college by serving as a student leader at the private

boarding school she attended on scholarship and financial aid and advocating for equitable funding for club and varsity sports all the way to the level of University President.

Poppy's first experience with technology literally came at her mother's feet. She tells the story of how when her mom took computer classes to learn to type when she was a child so her mom could get a better job. Poppy remembers spending the class time exploring the computer hardware and cords under the desk during those night classes. She talks of having a computer that she played games on as a kid and being someone at her public middle school who had more access to technology than most students. When she got to her private high school, however, she was shamed by teachers for not knowing how to use a proprietary program like Illustrator already. In our class discussions and written work, Poppy reflected on her long time interest in majoring in Computer Science or Engineering, but felt like this disappointing classroom experience meant she would be starting in the field too late by majoring in one of those fields in college. She did not give up on her dream of computer science and took a CS "for jocks" class. She identifies the final project in that class--building a website completely from the back end via coding rather than a graphic user interface content management system--as one of her most proud moments in a full college experience.

Poppy uses her own stories above as examples to clearly articulate that she wants to be a "holistically compassionate teacher…. [who] inspire[s] my students beyond the classroom" with a central responsibility as a teacher to be an activist and advocate in the school and community. She began this mission by building curriculum and teaching in a summer bridge program for Algebra I and Physics aimed at preparing youth from similar backgrounds to be successful at her private high school. As a student in the residency program, she pushed back against practices at her placement school regarding the use of iPads for standardized tests and de-contextualized use

of Khan Academy online lessons without scaffolding. She says, “I know my students’ test scores and learning are suffering…” and points out that “technology is used to label students and turn them into statistics...to pathologize students’ ‘misconduct’ and ‘absenteeism’ instead of helping students to learn.” Instead, Poppy imagines using digital tools to support students in their self-assessment and agency building, such as using the VoiceThread tool from her assignment to have students explain their thinking as part of an assessment, or even just using their phones to record a quick video doing the same for classwork.

When looking at Poppy’s case it is important to recognize her story as an example of the power of an individual’s early exposure to technology detrimentally shaping her ideas about what practices are available to her -- the narrative she tells about herself was clearly shaped by an influential figure (CS teacher in high school who embarrassed and ridiculed her) with additional experiences mediating that negative identification (positive experience with CS class in college). She now has a personal connection to the power of digital tools for destroying opportunities to learn and for how those same tools can be used for empowerment.

Lilia- A Tool for Teachers, Not Students

Lilia has a long resume of teaching experience, from tutoring children her pediatrician connects her with for supplemental support and engaging with the Next Generation Science Standards in her Psychology Master’s Degree, volunteering at the Discovery Science Center each summer during college, and one-on-one support for struggling students in a Title I school. In her reflections about her own educational history and life story, she balances being grateful for opportunities she had due to her father working multiple jobs while being realistic about how that compared to other students in her magnet Gifted program. She is the first in her family to be born in the U.S., and when her mother immigrated she was not literate in Spanish or English.

Lilia pointedly brings this immigrant perspective to her teaching ethos including wanting to spread to students the teachings of her family "that limitless potential is housed within me..." Lilia's story is marked by periods of extreme economic hardship when her father went into heart failure and needed a transplant preceded by a period where her family was considered well off in their community, but not in the community where she attended a gifted magnet.

When Lilia recounts in her digital autobiography how she is described by her family, they tell her she was "born in *el ano del cado"* [sic] (a long time ago) because of my 'old people' tendencies." She rejects social media and only has a Facebook account because a friend made it as a joke; Lilia sees it as fake and in contradiction to her straightforward personality. Before she started attending school, both Lilia and her mother learned to read by using a tape recorder and the Hooked on Phonics materials from the library. In 2nd grade she "met computers at...school" but was intimidated at them at first because "the motor roared and the screen seemed to move too fast for my eyes to keep up" while she was also afraid of breaking the costly machines. She goes on to describe how computers were "a tool for learning that soon became a tool for work" when, at 10 years old, she became the family expert on email, website building, and Excel. Lilia explains that "technology became my favorite part of feeling productive and like an asset" to her family. She also related the power of technology satiate her "overly inquisitive" mind that had previously had to settle for "the 'because I said so' answer" and could now find the answers she was seeking and fueling even more research.

When exploring her own digital practices in the classroom as a teacher, Lilia recounts a story of how when she was ten her 3rd grade teacher encouraged all students to go out and buy a digital timer to practice for times tables races, but that kind of frivolous expense was not possible for her family's budget. She explains that this memory reminds her that while technology can be

a great tool, it is not available to everyone equally. For example, Lilia's first student teaching placement had no computers or tablets available for use and most did not have access at home either, so she wonders "...how can we teach students about how to use technology in a technological moving world without giving them that hands on experience to it?" In her second elementary placement, Lilia's students all had their own iPad and so she integrated use of technology with daily practices to have students "CREATE" because she believes that "technology is a great means of advocacy and... creation…[to] empower students…" She is most worried that technology is primarily a tool used as "a mean[s] of making the life of a teacher easier...but rarely do I see it being used as a tool for the students."

In a clear example of Lilia's social justice orientation, she asks, "How do we continue to encourage the use of technology without addressing the face that many classrooms lack the access to it?" This question brings up the issues of resource hoarding and the ethics of expanding digital practices in some schools while others are left behind -- if all students don't have access to technology, can we ethically increase technology integration in some schools? Lilia is deeply committed to equitable access to learning, but does so in a way that is aimed at bringing the most progressive practices--like the examples she gave in class from her time working in a Montessori preschool which would be powerful for young children, not just those elites with the ability to pay for private education--to all children. In this way, she is interested in using technology to transform the opportunities for students to be advocates and activists in their communities rather than an equal opportunity to be receptacles of knowledge. `

Discussion

In the profiles shared above, you see a wide variety of personal, educational, and technology histories which align with or challenge a particular participant's ideological

commitments to transformation or access oriented social justice education. In those orientations, histories of gaming, work-related technology use, and community building online intersect to influence the ways novices establish their goals for technology integration. When new practices and new tools which encourage transformative social justice are introduced in a course like the one these novice teachers participated in, there can be an opening for establishing news goals and new teacher professional identity narratives. Those narrative frameworks may then help support new technology integration patterns to serve all students no matter the affordances or constraints of the particular context.

The diversity of experiences and technology identities reflected in the participant portraits detailed above were chosen to explain five ways the technology histories and identities and approaches to social justice teachers bring to their work and how those interact with regards to technology: (1) positive technology identity resources in use for educational access [Kevin & Andres]; (2) positive technology identity resources in use for educational transformation [Edward & Ted]; (3) a negative technology identity in use for educational transformation by way of rejection [Poppy & Lilia]; (4) limited technology identity allowing for strong integration of transformative justice orientation to technology use [Adrí]; and (5) a clean separation of historical technology identity and professional identity gone unchallenged [Jae].

In Kevin and Andres examples, they both had positive associations with technology and incorporated the feelings of belonging and joy they experienced using digital tools to utilize similar tools for student engagement and efficiency's sake. Kevin talks about using translation tools and Andres feels comfortable enough with technology through his background that he can easily utilize presentation tools to make his classroom more engaging and efficient. In a similar vein of experience, Edward and Ted, who both have long histories of identifying as MMORPG

and console gamers (even playing them in our class during dinner breaks) were more reticent to see the purpose of technology as efficiency and engagement. They both share qualms they have about the power of technology to reinforce bias and exacerbate inequalities in resources. In the end, both Edward and Ted are open to utilizing digital tools in the classroom but are most committed to teaching with an ethos of care, relationship building, and educational transformation.

Poppy and Lilia both tell vivid stories of access to and experiences with technology in elementary and middle school which shaped their perspectives on technology integration in their own classrooms. The difference from others in the cohort is that their experiences with technology were negative – they were treated as less than by teachers for not having access to digital hardware or experience with particular software. Both women bring that history and their commitment to serving students of color in more humane and supportive ways than they were as children, rejecting this belief that everyone should know and have access to digital tools they are more interested in the affective experience of using those tools to support the needs of students especially when it comes to technology in the classroom. Where they differ, however, is in their theoretical commitments; Poppy wants to make computer science available to all children with the express plan to radically change the function and features of those courses to serve a transformative vision of education while Lilia is most interested in building relationships with the children in her classroom to inspire them to succeed in the current educational system in the same way that she did, despite having little access to the same digital tools her classmates took for granted. In Adrí's case, her experience of having very little exposure to digital technologies in her K-12 schooling, as marked by in her words "slow and awkward" typing capabilities, along with a growing outside interest in political issues regarding internet neutrality and capitalism, led

her to imagine and begin to implement ways of utilizing technology as a support for her radical empowerment and transformative vision.

Finally, in Jae's narratives I see a young woman who has a background of struggle and fear of addiction when it comes to digital technologies like MMORPGs or a false belief in the health hazards of technology, but is still viewed as a technology expert in her residency school placement. Despite her deep commitment to teaching for moral and social justice, she does not make space for connecting the use of digital tools for those justice goals. This makes sense, though, because she is already seen as an expert on educational technology in the community she places value on, so there is no reason for her to make the effort to engage with digital technology and justice orientation in any new or more critical manner.

In the course of this paper, I focused on the educational histories, goals, and narratives of technological experience to build a framework for how teachers begin their process of learning to teach with technology. We must understand those historical narratives that make up the identities which have been both imposed upon new teachers (digital native, social media obsessed, technology reliant) and those to which they ascribe (gamer, skeptic, efficiency oriented). Those identities are deeply consequential for how they approach technology integration and support in their teacher education programs, in their field placements, and in their own classrooms in the early years of their teaching. It may even impact how they continue to evolve as teachers in a continuously changing technology context, especially with recent turns toward online and hybrid instruction due to the COVID-19 virus.

In other work (Gravell Chapter 4), I explore how two iterations of this course lend itself to design principles for future work in building transformational critical technology literacies into the single technology course most teachers are required to take in their credential programs.

As a new teacher in the late 2000s, I used digital tools in my Washington, DC public school classroom that I now see for the carceral pedagogies they enforce. I stopped because they didn't work, but I can now see the damage I inflicted through my unthinking and naïve adoption of an app that had only deficit perspectives to bring on the behavior of my students and communication with their families. Even with a critical perspective on the purpose of education, I was never expected to or exposed to the application of critical theory to the everyday practices and tools of teaching; as teacher educators we must do better. Please remember going forward that this work is not just about how one uses a digital tool once or twice a day with students, but rather also about what ends and for whom that technology is built? What purpose does it serve, and is that purpose aligned with what education should and could be for young people, especially those who have been failed by the educational system for so long?

Chapter 4 - Paper III

Designing for Critical Technology Literacy:

Identities, Playful Enactment, and Drawing into Relation

Abstract: Based the theoretical framing of seeing educational technology as an instance of interest convergence (Gravell, Chapter 2) and on the findings of Gravell (Chapter 3), I identify three design principles that will be useful for other teacher education programs when designing for critical technology literacies. First, personal and professional technology identities mediate what teachers take up from readings and learning activities in the class and must be central to course design and learning to teach with technology. Secondly, technology courses should encourage playful enactment with the goal of productive failure; meaning that our work should focus on getting teacher candidates comfortable enough with each other and their own histories with technology for them to engage with new digital tools in 'badly structured' (Kapur & Bielaczyc, 2012) manner with plenty of opportunities to have digital tools fail. Finally, due to this need for playful enactment and complex intersections between identity, classroom context, and digital tool availability, it is important provide multiple structures for engaging in accountable talk to draw into relation all of these intersections and make connections between the digital and social justice realms to envision productive use of digital technologies in the classroom.

The U.S Department of Education's National Educational Technology Plan (Cullatta, 2016) calls on all those involved in public education in the United States to do a better job at integrating technology in schools with more attention to equity and accessibility. As part of that call, the authors point out two issues relevant to this problem analysis: teacher preparation fails "to prepare teachers to use technology in effective ways", and there exists a large "digital use divide between learners who are using technology in active, creative ways to support their learning and those who predominantly use technology for passive content consumption" (p.5). This paper begins to lay out some empirically grounded design principles useful for teacher education programs and instructors designing courses for apprentice teachers to use digital technology in effective ways that actively engage all students in creative technology creation rather than consumption.

While computers have been expected resources in suburban schools since the early 2000s, only recently has it been a priority to get all students – even those in our most underserved and dilapidated schools – regular access to computers and other educational technology with little evidence of successful implementation (Anthony & Clark, 2011). Philip and Garcia (2014) argue that while the "proximal benefits" of technology are said to be engagement and attention, the "distal benefits" are focused on exposing underserved students to the skills necessary for learning and workforce success. However, neither of these goals are readily evident in implementation in schools that serve marginalized students because of the lack of teacher preparation and use gap.

Additionally, technologies are created and exist within particular power structures and ideologies, and may be used to not only re-inscribe old power structures, but also introduce new hierarchical structures. Remote learning during the current COVID-19 pandemic has brought to

light the problems that teachers in urban and rural schools have known for a long time – many affluent and suburban districts have a "10-year head start on urban and poor districts that didn't have any money to buy technology…" (*Online Equity Would Require More than Chromebooks*, 2020). However, as the title of this article says, online equity won't be met with just access to hardware like Chromebooks. Not only does access to hardware not solve the problem of highspeed broadband internet access (see Gravell, CH3 for further details), it does nothing to address what kind of learning and activities are available to students on Chromebooks versus those districts which can afford full-fledged laptops and the additional software that can only be used on a PC or Mac operating system. This means that the students graduating from high school in the context of only having access to Chromebooks or iPads are prepared to use the digital tools of entry-level or service industry positions, but not to succeed in college due to the more technologically complex and independent work at the college level (Knight & Marciano, 2013).

Despite the field of teacher education's increased focus on equity and inclusion in teacher recruitment and professional training in the past 20 years, disparate educational and societal outcomes for minoritized students and their white counterparts continue in the K-12 context (Carter & Welner, 2013; Howard, 2015; G. Ladson-Billings, 2006; Noguera, 2001). New technologies, whether freely available printed books, instructional radio, or distance learning via television, are regularly professed to be the silver bullet for any problem in education. Research and experience instead show us that culturally aware professional educators, in collaboration with visionary leaders, can utilize the promise of technology to supplement rather than supplant teacher analog expertise for transformative outcomes but technology alone cannot make education equitable (Cuban, 1986, 2009; Cuban & Jandrić, 2015). This study asks teacher

educators: How do we design for novice teacher learning—who are raced, gendered, and classed with respect to their own history with technology?

I argue that teacher education programs meant to prepare teachers to serve working class students of color need to prepare pre-service teachers to address issues of equity and social justice head-on when it comes to educational technology. Incomplete technology preparation leaves novice teachers unprepared for the current contested educational terrain of educational technology, and likely to perpetuate the use gap. To counteract the current failure, we can engage apprentice teachers in developing an integrated practice-based identity as transformation-oriented social justice educators prepared to teach in a technology-rich world. This paper reports the principles of design identified after the redesign of the credential required technology course in an urban teacher residency program in a very large western U.S. city. The aim of the course was to combine the use of critical media literacy (Kellner & Share, 2007) with making sense of the learning theory and ideologies inherent in digital tools to incorporate those tools in to the classroom without teachers losing their ideological commitments to providing an excellent, equitable, and transformation-oriented education for all students. These design principles are derived from not only the small successes of the class but also by the failures—where our design conjectures did not play out as expected. Taken together the principles of design identified can provide a road map for future iterations and expansions of technology courses in teacher education programs that are committed to social justice

Digital Use Divide

While many critiques of educational technology focus on the quality of digital tools (Enyedy, 2014b) or the lack of infrastructure to support access for all students no matter socioeconomic status (Means et al., 2009), practitioner-facing work explains the biggest problem

with technology integration to be a that of a "digital use divide" (Cullatta, 2016, p. 5) – the finding that some students have the opportunity to access both higher order conceptual understandings and creative construction of knowledge while some students' are limited to memorization of facts and procedures. This divide is mediated by race and class (DiMaggio et al., 2001), and exists between students who are given an opportunity to use digital tools for active engaged learning experiences and those who are tasked with passive consumption of digital material during the school day. While the COVID-19 pandemic may have affected the whole world, the detrimental affect it will have on those children whose access to learning is restricted by not only the slow access to digital hardware and internet, but also their own teacher's inexperience with digital tools and instruction, who no matter their passion and hard work are trying to catch up in a few weeks or months to teachers who have been getting training and support on technology integration for more than a decade. This only exacerbates the systemic cycle of inequity in urban schools driven by continued disinvestment in US public schools and the ongoing educational debt owed to youth of color (G. Ladson-Billings, 2006). One can therefore argue that the 'digital use divide' is not only an opportunity gap, but a 'digital use debt.'

One way to address this 'digital use debt' would be to design better technologies, but in a study of teacher professional development tied to adopting a community-oriented data visualization project Philip and colleagues (2016) found that without explicit training in racial literacy, even an experiential mobile data collection curriculum focused on students lived experiences, resulted in re-inscription of racial stereotypes due to unexamined bias on the part of teachers in the ways they utilized data visualizations and the digital tool in the curriculum implementation. Although some students observed during the study were able to engage in

"micro-contestations" regarding the way data was decontextualized from their own racialized experience with the supposedly colorblind or the taken-for-granted analysis of the teachers sharing the data visualizations, they were eventually shut down from truly participating because the teachers were not racially literate, or if they were, they were unprepared to combine that race-consciousness with digital representations and tools. In another example of the need for contextualization of digital tools in the context in which they are used, Enyedy and colleagues (Enyedy et al., 2015) found that curriculum and tools that are built to be relevant for students while learning a standard school subject like statistics still required ongoing in-the-moment negotiation of curricular and instructional practices to serve the critical consciousness needs of students using the digital tool (Enyedy et al., 2015). Merely designing better tools is not sufficient for remedying the digital use debt.

Access to the Internet and even 1-to-1 computing programs in every classroom cannot guarantee an engaging learning experience organized by a teacher committed to culturally sustaining pedagogy, ambitious disciplinary instruction, and equity. If we understand digital technologies as tools for learning in an educational space which is situated within an encompassing socio-political context (Collective, 2017), then we can see the need for investigating how teacher's preparation programs, multiple identities, instructional goals, ideological commitments to social justice, and complex understandings of technology intersect in consequential ways for their learning and teaching.

Teachers as Learners

Even in best case scenarios where excellent teachers are dedicated to the need for a serious structural reform to their curriculum and practice, there are multiple roadblocks to changes at the district, school, and individual classroom level. Whether those roadblocks are

created or sustained by a decoherence in policy, professional development, and practice (Allen & Penuel, 2015) the intersection of compliance and commitment to a humanistic equity focused education (Horn, 2018) or the moment-to-moment negotiations of interaction in the classroom (Fields & Enyedy, 2013) understanding teacher learning is integral for continued improvement in classroom practice. By approaching teacher development from a sensemaking and conceptual development perspective (Philip, 2011) this study applies a lens of inquiry into the development of teachers as learners. Rather than trying to see if teachers implement a static model of technology integration (e.g. Romrell's SAMR – Substitution, Augmentation, Modification, Redefinition – model), this study was focused on understanding how preservice teachers make sense of technology use as a part of their professional and personal identity and how that identity formation was mediated by different participation structures, roles and responsibilities, and reflective practices they engaged in a particular class. When learning scientists study the learning of youth and children, we do not only focus exclusively on outcomes, but also investigate how learners' understandings progress over time, in what patterns, and with what tools and structures. This project aims to do the same with emerging adult (Arnett, 2000; 2010) learners as build critical technology literacies. Some scholars have called this technological pedagogical content knowledge (Koehler et al., 2014), but this course was focused on practices and identities that carry across content areas and age levels, rather than focusing only on tools and practices of use in secondary math courses or some other TPCK associated structure.

Course Design

Inspired by the work by Jurow and colleagues (2012), I applied Learning Sciences theories to the learning of pre-service teachers in technology methods course. I redesigned an existing critical media course in an urban teacher residency teacher education program, with a

mission of "preparing aspiring teachers to become social justice educators in urban settings" and a theoretical focus on sociocultural theories of learning, to focus on transformational uses of technology. The program's required technology course had previously focused entirely on critical media literacy (CML). I expanded the course to include a more expansive view of critical technology literacy which includes not only the consumption of media, but also the design, construction, and use digital tools including historical and personal individual and systemic agency use to modify how those tools are utilized in the classroom. This re-design was in part based on feedback from the teacher education program leaders that teachers in previous years of the STEM residency program did not feel adequately prepared to utilize the digital tools they were seeing in their schools, but did not want to lose the critical perspectives of CML.

In thinking through the re-design I used a conjecture map (Sandoval, 2014) to make sense of the relationships between big ideas, specific design features, and necessary mediating processes to reach the outcomes of: (1) an increased capacity for technology integration in the classroom; (2) an ability to defend and reflect on pedagogical choices made in the use of those digital tools; and (3) a transformation-oriented social justice professional identity comfortable with integrating technology to serve both the content and civic purposes of schooling (see far right column of Figure 1).

Conjecture Map

Our revisions to the course preserved the program's 'grand theory' of sociocultural learning theory (see upper left of Figure 1), particularly the idea of appropriation of cultural tools (Wertsch, 1998) and practice-based identity development (Fields & Enyedy, 2013; Holland et al., 2001; Nasir & Cooks, 2009). With regards to cultural tools, we were most interested in the appropriation of a critical social justice-oriented discourse regarding the purpose and practice of

education, which was a part of the entire teacher education program. While much of the work on practice-based identity has revolved around identity building in particular content areas (Barton & Tan, 2010; Brown et al., 2005; Epstein, 2010; Fields & Enyedy, 2013; Nasir, 2002), we were interested in the identity issues around the use of technology across the K-12 curriculum. Because digital technology has been and continues to be raced, classed, and gendered (Benjamin, 2016, 2019; A. Howley et al., 2011; Noble, 2013) along with the feminization and pervasiveness of whiteness in teaching on the whole (Aguayo, 2019; Applebaum, 2005; Castagno, 2014; Leonardo, 2002; Lynn & Smith-Maddox, 2007; Sleeter, 2016), the goal here was to bring that critical justice orientation to bear on the intersections of technology in a raced, classed, and gendered world that includes our classrooms. Based on this, my high-level conjecture here was that pre-service teachers need experience integrating theories of learning and social justice, particularly in regards to the use of technology to develop a professional identity that supports becoming excellent educators in urban schools (see center of left most column of Figure 1).

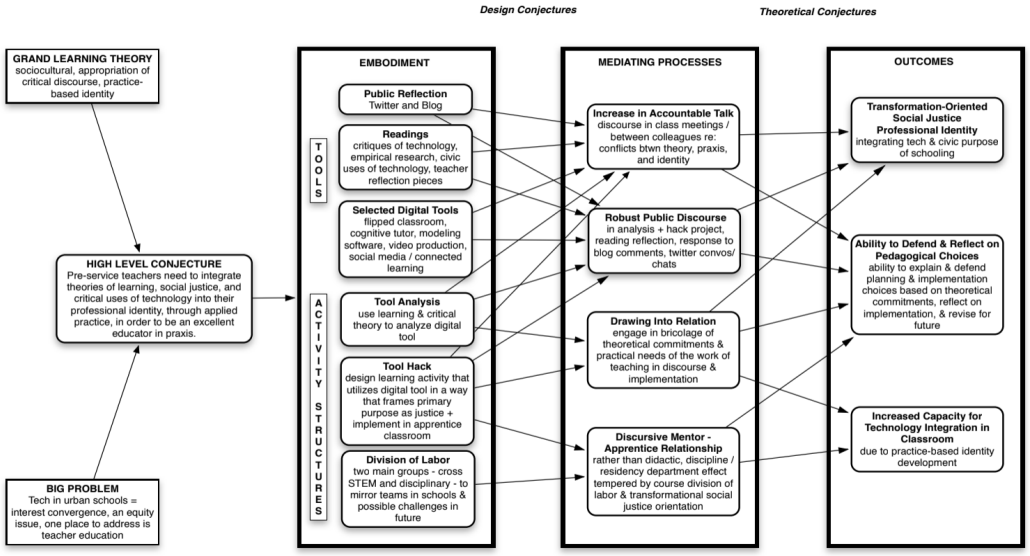

Figure 1. Early version of conjecture map

The practical re-design focused on enumerating a number of activities that the students would engage in repeatedly and a limited set of tools that embodied the high-level conjectures and would lead to the desired outcomes (see first boxed column of Figure 1). In this modified Critical Technology Literacy course, the student teachers engaged in *reflection* via quick writes in google docs or in personal public blogs. Course *readings* include civic use and critique of technology, learning theories behind digital tools and teacher reflections on technology integration in order to engage in the mediating processes of increased in accountable talk during course meetings and an ongoing robust practice of critical reflection. Student teachers were assigned to two groups for the duration of the course: (1) subject and grade-level specific (e.g. Pre-K/Kinder group, upper elementary group, middle school science group, high school math group, etc.), and (2) mixed grade-level and subject groups (i.e. one middle school member, one early elementary member, one secondary math member, and one secondary science member). The students engaged in a learning theory *analysis of a digital tool* in their mixed groups, but then engaged in *hacking* a chosen digital tool to create an instructional unit plan with implementation in their discipline specific (elementary or secondary science, math, engineering, computer science or other) residency classroom. In the original conjecture map, there was a plan for *division of labor* and assignment structure meant to encourage a discursive relationship between the apprentice and their groups, their mentor teacher, and myself as the instructor to engage the apprentices in creating a bricolage of their theoretical commitments and the practicalities of the classroom. Unfortunately, the mentor teacher aspect of the design was not met due to logistics with a lack of time from mentors and other coordination problems within the timeline of the academic year and standardized testing.

I recognized that the activities and tools, in and of themselves, would not guarantee the outcomes I hoped for and so enumerated a set of things that needed to happen during these activities. Namely, teachers needed to practice the skills necessary for reflection including accountable talk, appropriation of discourse, and drawing into relation (see second boxed column of Figure 1). First, teachers were expected to engage in structured discussion with both their mixed groups regarding the theories of learning and digital tools they read about and viewed in multimedia sources. By having these discussions with the mixed group, some of the taken-for-granted understandings of particular subject areas or grade levels could not be assumed across the mixed group. Instead, each person had to explain their thought processes and their own connections from the texts to their own instructional practice and lived experience. After these discussions, each individual was expected to engage in a public reflection – in the case of two of the students, they chose to write public blog posts while the rest of the class used shared google docs linked in a spreadsheet available to the whole class. They were not required to respond to one another, but some mentioned those reflections in the introductory discussion during the following week. When I reviewed the reflections as the instructor, I was looking for appropriation of both social justice and learning theory discourses along with a synthesis of those discourses with their own experiences as teacher sand students. Lastly, based on the work of John Dewey's foundational work "Art as Experience" where he connects the work of planning instruction and teaching to the work of an artist who brings multiple ways of seeing the world into one art piece, so does a teacher 'draw in to relation' multiple visions of how knowledge is created and the lives of learners in the classroom to orient, invent and envision the learning to be done (Kennett, 2017). This drawing into relation is necessary for the production of teacher planning, including the use of digital tools because the teacher has to construct a distillation of

theoretical commitments, theories of learning, available tools, and the people engaged in learning into a series of 15, 45, or 90 minute lessons that all tie together into one piece of art known as a unit plan.

All four of these processes (accountable talk, public discourse, drawing into relation, and discursive mentor-apprentice relationship—see second boxed column of figure 1) were expected to result in the desired outcomes (see far right column of figure 1)apprentices' ability to *defend and reflect on their planning* for and implementation of pedagogical choices, especially those related to *technology integration*. The theoretical conjectures connecting the two boxed columns on the right side of this figure are based on the "everyday work of teachers" literature (Cochran-Smith & Villegas, 2014; Gardiner & Salmon, 2014; Sato et al., 2008), the Deweyian (1923) idea of 'drawing into relation' and Feiman-Nemsers (Feiman-Nemser, 2012) framework focused on approaching teachers as learners first. Such work of pulling [digital] tools, pedagogical practices, instructional strategies and student relationship building into the classroom, combined with the discursive mentor-apprentice relationship related to practicalities, should result in an increased capacity for technology integration in the classroom for the apprentice teacher by the end of the course and into their novice teaching year. By engaging in a robust public discourse, accountable talk within this course, and the drawing into relation happening in practice, my theoretical conjecture is that this will result in a practice- based identity as a transformation-oriented social justice educator. Holland and colleagues (2001) and Hutchins (1995) work identify the need for personal narrative building around identity, and the relationship between material means and figured worlds. In this case, the resident teachers are engaged in narrating their identity as an educator throughout their urban teacher residency program, with the addition

of new digital tools as mediating material means within a particular participation structure in the course and mentor's classroom that should result in this practice-based identity.

Methods

During the project, I collected written and audio recordings of course artifacts, and weekly Go-Pro video recordings of all small group discussions class meetings. Additionally, the apprentice teacher's written reflections on both course readings and class discussions were collected and reviewed during data analysis. Readings included focuses on the civic use and critique of technology, learning theories behind digital tools, and multiple teacher and researcher reflections on technology integration. Participants also engaged in inquiry and reenactment with the provided empirical articles, experimentation with a variety of digital tools, weekly reflection and design of extended unit plans incorporating digital tools. A technology biography, a digital tool critique, a critical media critique, weekly blog posts, and a detailed unit plan including digital tool integration were all collected in writing. Small group discussions regarding class readings and tool experimentation were also video recorded using small GoPro cameras controlled by the students themselves.

Although the conjecture map was an important step in the process of developing a theoretically grounded course, our analysis of apprentice teacher learning revealed several new processes that mediated the desired outcomes. We use the findings of that analysis to identify a series of three design principles we believe to be integral to technology courses in teacher education programs: (1) expect intertwined personal and professional technology identities to mediate what teachers get out of the readings and learning practices; (2) encourage playful enactment for productive failure; (3) focus on facilitating accountable talk and opportunities for apprentice teachers to engage in reflection in order to draw into relation their ideological

commitments to social justice and available technology tools to envision classroom implementation.

Context

The study upon which these design principles rest had the goal of mapping the variations in teacher narratives of practice-based identity to understand how teachers learn to teach with technology in a manner which aligns to their social justice goals. Now that we have a better understanding of those narratives and the sensemaking occurring during their creation, our findings from the broader study can be used to further design for improved learning experiences and outcomes for teachers planning to serve in the particular educational, social, and technological contexts of urban schools.

As a central location of work aimed at addressing the cycle of educational inequity, the Urban Teacher Residency (UTR) program which these design principals are based on is exclusively focused on recruiting, preparing and supporting teachers dedicated to serving youth of color in urban schools (Gatti, 2016). As part of a ten-week Critical Media and Technology Literacy (CMTL) course the participants are candidates for a teacher credential within a post-graduate MA program. During the second phase, 32 students were enrolled in the class and evenly divided between those pursuing elementary and secondary credentials. Within the 16 students pursuing a multiple subject credential (elementary), fourteen self-identified as women. In the single-subject secondary level group, nine identify as men and seven as women. This UTR group is more racially and socioeconomically diverse than the current teaching force, and more closely represents the demographics of the urban schools in which they were teaching.

	Black	Latinx	Asian American	White	Black and white	Latinx and white	Asian American	All
Women	1	9	4	5	0	2	0	**21**
Men	0	2	5	0	1	1	1	**10**
Total	**1**	**11**	**9**	**5**	**1**	**3**	**1**	**1**

Table 1: Participant racial demographics as self-reported

All residency placements are purposefully chosen for their supportive and social justice-oriented partner teachers within district partner schools. Each group—elementary and secondary—are part of a team led by their faculty advisor who serves as field supervisor, and methods and seminar instructors. The cohort also took courses throughout the year on the university campus in the afternoons and evenings with about one third of the group concurrently enrolled in a bilingual authorization program.

Findings

Using a case study of one class session of our course, I identify three design principles that will be useful for others designing for critical technology literacies in teacher education: (1) center intertwined personal and professional technology identities; (2) encourage playful enactment for productive failure; (3) focus on accountable talk and critical reflection to draw technology and social justice into relation. I chose the fourth meeting of the 10-week course for this design case study because it presented teachers a chance step out of their comfort zones in this hands-on activity. In the debrief of the activities I was also able to see how the apprentices might actually enact technology rich lessons in their future classrooms. During this class we had the opportunity for participants to take on the role of students in the on-campus lab school's makerspace. Outfitted with everything from welding materials to sewing machines, the STEAM

Lab as it is called in the Lab School, is a space that students from age 5 to 12 get a chance to use a variety of materials to support their learning across the curriculum.

When we arrived on our class visit which was scheduled to take up the entire 3.5-hour long course meeting the STEAM Lab director, Mr. Yung a former elementary, teacher asked our residency students to sit at tables of 6-8 people. He explained the history of the STEAM lab and its purpose to connect content from the esoteric of school subjects to the physical nature of making. For our students, they were interested to see what materials and tools were available in the campus lab school which is a private school compared to their chronically underfunded public schools. They were surprised to know that Mr. Yung was a public-school teacher for years before joining the lab school team and had been using these types of materials across socioeconomic contexts.

He also ran them through the way he organized student introduction and interaction in the STEAM lab by having each table of 6-8 preservice teachers participate in a project his students began the year with in 3rd through 6th grade, when they attend class in the STEAM lab much like an art or music "special." The exemplar options for students were using construction-paper to create a city, programming a simple game in the Scratch application, or putting together a robot that can successfully draw on paper independently. Using the information collected from the digital autobiographies of students and their contributions during small group and whole class discussions, we were able to direct them towards groups in the STEAM lab visit that both challenged their assumptions about their own abilities, sometimes based on their histories with technology, and opened up opportunities for growth. The last table, with a very mixed levels of technology comfort, was given iPads to borrow each loaded with the student Scratch app.

In the construction paper city, students were asked to build a dream civilization in three dimensions, working entirely out of construction paper with the purpose of learning basic cutting, pasting and physical construction. Yung explained that this activity was regularly the first introduction to independent "making" for upper elementary students to help them work through structural problem solving without the need for extensive tools or expensive supplies. For the Scratch game creation, the teachers were able to experience using the Scratch block coding language to create a simple game by programming a small visual sprite, or animated character, using simple repetitive loops and triggers to perform specific movements around the screen. Finally, the object of the robot programming was to engineer a way to use the provided Arduino processor, motor, gaffer tap, wheels, and other small parts to create a robot that could draw a circle using the provided ink pens. The teachers had to investigate how they could connect the motor and processor, and how weight and balance came into the build to keep the pen touching the paper to make actual lines and drawings.

Across the STEAM lab there was grumbling and annoyance. Almost halfway through the quarter-long course and students had gotten comfortable with three weeks of traditional readings and reflections and class discussions. Although there were small opportunities for hands on exploration of digital communities like teacher twitter hashtag chats or showing understanding by creating memes on poignant points from the course readings, this week was the first time in the course where students had almost an entire class meeting to embody the role of naïve learner. It should come as no surprise that it then took most of the class time for students to adopt that role and truly connect with the making activity, but in the end with a bit of prompting and cajoling, the students truly engaged with the playful nature of these activities to take on the role of student and learner in the moment. The buzz in the room was contagious and resulted in

students chatting between tables, sharing ideas of how to use these materials and tools in the classrooms they would be leading as the teacher of record the following year. A few students arrived late to class, having forgotten it was moved to the on-campus maker space and they were visibly surprised by the buzz in the room and joked that they missed all the good ideas. All of this was after a full week of teaching and graduate level classes on Friday afternoon with the weekend in sight. We had to push students to stop working and refocus to debrief the experience and clean up so our host Mr. Yung could go home after spending his afternoon with us.

Intertwined Personal and Professional Technology Identity

We used a previous assignment, a digital autobiography, to inform our groupings by technology comfort levels and experience in the makerspace. That assignment asked teachers to reflect on and review their own history with the use of digital technologies at home, as students, and professional educators. Due to the varied background of our students from experienced paraprofessionals and education nonprofit veterans to recent college graduates, along with varied socioeconomic backgrounds, we needed information directly from the student teachers to be able to structure our course. Similar to scholarship regarding the power of prior experience and identity association with learning new skills or content (Bruce & Bishop, 2008; de los Ríos et al., 2015; Mirra & Garcia, 2020; Nasir, 2002) we knew our apprentice student teachers would enter our class with preconceived notions not only about the content of learning to be done but also about their experience level with technology and how well they and their students experiences would be represented in the educational technology landscape. This might be a particularly salient issued if they had negative or little to no experience with technology in schools, including during their student teaching thus far that academic year. As shown in previous work (Gravell, under review), our student teachers had previously used technology primarily for entertainment

or work purposes (both in school and out of school work responsibilities), but within those categories there were marked differences in how they used or thought digital tools should be used in the classroom based on whether their social justice perspective was oriented toward access to the current educational system or toward transforming the current system of learning and society to a more just future.

During class the week before this class session, there was a situation that shows the salience of gender and race to how teachers (and people in general) are assumed to have different levels of understanding with digital issues and discussions depending on their interlocutor's assumptions about their capacity for facility with technology. For example, a group of four student teachers—Jane (white woman elementary teacher), Tiana (Black woman elementary teacher), Lindsay (white woman secondary math teacher), and James (white presenting* male secondary math teacher)—were working together during the third week of class to discuss a reading and the marginalization of women and Black women in particular was exemplified in their interaction. That week's reading focused on issues of representation in digital media and included materials by Stuart Hall, Safiya Noble, and the Misrepresentation documentary. The group in discussion here focused on the article about hypervisibility of Black women and girls in Google search (Noble, 2013) which included some technical discussion of how google search engine algorithms work.

Structuring large swathes of data like the Google search algorithm does are often found to reflect the racism and misogyny of the wider society, especially for Black women and girls who are marginalized in digital and analog spaces alike. The group's verbal discussion focused on the technical aspect of how this might be possible; for example, Amira explained that pictures of young Black women being tagged with derogatory terms repeatedly would make those images

and to what they link would appear when someone searched for both “Black girls” and when just those derogatory or misogynistic terms were searched even without “Black girls” being included in the search. John interrupted her explanation to tell her she was wrong and that they ‘algorithm’ determined what appeared and when, and while his explanation was also correct, he did not acknowledge that one of the major drivers of that algorithm is the html tagging of images and file names tied to those search parameters. The Noble article went on to explain that the more people search derogatory things along with the search term “Black girls” the more derogatory things will be connected to those girls in Google search. John had either not read the article in its entirety or mistakenly understood the author’s explanation which led him to contradict a Black woman’s interpretation of a reading which was directly speaking to her own lived experience existing and using digital tools as simple as Google search. This example of the intersections of race, gender, and technology in class discussion was not singular, but rather made salient the ways teachers are themselves racialized and gendered in their interaction with one another much less their interactions with students; no matter if that interaction is within digital or analog spaces.

In the makerspace visit, it was especially interesting to see Lilía engage with the robot building project. We asked her to join that group when she arrived a bit late for class because it had the least number of students and because robotics was never a topic she mentioned being of interest to her. In fact, despite a background running her family small restaurant business’s website and point of service system from a very young age, Lilía did not express positive feelings about using digital tools in the early childhood classrooms she had experience in as a teacher’s assistant and now as an apprentice teacher. She was far more interested in building strong supportive and trusting relationships with her students and families and did not see digital

tools as a good way to do that. In this context, though, as a learner she ended up being quite adept at building the drawing robot; working from her experience helping her father install garage doors on the weekends as a child, she was able to transfer those skills to being comfortable enough using the small tools necessary to join together the components to make a moving robot. Although Lilía could not get the group's to reliably hold onto a pen and move at the same time, she did continue to tinker with the materials even after being asked to stop for the class debrief. I noticed that even she seemed surprised by her engagement with this activity; she had been previously reticent to engage because the of the vast disparity in resources available to students at the lab school we were visiting and those in the school where she was doing her student teaching. With her own lived experience being valued in that space, along with Mr. Yung's explanation that these simple robotics materials were far more inexpensive to get than expected, Lilía began to brainstorm how she might connect this type of activity with her own social justice and community-oriented goals.

In the course conceptualization seen in the conjecture map above, I focused on the activities and discussions I wanted the apprentice teachers to engage in during the meetings. And while I was aware their intersectional identities come in to play in the wider context of their classrooms and engagement with social justice teaching, I did not adequately estimate the centrality of identity for their learning with technology. Not only did their own personal and professional experiences and affiliations influence how willing they were to engage with technology at all, it also mediated how they engaged or resisted particular discussions or assignments. This design principle accounts for and begins to outline how instructors can design activities to elicit their students' histories and use them to modify participation structures for opportunities for growth.

Teachers as Learners: Playful Enactment and Productive Failure

Sitting on small chairs at tiny tables built for elementary students, everyone had a chance to take a vacation back to childhood especially for the secondary teachers in the room who were normally hardest to get to think outside their content focused boxes. This day's activities were notably different from our previous hands-on activities with technology in that they were not asked to engage with an eye towards how they would use the technology in their own classroom, but were asked only to experience the activity as learners. By engaging teachers in the exact kind of playful learning called for by educators from Maria Montessori to the MIT Media Lab, the experience in the STEAM lab was an enactment of just the type of pedagogical practices the course was designed to build.

The playful learning environment, from the physical space to the trust built up among the participants over the course of the entire previous year allowed for the comfort level necessary to engage in 'productive failure' (Kapur, 2008; Kapur & Bielaczyc, 2012) or the experience of solving ill-structured problems in order to result in latent successful development of skill with a particular process or concept. For example, in the group exploring how to use the Scratch app to program a simple game, they decided to work in pairs with two people working on one screen to design the simple game together. There was quite a lot of boisterous laughing going on as these "grownups" had a hard time making their "sprites" or avatar characters do anything at all in the Scratch programming environment. One pair, Brittany and Violet, decided to investigate the student gallery of creations on the Scratch website to see if they could figure out what was going wrong for them. They were so impressed by the young people's creations that they decide to "remix" one of those rather than starting from a blank slate. Because they were unable to make it work for themselves at first, they not only experienced what that kind of failure might feel like

for their future students, but they also used the lack of requirements for their product (i.e. an ill structured problem) to inspire them to recognize and value the expert products that young people had already created. In this case, having a chance to play with digital tools with no "correct" answer or outcome helped the teacher candidates develop a more comprehensive understanding of both the expected uses of that tool and the experience of learning to use it much like their students would experience when they brought it into their classrooms.

The experience of learning a new technology in order to use that technology in a lesson in their classroom and play around with a tool that had previously intimidated the apprentices , now gave them a chance to try out multiple roles and division of responsibilities in their exploration groups. Ironically, this playful exploration ended up leading to imagining future uses of the tools in their own classrooms. In the case of the group that was building a construction paper city, Jenna and Elizabeth—both secondary math teachers—were having fun with the construction paper but explained in the debrief that they didn't think the activity would have any relevance to their own classrooms. As they were working on getting the floor of a paper structure to balance, they began to see how they could connect the physical representation used in a simple tool like construction paper to build conceptual understanding for their high school students around balancing equations. They made plans to bring construction paper to class the next week to use as a manipulative for thinking about 'balancing' equations. By engaging in this task as a learner, with no expectation that it would be relevant to their own teaching, they were able to begin to imagine new possibilities for learning that were previously outside their realm of possibility. Similar to Boaz's *Theatre of the Oppressed* methodology, which engages youth and community members in acting out intimidating or oppressive structure in order to imagine an empowering alternative, so too did the playful enactment and opportunity for productive failure create

opportunities for the apprentice teachers to imagine more empowered and empowering uses for digital tools in their own classrooms.

In the course of designing this class, I had built in expectations for the apprentice teachers building relationships with me as their instructor in the form of a mentoring relationship, and for them to be in community in a way that they could hold one another accountable as publicly engaged educators committed to social justice. I did not, however, specify how they would relate to the technologies in the class. Including a design principle of playful learner rectifies that oversight—it outlines the necessity of teachers building the practice of engaging with technologies as learners first before envisioning and critiquing its potential for their future classrooms.

Drawing Into Relation: Reflection to Envision Critical Technology Literacy in Practice

This design principle calls for a focus on facilitating accountable talk and opportunities for apprentice teachers to engage in reflection in order to draw into relation their ideological commitments to social justice and available technology tools to envision classroom implementation. One of the major issues that teachers had trouble doing on their own was drawing together the use of a tool for a specific purpose and aligning it with their espoused social justice goals. This was an outcome that was designed for in the original conjecture map, but the extensive nature of this work was not adequately supported in the original design because it did not take into account the necessity for not only evaluating the digital tool, but also the instructional and community practices to be utilized with the tool.

After teachers experience the tools they might use in their classrooms as learners, they need to step back and take a critical eye towards the potential and the downsides to using this tool in their classroom. This means transitioning from thinking about the tool itself and instead

evaluating the practices that surround the tool. One of the complicated issues with educational technology is that many teachers are introduced to digital tools by consultants who are promoting a specific learning management system or personalized learning software, rather than by their teacher education program, their own research for a particular need, or even by their school-based instructional leadership. In this course, teacher candidates instead were asked to approach the tools discussed in their readings and explored in class with a critical eye. During the second class meeting, the expectation was set that specific tools or readings about tools were not shared because they were necessarily good or useful, but rather because they were things that were out in the world and could end up on their professional development or evaluation docket in schools as they became teachers.

As discussed above, Brittany and Violet were very interested in exploring Scratch during their time in the STEAM lab. They had both entered that class meeting with questions about equitable access to both makerspaces and tools like Scratch. Brittany was focused on whether access alone was equitable or culturally responsive when not taking into account and valuing the home repertoires of tinkering and making that poor and working-class students have without formal makerspaces. Violet was already questioning how access to the Scratch application or website would be negotiated and whether there had been adequate advancement in the tool in the time since it was founded to reflect a more diverse audience both in race and gender representation and free access via the web browser. Both of those things were true in the updated version of Scratch that they explored in the STEAM lab, but the important part of their experience in the lead up to, the actual makerspace experience, and their eventual use of critique *and* use of the tools in their own classrooms was the actual process of deciding how to utilize these tools. Both Violet and Brittany engaged in the full process of playful engagement,

productive failure, critical evaluation, and envisioning of how their justice orientation comes into reality in their particular context and with a particular tool.

This practice of drawing into relation was also supported by the design following the STEAM lab visit, as part of a group podcast project, participants were asked to work in a group to evaluate a digital tool from an expansive list using the following questions:

> How does it work? How does it motivate or engage (or not) students? How is it relevant to students' lives (or not)? How does it teach? Is it telling, inquiry, collaboration, etc? What ideologies are in play in the design of digital tool? What are the roles for peers, collaboration, the teacher? What does the technology add, what does it subtract? How might you (or have you already) use the digital tool in your classroom? Do your answers (and therefore the digital tool) fit with your values and goals for your classroom? How might you modify the digital tool to make it fit with your ideological commitments?

The purpose of this assignment was to provide thought prompts for teachers to utilize over the course of their career as they are introduced to various tools that appear and change from year to year and can even change as one uses new tools in their own context. In the time since this course was enacted and data for this project was collected, I have been contacted by five of the participants to act as a thought partner in their quest to decide whether to use a tool like Nearpod, Schoology, or Khan Academy with their students in their first two years as the instructor of record in their own classrooms. While this is heartening, it means that I was not entirely successful at empowering the participants to engage in this work on their own, which is indicative of both the isolation of teachers and the need for this third design principle not only in preservice teacher education but also in-service teacher professional development.

In designing the course, I had thought to encourage a critical stance towards technologies by providing examples of readings that took a critical eye and by modeling the types of questions to ask about the technologies. Additionally, I sought to encourage those critical discussions in public writing and in accountable talk between students. What I did not consider was that the

learning of the tool and the critique of its use in practice needed to be separated in time, so that the teachers had a chance to see the positives before they engaged in the critique. This alternative progression would allow teachers to engage fully with the tool to facilitate a truly critical analysis of it rather than an immediate rejection or uncritical adoption for expediency's sake. Without a thought partner it was hard for these teachers to engage in the envisioning how their ideological commitments to transformative social justice with a critical lens could be supported by digital tools regularly being imposed upon them and their students by school-based leadership. Combined with the prevalent cultural discourse challenging the raced and gendered myth of digital spaces as neutral, and the ongoing COVID-19 pandemic, participants in this study have repeatedly reached out to me via email and social media to share how they are thinking about our class discussions and the requirement to always identify the connection between practices and ideologies as they enter the 100% virtual schooling environment in their district this year.

Designing for Expansive Learning in Teacher Education

It is important for teacher educators, the programs in which they teach, and the evaluation and accreditation leaders to engage with classrooms as complex activity systems (L. Anderson et al., 2013; Cole & Engeström, 1993) with competing goals, rules of engagement, negotiation of control, and individual and communal histories at play. To reduce these spaces to simple settings of compliance with a required tool—digital or otherwise—was unrealistic and short sighted. Much like curriculum theory and identity-based practices which have identified the requirement to engage youth in making sense of building on home repertoires and field-specific crosscutting practices and skills, we must do the same in teacher education particularly when focused on issues of technology. One area of further exploration from this study and design principles is in

the value of making the design of the course transparent from the beginning and whether that would destroy the power of ill structured problems for deep conceptual understanding and practice.

Chapter 5: Implications

This dissertation highlights the importance of studying teachers as learners first in the realm of educational technology. By focusing on a particular cohort of apprentice teachers within an urban teacher residency program, I am able to zoom in on the multiple ways identity, structural racism, learning practices, and community structuring can intersect to mediate the learning of novice teachers. In the first paper, I showed the intertwining of personal histories and technology identity with the professional educator identity these apprentices were developing within the teacher education program and their student teaching contexts. By applying the scholarship of practice-based identity development and critical literacies, I was able to map the relationship between personal technology identity and social justice orientation (access or transformation based) to see how those influence the way teachers envision utilizing technology in their own classrooms. In the second paper, I compare the formative example of Brown v. Board of Education for Critical Race Theory in the Law and the concept of interest convergence with the current educational technology policies in urban schools like Los Angeles Unified to identify a similar convergence of white interests and Black and Latinx communities demands for equitable technology access. This way of seeing is important for the work of teacher educators and apprentice teachers alike – we need to see a problem from a critical lens in order to develop an appropriately critical response in our classrooms even to systemic issues like interest convergence otherwise novice social justice educators can unknowingly exacerbate the oppression of their students through extractive technology practices and programs. Finally, in paper three I propose three major design principles for designing teacher education courses focused on developing critical technology literacy for transformative education.

For Researchers: This dissertation provides a reminder that teachers are learners first, and that adult education should not be approached as if what we know about learning other content and skills does not exist. Much in the same way we study learning progressions for concepts in math and English courses, we must also continue to study the ways teachers learn. As is the case for K-12 students, considering who the learner is, what they bring to the classroom, and who they desire to become becomes more important as what is to be learned becomes more complicated. This is why it is especially important when it comes to issue of developing teaching practices consistent with the goals of social justice and transformation. Additionally, as it is the case for K-12 students, teachers are also diverse in their racial, cultural, and socioeconomic backgrounds. We must think through what sorts of educational experiences will be productive for a wide variety of student teachers, without making assumptions about the histories and experiences apprentice teachers have with technology. Finally, I identify the importance of understanding educational problems from critical, race-conscious frameworks in order to have a chance of designing any form of improvement to the current educational landscape. Without the appropriate framework identifying the problem in enough depth, we will only continue to fall short of expectations for improvement in the same way Brown v. Board of Education have failed to eradicate de facto segregation.

For Policy Makers: Article 1 and Article 2 make clear that the solution to these problems of digital equity is not just more access to hardware and internet connection, but rather a concerted effort must be made to improve the way educational technology and learning to teach with technology is addressed in both pre-service and in-service teacher education. This means providing funding for not only collecting and synthesizing the current programs that have extensive technology literacy programs, but also requiring that issues of racial and gender equity

are addressed in research and programming around educational technology in public schools. When the major focus of educational technology policy is aimed at developing workforce readiness, the solutions that occur currently in the context of interest convergence are not adequate or equitable. The result instead is preparing those children whose communities cannot afford their own hardware and software to use whatever is most useful for funding organizations which regularly reflect entry level job training rather than transformative opportunities for engaging in the knowledge economy. Because their education reflects the need of corporate elites rather than their own communities, there is little opportunity for using digital tools for civic engagement or community organizing and instead promotes the brain drain effect pulling the most successful children out of their communities.

For Teacher Education Practitioners: Article 3, both in the conjecture map and in the lessons learned, provides a framework for designing new critical technology literacy frameworks and courses within the current educational technology requirements in credential programs. The same framework encourages novice teachers to approach educational technology from the social justice inquiry framework that they already bring to their work. By starting the development of critical reflection practices, teacher educators and district or school-based leadership can engage with the realities of persistent racism and oppression rather than treating technology like some kind of silver bullet that will solve all issues. The design principles encourage teacher educators and teacher education programs to build courses and programs around teachers as learners first, starting with the same opportunities for inquiry, playful enactment, and productive failure we advocate for in the K-12 context. Once those opportunities are established along with a program wide ideological commitment to social justice, opportunities for reflection and accountable talk with cross-curricular and subject-area alike colleagues can create the opportunities necessary for

moving toward classroom enactment. Facilitating the drawing into relation of pedagogical learning theory, social justice commitments, available digital and analog tools, and familiarity with community and context can then create the necessary conditions for teachers to envision and instantiate transformative education opportunities in their classrooms and schools.

Limitations

These studies were focused on a very particular context of a social justice-oriented cohort-based urban teacher residency in a very large district. The moment to moment interactions which exemplify the drawing into relation that teachers go through was not analyzed for this dissertation at this time. This study was also conducted in a post-hoc nature after the course was completed and did not involve direct input from the participants on how to design the research nor make sense of the results. Issues of identity and practice will continue to develop as the COVID-19 pandemic forces huge swathes of teachers to engage online without necessarily approaching their virtual learning and teaching with a critical eye.

Future Research

In future work, I have three major expansions of this research planned: (1) participatory research with youth and families on educational technology use in schools as part of district-based research practice partnerships; (2) engaging focal apprentice teachers in interpretation of video data and collection for more insight into sensemaking as novice colleagues; and (3) developing alternative models of educational technology ***use*** in urban schools that honors and supports the creativity and civic engagement of the most under resourced children.

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