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Theory-Practice Divides and the Persistent Challenges of Embedding Tools for Social Justice in a STEM Urban Teacher Residency Program

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Abstract

This study examined how the concept of social justice was operationalized in the university coursework of students enrolled in an urban teacher residency program that aims to diversify the teaching corps and prepare secondary STEM teachers for urban classroom environments. Based on analysis of 39 syllabi and interviews with nine faculty members, we found that challenges in embedding social justice theory with STEM content knowledge were attributable to the lack of a shared definition among program faculty, and external pressures imposed by state teacher credentialing requirements. We conclude with recommendations for practice by suggesting ways that rigorous STEM content knowledge can be combined with locally and historically contextualized social critique and tools for change in order to support teachers in enacting justice-oriented practice in communities.

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Introduction

Urban teacher residency programs, in which pre-service teachers spend a year embedded in a classroom with a mentor teacher while simultaneously completing university coursework, have emerged over the last two decades as an additional model of teacher preparation, alongside traditional and alternative certification routes (Hammerness et al., 2016; Papay et al., 2011; Solomon, 2009). Previous research has explored the dispositions and self-perceptions of teachers prepared through residency programs (Gatti, 2019; Tindle et al., 2011), examined links to K-12 student outcomes (Papay et al., 2011), mentoring strategies and relationships (Goodwin et al., 2016), and proposed teacher residencies as a way to address chronic shortage areas (Garza & Werner, 2014; Guha et al., 2017a, 2017b). Urban school districts, typically characterized not just by geography or population density, but by a set of often deficit-oriented assumptions associated with racial and socioeconomic demographics (Milner, 2012; Welsh & Swain, 2020), have for decades been seen as sites where educational reform and intervention are needed (Anyon, 1997, 2014; Lipman, 2011).

Understanding how to best support pre-service teacher development of social justice perspectives and commitments is also a burgeoning area of teacher educator practice and scholarly research (see e.g., Convertino, 2016; Reagan et al., 2016; Sleeter, 2017; Zeichner, 2016). Despite a dramatic rise in the number of education programs that claim to be social-justice focused (Hytten, 2015), developing social justice praxis in new teachers requires specific critical dispositions that ground all classroom practice—including content instruction (Bondy et al., 2017). Teacher residency programs are a potential way to bridge ongoing theory-practice divides (Klein et al., 2013) and meet the need for critically conscious educators in urban K-12 schools by providing context-specific preparation (Hammerness & Craig, 2016; Williamson et al., 2016).

This article contributes to dialogue about social justice-oriented urban teacher residencies—particularly those that aim to diversify the STEM teaching corps—by focusing on the role of university faculty and curricula in the preparation of these new teachers. As Gatti (2019) concluded, programmatic supports to help new teachers understand issues of race, class, relationships, and power are essential to consider as urban teacher residencies proliferate. Through this research we explored the challenges that arise when teacher

educators who have themselves been socialized into a public system of education predicated on values and histories that are fundamentally counter to social justice principles are tasked with developing new teachers' capacities to become social justice educators. We found that internal program contradictions arose from a combination of inconsistent personal definitions on the part of instructors and an unresolved collective understanding of social justice, and that external sociopolitical factors limited the capacities of teacher education programs to counter injustice, but that possibilities for disruption exist.

Theory Versus Practice Dichotomies in Pre-Service STEM Teacher Preparation

Teacher preparation has for decades been marked by tensions around the appropriate balance of two foci—providing teachers with so-called "practical" professional skills for use in the classroom, and background knowledge about theories of individual and group learning in social contexts. Teacher education programs are tasked with working to determine an appropriate and alternative balance of the two but these efforts are challenging because there is no one practice or setting that guarantees complete student learning, as many variables operate for and against student success with contradictory results (Hennissen et al., 2017; Rasmussen & Rash-Christensen, 2015). Furthermore, mentor teachers are often in the "midst of developing their own theoretical knowledge and pedagogy" and may struggle to help pre-service teachers cultivate these capacities (Gelfuso et al., 2015, p. 3). Many researchers have suggested ways to address the gap between theory and practice while also offering recommendations to narrow it, with aims to generate a symbiotic relationship but no clear formula has emerged (Gelfuso et al., 2015; Hennissen et al., 2017; Rasmussen & Rash-Christensen, 2015).

Dominant Approaches and Influences in STEM Education

Previous research has suggested that embedding social justice in science and mathematics education is particularly difficult for new secondary educators and that social justice approaches have been undertheorized in science education research (Atwater, 2011; Dimick, 2012; Garii & Rule, 2009; Maulucci, 2012; Sondel et al., 2017). New teachers' attempts to integrate multicultural content into science curricula are typically only superficial, and applying critical multicultural lenses to support students with a range of identities can be especially challenging (Boda, 2019; Suriel & Atwater, 2012). Some of the explanation for this disconnect between social justice theory and practice in

science education lies in the development of STEM education as a field. U.S. government investment in STEM education has long been tied to goals of military and economic competitiveness, an association that has sometimes led to negative perceptions of the field by non-STEM educators (Basile & Lopez, 2014; Breiner et al., 2012; Rodriguez & Morrison, 2019; Vossoughi & Vakil, 2018). In work that has explored the addition of arts into STEM (known as "STEAM"), educators seek to identify disciplinary core practices that can transcend subject areas and build deeper learning and problem solving skills (Herro & Quigley, 2017); although this approach broadens traditional understandings of science and mathematics education, social context is usually not at the center of teacher development or student experience. The increased influence of standardized assessments on U.S. public education during the NCLB era also influenced new teachers' perspectives about their roles in different ways, with some resistant to these forms of "accountability" and others more accepting of scripted curricula and narrowed measures of learning (Nichols & Brewington, 2020).

Calls to teach STEM in a more integrated way are based on research that suggests this approach will lead to less compartmentalized understandings of the applicability of science and technology in daily lives (Breiner et al., 2012; Zollman, 2012). This perspective is also embedded in the Next Generation Science Standards (NGSS), which call on K-12 teachers to draw explicit connections to other areas of learning—specifically, the English Language Arts and Mathematics content objectives outlined in the Common Core State Standards (Butler et al., 2013). Despite the call for integration and more interdisciplinary engagement, however, the NGSS fall short in promoting reflexive, socially transformative teaching or increasing the diversity of voice and representation in curricular materials (Rodriguez, 2015). Although discussions of equity and access have become popular in science teaching circles, attention to critical justice issues have not; therefore, if the NGSS are not implemented through a justice oriented lens, teaching under these "new" standards can easily perpetuate dominant neoliberal valuations of STEM (Fortney et al., 2019; Schenkel et al., 2019). In their development of a conceptual framework for integrated STEM education, Kelley and Knowles (2016) relied on an argument of "global urgency" that ties the social impacts of STEM education to the maximization of human potential to solve pressing problems (such as environmental degradation) through innovation. Although these challenges certainly merit immediate attention, this key motivation is counter to a social justice approach, which would examine the source of these same problems as rooted in social inequities and histories of racism and genocide and look for solutions that incorporate this perspective.

Emerging Social Justice Perspectives in STEM Education

Small advances made toward equity and justice in U.S. public education are threatened by the current neoliberal sociopolitical climate, and without clear articulation of these goals in STEM teacher preparation programs, even well-intentioned new educators will dilute or contradict the meanings of social justice in their work (Rodriguez & Morrison, 2019). Preparing new teachers to serve as social justice advocates and to deliver rigorous STEM content involves developing deep theoretical knowledge as well as practical experience navigating the challenges posed by such work (Butler et al., 2013). This process involves confronting white supremacy, imperialism, and heteropatriarchy, especially in acknowledging the ways Black contributions to math and science education in the U.S. are often erased and of the role of schooling in the historical erasure and contemporary marginalization of Indigenous peoples and epistemologies (Bang & Medin, 2010; Joseph et al., 2019; Kumashiro, 2018; McGee, 2016; Ridgeway, 2019).

Research has documented that educators struggle to balance a focus on science content learning with goals of political empowerment and flattening hierarchies between teachers and students. Marco-Bujosa et al. (2020) documented how graduates of a well-designed cohort-based urban science teacher preparation program developed strong social justice orientations, but still faced challenges with workplace dynamics and politics, while Dimick (2012) documented how a white urban environmental science high school teacher expressed commitments to student-centered instruction and awareness of unequal power distribution, but was challenged by a prior reliance on traditional modes of authority. Teachers who are themselves members of a marginalized racialized or ethnic group or who have had experienced "transformational" interactions with others may be more successful in integrating social justice perspectives in their science instruction (Kokka, 2018; Madkins et al., 2019; Suriel & Atwater, 2012). These teachers are themselves, however, often minoritized as professionals and situated in school contexts where they encounter dominant deficit-based discourses related to race and ethnicity (Basile & Lopez, 2014).

Connecting STEM learning to transformative community improvement and engagement goals is also a necessary but challenging component of justice-oriented science pedagogy (Morales-Doyle, 2017). The literature in this area builds on the work of researchers who began challenging other science educators to address social justice goals in their work in the early 2000s, especially Barton et al.'s (2003) text *Teaching Science for Social Justice*. Zembylas (2005) contrasted the youth-empowerment and locally contextualized perspective that guided this book with an alternative focus on "science

for citizenship"—this latter approach remains prominent in calls for integrated STEM teaching situated in the identification of social problems without deep analysis of their political contexts. For example, in their study of a social justice oriented weekend STEM program for urban high school students, Kozan et al. (2017) identified the potential conflict in enacting programming that sought to develop a Freierean type of critical consciousness to critique existing systems, while also promoting college attendance and career exploration as part of capitalist social mobility objectives. In our work, we support continued research on STEM education that interrogates the racial politics inherent to the field (Vakil & Ayers, 2019) and encourage self-reflection on the part of teacher education programs engaged in the necessary and crucial work of developing social-justice oriented K-12 STEM educators.

Conceptual Framework: Social Justice and Core Teaching Practices

Most work on social justice in education in the United States is aligned with tenets of critical theory that ontologically assume power is unequally distributed among groups of people in society based on social identities—especially race, ethnicity, language, ability, gender, and sexuality—and that although socially constructed, these identities have material impacts on individuals' lives. Informed by the extensive body of work in this area, we selected a specific analytic framework that connected conceptual understandings of social justice to particular teaching tasks. Rooted in knowledge of historic injustices, awareness of broader social inequities, and a critique of formal schooling as a site of structural discrimination, Hackman (2005) identified five social justice capacities new teachers should develop during their induction period as: "content mastery, tools for critical analysis, tools for social change, tools for personal reflection, and an awareness of multicultural group dynamics" (p. 104).

In order to identify connections between these capacities and instructional practice, we were also informed by McDonald's (2005) description of three dimensions related to social justice about which teachers need opportunities to learn both conceptual and practical tools: individual identity, organizational and categorical membership, and institutionally maintained oppression (p. 427), and the identification of a situated learning model by which teacher educators can prepare novice teachers to enact "core practices" in their own classrooms (McDonald et al., 2013). The teacher preparation program we studied has adopted the University of Michigan's TeachingWorks "High Leverage Practices" to define specific classroom skills and tasks; we therefore adopt these as a list of the type of "core practices" described by McDonald

et al. (2013). Using these conceptual tools, we employed a framework that assumes that pre-service teachers benefit from instruction that models both practical teaching strategies and explicitly draws connections to a critical analysis of structural inequality and social stratification based on individual and group identity categories, the historical roots of contemporary opportunity gaps and education debts (see Ladson-Billings, 2006), and the role of education in maintaining or disrupting institutional discrimination.

Study Context and Purpose

The Gran Pueblo Urban Teacher Residency (GPUTR[1]) is a preparation program designed to improve teacher quality in Math and Science in both general and special education secondary classrooms in a large metro area in California. GPUTR residents are challenged "to positively impact and overcome historical and new emerging educational challenges in urban schools in Gran Pueblo" and spend a year paired with a mentor teacher (a subject-area teacher with at least 5 years of experience in their role). Although the term "urban" is not clearly defined in program documents and discourse, the phrase "high need schools" is used to characterize placement sites, utilizing the federal definition which specifies that 30% of students come from families with incomes below the poverty line, teacher turnover is high, and there are high percentages of teachers working outside their credential area or on provisional licenses (Laws & Guidance, Elementary & Secondary Education, 2004). Residents are paid a stipend during their credential coursework and training year, and complete a Master's degree in Integrated STEM Teaching during the second year. The university with which the program is affiliated serves a student body comprised of 90% students of color and 70% first generation college attendees, and all teacher credential programs are designed to accommodate students who are working full-time. Although the embedded nature and the extended student teaching portion of their preparation is unique, GPUTR residents are taught by faculty who primarily work with traditional credential seekers.

In addition to preparing educators for shortage content areas (STEM and Special Education), GPUTR also aims to recruit and retain teachers of color in local school districts, and its university partner is a federally designated Minority-Serving Institution (MSI). K-12 teachers of color are disproportionately likely to have received their preparation at MSIs and are often motivated by a desire to serve communities of color (Gasman et al., 2017). Because of an emphasis on STEM innovation as a driver of economic improvement, however, urban communities where schools serve large numbers of students of color from lower socioeconomic strata are frequently the

targets of reform efforts that promote STEM education as a neoliberal endeavor (Vakil & Ayers, 2019).

In this study, we explored how the concept of social justice was operationalized in the credential and MA coursework of students enrolled in GPUTR. Although many scholars and practitioners believe that social justice focused teacher preparation will better prepare new educators to maximize student achievement and well-being, concepts related to social justice are rarely emphasized in preparation programs (Butin, 2007) or are viewed as subordinate and disposable (Carr, 2008). In keeping with an understanding that novice teachers benefit from having models to build from but arrive to their preparation programs with preconceived beliefs about teaching (Luft, 2012), we investigated how university faculty communicated their own beliefs to GPUTR residents, explicitly and implicitly. We also examined the degree to which skills-based core teaching practices and STEM content objectives were blended with conceptual understanding linked to social justice dispositions and capacities.

Methods

Guided by an understanding of theory-practice dichotomy as a long-standing tension in teacher education and critical perspectives that assume existing inequities in education are foundational to public K-12 schooling, we sought to answer the following research question:

How is social justice conceptually understood and embedded in GPUTR university coursework? and to address the sub-question: *How are social justice goals tied to STEM content instruction objectives?* We conducted a qualitative case study (Bhattacharya, 2017; Merriam, 2009; Yin, 2013) to identify and compare the understandings of social justice presented in GPUTR course syllabi and performance assessment descriptions to those articulated by faculty and program leadership. We utilized a single case study design with two embedded units of analysis (Yin, 2013) to compare and contrast how instructors described their perspectives in interviews to those reflected in documents. Our overall research approach involved the collection of multiple forms of qualitative data to capture different perspectives for triangulation purposes (Creswell, 2013; Patton, 1999) and utilized an iterative, interpretive analytic approach (Maxwell, 2013). Figure 1 provides a summary of the research process we engaged in over the course of 2 years, with a specific overview of our case study design and activities.

Researcher Positionality

This project was conducted by a team of four researchers with diverse background experiences and identities, but with a shared commitment to promoting

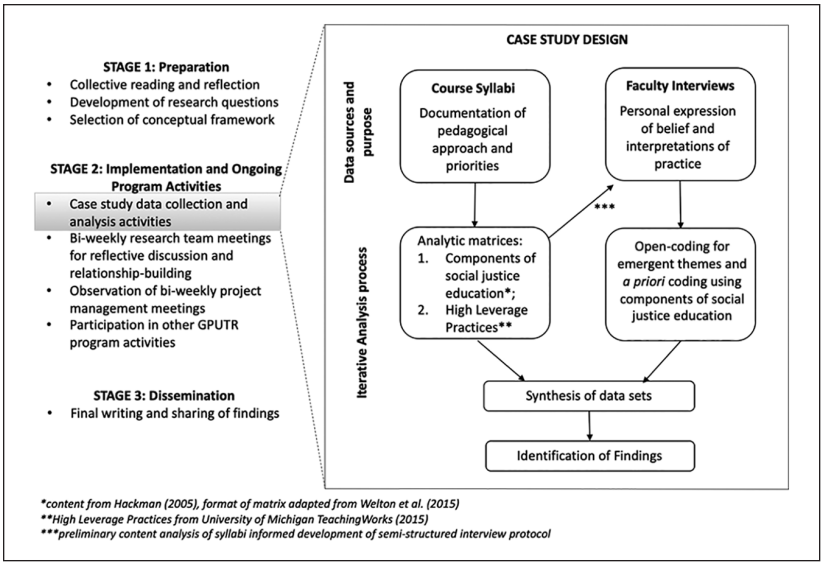

Figure 1. Overview of research process.

education as a path to social change. Allison Mattheis, a faculty member who previously taught in the GPUTR program and is a former middle school science teacher, was contracted by GPUTR to conduct research on the program. The research assistants were selected based on their previous experience working at various levels of the educational system (K-12 through higher education) and demonstrated capacities to engage in reflexive and collective practices. Mattheis is a white queer woman who teaches courses related to the sociopolitical contexts of education and the impacts of social identity on learning experiences. Lucrecia Nava completed an EdD in Educational Leadership after teaching high school for 8 years. She is a queer Chicana Nicaraguan woman who is now a school leader and also teaches pre-service teacher credential courses, primarily in bilingual and literacy education. Maria Beltran was born in El Salvador and is passionate about migration and food justice activism. She completed an MA in Latin American Studies and became a mother during the time of this research. Erick West completed a BA in Pan African Studies and an MA in Educational Evaluation and Research and is currently pursuing a PhD in Higher Education. He is a Black man who believes that social change requires collective action and that education is at the forefront of change. As part of our research process, we engaged in individual and collective reflection about how our identities brought us to this work, and how it impacted our experience of learning about others'

social justice dispositions. Our preparatory reading and dialogue included discussions about the whiteness of teacher education and U.S. education in general (Matias, 2016; Sleeter, 2017) as a fundamental aspect of the systems in which we are employed and that we sought to research.

Data Collection and Analysis

Analysis of key documents can inform larger studies of programs or events (Bowen, 2009); we therefore began this study with an in-depth directed content analysis (Hsieh & Shannon, 2005) of syllabi and then developed interview protocols for selected GPUTR faculty. All data for this study were collected and analyzed during the 2017–2018 academic year, and all research activities were conducted with Institutional Review Board approval.

Course syllabi. We first reviewed program documents that outlined the courses that GPUTR residents were required to take during their 2 years of university study, and then compiled as complete a list as possible of the faculty who had taught sections of these courses. We requested copies of syllabi from relevant department offices and collected 39 separate syllabi dating back to 2014. This total does not reflect the actual number of courses taken by individual teacher candidates, but rather the range of courses offered between 2014 and 2018 in the GPUTR program. Because the university transitioned from a quarter to semester calendar in Fall 2016, many courses and curricular materials were revised and adjusted.

We developed two analytic matrices based on our conceptual framework and used these to analyze each syllabus—with permission, we adopted an organizational table used by Welton et al. (2015) which showed how they applied Hackman's five essential components to study social justice educational discourse and practice in a high school classroom (p. 560). We used the High Leverage Practices developed by the University of Michigan's TeachingWorks to organize a similar chart that allowed us to document examples and record notes about course assignments, class activities, and other elements (e.g., word use/instructor notes). We made electronic copies of these matrices and used them to examine each syllabus by recording specific examples and language drawn directly from the text, adding additional notes where necessary, or leaving quadrants blank. At least two graduate student researchers examined each syllabus, resulting in a set of 156 completed matrices. All results were discussed collectively in weekly group work sessions.

Faculty interviews. Following the analysis of all syllabi, Nava, Beltran, and West reached out to faculty who taught in the GPUTR program and requested

interviews. They began by interviewing the program director together, and then conducted eight additional individual interviews with faculty who had taught courses to at least three cohorts of GPUTR residents. These included three full-time and two part-time Curriculum and Instruction faculty members, two full-time Special Education faculty members, and two part-time Educational Foundations faculty members. The interviews ranged in length from 30 to 60 minutes and were audio-recorded and transcribed verbatim by the researchers who conducted them. We then analyzed the transcripts using an iterative coding strategy (Saldaña, 2013) in the software program Dedoose (Dedoose, 2018). An initial set of codes was developed based on our conceptual framework (e.g., "critical analysis of personal identities," "historical perspective") and an open coding process was used to add additional descriptive and interpretive phrases to the codebook during examination of each transcript (e.g., " K-12 teaching experience," "educator stress and burnout").

Trustworthiness

Our overall research process emphasized reflexivity and systematic discussion, and attention to how our own positionalities and the politics of our study impacted our decisions (Rossman & Rallis, 2017). Our research team met weekly to discuss analytic tasks completed independently, compare initial findings, and to ensure our analysis would be guided by our conceptual framework but allow for new discoveries. Detailed notes from these meetings served as an audit trail to document research decisions and track our collective interpretation (Rossman & Rallis, 2017). Two graduate student researchers analyzed each syllabus or interview transcript independently, Mattheis served as a peer reviewer and third coder, and any discrepancies were clarified during in-person group meetings. This process allowed us to maintain internal reliability through interrater checks. All syllabi were analyzed prior to conducting interviews, and once preliminary coding was completed for interview transcripts, we engaged in a process of cross-checking and comparison of the results of analysis from both data sets using an axial coding approach. At this stage we looked to compare meaning across and between the syllabi as documented evidence of pedagogical approach with faculty language in interviews as personal expressions of belief and interpretations of practice. We revisited written memos and research team meeting notes throughout the final stages of analysis to connect analyses of these separate data sets to our overall study goals. Our analysis was also informed by our participation in bi-weekly meetings of the GPUTR administrative and evaluation team between January 2017 and May 2018, through which we gained an understanding of how the overall program was structured, how social

justice was discussed, and how university coursework was connected to fieldwork. Field notes from these meetings, along with observation of other program activities, were used to clarify details about program terminology and practices. In keeping with an understanding of the extent to which qualitative findings can be generalized across contexts, we used our findings to offer recommendations for change that are specific to GPUTR. We hope that our case study serves as a useful example for other similar programs and illustrates themes relevant to STEM teacher education more broadly, but acknowledge the limitations of our research.

Findings and Discussion

Based on our analysis of data from syllabi and interviews, we found that the Gran Pueblo Urban Teacher Residency is partially accomplishing its goals to infuse social justice perspectives along with strong applied classroom skills in its teacher preparation coursework, but that implementation varies widely. We also found that social justice theory and content was not adequately integrated into courses focused on STEM instructional methods. Through our interpretive process, we identified two primary explanations for these persistent disconnects: the internal lack of a coherent, shared understanding of social justice rooted in critical perspectives, and the external pressures posed by a teacher credentialing system that reinforces neoliberal notions of quality and efficiency and disproportionately disadvantages teacher candidates from minoritized backgrounds.

Inconsistent Understandings of Social Justice and Disconnected Implementation

Echoing findings from other researchers about teacher educators' perceptions of their own practice (e.g., Sleeter, 2017; Zeichner, 2016), we found that most faculty in GPUTR believe that they are enacting social justice principles in their instruction. The definitions and practices captured in individual interviews, and absent from syllabi, however, revealed areas of inconsistency and contradiction among colleagues and a lack of alignment with definitions of social justice linked to a contextualized historical awareness and a structural critique. To a great extent, social justice theory was not well connected to the presentation of STEM content or instructional methods and was only superficially present in course syllabi.

Faculty definitions of social justice. Many instructors expressed definitions of social justice that emphasized equity rather than equality, and honored diversity. One Special Education faculty member explained:

> For me, social justice is equated with the concept of a true democracy. The idea that there isn't a hierarchy, there isn't a pecking order, there isn't the haves and have nots . . . there really is a system in place or a school system in place that treats everybody with the same level of respect, [but recognizes that] not everybody needs the same thing.

A Curriculum and Instruction faculty member referenced the significance of social hierarchies and emphasized the responsibility of schools to create circumstances in which "an upper class person [and] a working class kid [receive] the same empowering teaching practices . . . and the students are expecting that that is what their school is about rather than that stratification." Although these statements identify stratification negatively, they do not connect existing inequities to specific oppressive forces such as racism and settler colonialism and do not address the active dismantling of hierarchies as part of the work and responsibility of socially just educators (Bondy et al., 2017). Such perspectives can reinforce colorblind interpretations of educational reform (Basile & Lopez, 2015) and support individualized approaches to improving access and achievement—as Fortney et al. (2019) note, traditional notions of equity in science education are often predicated on ahistorical and value-neutral conceptions.

We also found that many faculty expressed beliefs—or at least hope—that the current schooling system could potentially be made socially just with sufficient internal changes, rather than recognizing the need for fundamental shifts in the social systems in which education is embedded. Another Special Education faculty member stated "Really it is about . . . looking at equity and access across so many variables. It's socio-economic, LGBT, religion, etc., and for me it falls into creating very inclusive environments so all students get equal access and equity for sound curriculum and instruction." Although this statement acknowledges specific social identity categories related to marginalization in education, the stated goal of change is to improve the status quo rather than confront the underlying logics of a flawed system that by design situates members of these categories unequally (see Anyon, 2014).

Others emphasized the importance of personal connections and knowing students and their identities and context, such as the Curriculum and Instruction faculty member who stated, "if we are talking about curriculum, if we are talking about education, it's equal access for everybody." She described being inspired by Delpit's (2013) statement that "In order to teach you, I must know you" (p. 162). For this professor,

> . . .being a socially just person means I know who I am working with, I know who I am teaching. I know what their backgrounds are, I know where they

> come from, because then I am able to design my curriculum and what I am teaching to match their needs.

These faculty definitions of social justice show a commitment to student success and a belief that education can be equitably provided in public schools but indicated only limited understandings of broader structural issues or historical contexts that impact the sociopolitical climate in which contemporary urban education takes place. Without additional context, such sincere and well-meaning beliefs can "succumb to deceptive deficit discourses grounded in common stereotypes about families from cultures not positioned as mainstream" (Croom et al., 2019, p. 3). Although a belief in education as a way to provide equitable access and opportunity is one component of social justice teaching, teacher educators must also make deeper connections to the role of schooling in maintaining, rather than dismantling, institutionalized discrimination and oppression.

The varied interpretations offered by interview participants likely reflect differences in background knowledge and exposure to critical epistemologies during their own preparation as educators (Gelfuso et al., 2015). Given the pressures of work at an under-resourced public institution, with a four-four standard teaching load, it is also unlikely that these professors have been provided the time to deeply interrogate their own identities as part of their professional work—but such practices are necessary if teacher educators are tasked with modeling for novice educators how to develop a critical consciousness (Goodwin & Darity, 2019). The overwork and emphasis on production that constrains teacher educators' focus is also related to broader issues of neoliberal marketplace pressures on teacher education as a whole (Zeichner, 2016).

Faculty who expressed deeper understandings of social justice in interviews often referenced their own positionalities and experiences as relevant to their perspectives, similar to findings by Suriel and Atwater (2012) and Kokka (2018) who have explored the relationships between teacher identity and practice. One adjunct faculty member (who had gone through the credential program herself and now taught Educational Foundations courses for credential students) related her own experience as a refugee who arrived in the U.S. as a child to her perspectives as a teacher and learner, and made specific connections to understanding sociopolitical contexts and classroom practice. She described social justice in education as rooted in understanding individual students' challenges and motivations, but then helping them feel empowered to work toward change. She said "we need to raise consciousness, by dialogue . . . you have to cultivate the relationship with students, [build] trust. When we encounter something that is inspiring, that shift enables us to

do something." Her commitment to mutual development of teachers and learners and attention to the importance of generational and historic knowledge as a source of empowerment is reflected in her statement that "we reach social justice when we pass on the torch to others." This praxis-oriented perspective is in keeping with social justice dispositions that focus on collective transformation (Bondy et al., 2017). The program director also expressed a nuanced definition of social justice that indicated deep knowledge:

> In the classroom, for me social justice is about the application of content so that students can address inequalities and ways of marginalization through that lens of content, and solve issues within their own lived communities. Social justice is about challenging the systems that marginalize students or marginalize groups of people and helping folks realize that their voices have merit, have value, have worth.

These perspectives reflect a more nuanced understanding of social justice and illustrate that this expertise and knowledge is present in the GPUTR program. It is important to note, however, that these faculty members—both people of color in a college and university led by white administrators—must navigate institutional politics in order to serve as advocates for their own students. Although pre-service teachers of color may also draw on their own experiences of marginalization to enact social justice-oriented STEM education in K-12 schools (see Marco-Bujosa et al., 2019; Subramaniam, 2013), preparing them for this work should be the responsibility of *all* faculty and staff in their preparation programs.

Disconnects between social justice theory, instructional methods, and STEM content. The extent to which social justice principles were included in course syllabi also reflected the lack of a collective shared understanding of both social justice and of integrated STEM teaching. Table 1 presents the frequency with which we identified examples of course assignments, class activities, or other elements of instructor practice (e.g., notes about terminology use, reading lists) that were aligned with Hackman's (2005) components of social justice education in the syllabi we examined.

A majority of syllabi included a focus on diversity and multiculturalism and presented introductory frameworks for understanding current and historic demographic contexts. Few courses, however, emphasized the need for examining educational practices from societal perspectives or required reflective exercises that were designed to connect personal experience (both inside and outside schools) to disrupting hierarchies and dominant discourses, supporting other research that has found that deep engagement with theory

Table 1. Frequency of Evidence of Components of Social Justice Education as Identified in GPUTR Syllabi.

Five components of social justice education (Hackman, 2005)	Content mastery • Factual information • Historical contextualization • Macro-to-micro content analysis	Critical thinking and the analysis of oppression • Perspective • Positionality • Power • Possibilities • Content	Action and social change • With citizenship comes responsibilities—of participation, voice, and protest • Use action to become a society of, by, and for all of its citizens	Personal reflection • Self as a site for change and for action • Self as a site for examination of impact of internalized oppression on self and communities • Self as a site for understanding how dominant and subordinate identities interact	Awareness of multicultural group dynamics • Dialogue about diversity • Dialogue about identity
All syllabi ($N = 39$)	21/39 (54%)	12/39 (31%)	6/39 (15%)	9/39 (23%)	27/39 (69%)
Math and Science instructional methods syllabi ($N = 6$)	3/6 (50%)	1/6 (17%)	0/6 (0%)	0/6 (0%)	2/6 (33%)

Note. The organization of this table is borrowed from Welton et al. (2015, p. 560).

and praxis is often confined to educational foundations courses or seen as peripheral (Boda, 2019; Butin, 2007). In addition to a diluted focus on social justice, we found that the concept of "integrated STEM" was also undertheorized in the program. Because urban teacher residency models work from a theory of action that suggests educational systems can be changed from within by preparing teachers specifically for the strengths and challenges present in local communities (Hammerness et al., 2016), finding ways to blend theory and practice is crucial.

The dichotomous presentation of STEM-specific content and social justice theory was mirrored by a general separation of core teaching tasks and culturally responsive pedagogical approaches. Some course content and faculty perspectives represented missed opportunities to make important connections between the visible everyday practices common in K-12 classrooms and the hidden curriculum that often thwarts efforts to use these practices to disrupt injustice. For example, an Assessment Strategies course is clearly aligned with High Leverage Practice 17, "interpreting the results of student work, including routine assignments, quizzes, tests, projects, and standardized assessments." The syllabus vaguely listed "history of education" as a theme for 1 week of class but did not clarify how addressing bias against historically "othered" and underserved populations is essential in accurately understanding an individual student's academic strengths and areas of need. Without explicit identification of how assessment strategies—and the (mis) use of assessment data—have been used as tools to maintain hierarchies and construct some groups of students as "underachieving," GPUTR residents are more likely to enact these same practices themselves. Courses that introduce assessment practices critically, leading pre-service teachers through an examination of the racist histories of intelligence testing and use of normal distribution curves to categorize student achievement, can also challenge assumptions of objectivity in Western-oriented STEM instruction.

Moving away from an overreliance on past practices can open space for teachers to imagine new justice-oriented pedagogies, including viewing students as transformative intellectuals themselves (Morales-Doyle, 2017). Such a shift requires contextualizing taken for granted "best practices" (including the High Leverage Practices); most coursework and readings included in syllabi focused on classroom-level behaviors and practices that emphasized teacher-student interactions but did not also reflect upon the structures that produce the spaces where these interactions occur. Understanding histories of oppression is necessary to identify how certain epistemological stances have come to dominate schooling in the U.S. and is part of understanding social justice education (Hackman, 2005). Deconstructing local contexts and understanding how to position themselves "within and against" these contexts are

essential parts of enacting social justice in science teaching (Marco-Bujosa et al., 2020).

In another course focused on "Characteristics and Needs of Urban Secondary Schools, Families, and Students," ideals of community empowerment and respect for families were included several times, but there was little evidence that students would be encouraged to interrogate who or what constitutes "community" or "family" in different contexts or for different students. Unsurprisingly, courses titled "Teaching for Cross-Cultural and Global Awareness" and "Foundations of Schooling in Urban Communities" were more likely to contain specific assignments and readings that were aligned with Hackman's (2005) components of social justice education. For example, in one course students were required to write structured reflections that connected their lived experiences to course readings, while group activities were designed to give students a sense of how different identities—and oppressions—overlap. Other assignments directed students to move beyond the classroom and directly engage with community organizations to support justice-oriented problem solving with other stakeholders, or provided structured ways for residents to identify the expertise present in families and communities, using frameworks like Funds of Knowledge (González et al., 2006) and Community Cultural Wealth (Yosso, 2005). Syllabi such as these serve as important models and demonstrate existing expertise relative to social justice in the Gran Pueblo State University education faculty that can be applied to classes traditionally more focused on discipline-specific and general instructional methods.

Overall, however, our examination of syllabi indicated that STEM concepts were rarely discussed in instructional methods or foundations courses, and STEM-specific courses did not address social justice theory and practice. This lack of integration was also evident in first person explanations; in our interviews with GPUTR faculty, we found that the only person who explicitly connected STEM content instruction and social justice was the program director, who talked about working with his teacher educator colleagues to "help them understand [how to use] that content—using chemistry, using biology, using mathematics, using physics to address the needs of these communities that these students come from." He emphasized the importance of self-reflection in helping new teachers see how "they themselves might be complicit in marginalizing these specific communities" and the role of teacher educators to help residents find "new ways of constructing their own experiences in a way that is going to help them potentially reconstruct their experiences in a way that will help others succeed." In order to prepare new teachers for social justice practice, their instructors must be able to engage

them in activities that develop critical knowledge at both the personal and contextual levels (Goodwin & Darity, 2019).

Hegemonic Credentialing Procedures Contradict Goals of Social Justice

State teacher credentialing procedures emerged as a specific concern that hinders enactment of social justice in GPUTR. As instructors, Mattheis and Nava experienced the constraining influence of these expectations directly—administrative messaging to faculty emphasized the inclusion of California Teacher Performance Expectations on syllabi and student pass rates on preparation exams, but did not focus on the integration of social justice concepts in methods courses. Aspiring teachers in California are among the most heavily tested in the United States. In order to receive their initial credential, they must pass a range of standardized assessments including the CBEST, CSET, and RICA, and submit an edTPA portfolio. Within 5 years of full-time teaching with a preliminary credential, they must apply for a "clear" credential from the state. Educational research has documented the racist histories of standardized assessments (see e.g., Ladson-Billings, 2006) and pointed out their specious use as predictors of future professional success. Although supported by calls for rigor and quality (words that are also used to promote urban teacher residencies), the implementation of these credentialing systems creates the impossible demand on teacher preparation programs to promote system-changing dispositions that require critical analysis of high stakes testing, while also preparing candidates from backgrounds least well-served by the system to pass these tests. Furthermore, these tests are typically administered by for-profit companies and scored in a manner that encourages speed over depth of analysis. These same companies profit from the hyper-focus on standards-based instruction at the K-12 level; as Rodriguez (2015) warned, "unless we take prompt and more direct transformative action, the only ones to benefit from the NGSS will be publishing companies—as they scurry to provide the latest 'teacher friendly guides' and 'true assessments'" (p. 1032).

For programs like GPUTR that seek to increase the diversity of the existing teaching corps by bringing new teachers of color into the field, these credentialing requirements add obstacles. Despite their supposed "race neutral" approach, the strict requirements of assessments such as the edTPA are even more challenging for teacher candidates completing their certification in high need schools (Tuck & Gorlewski, 2016). One of the part-time instructors we interviewed had taught in local public schools on an emergency credential but ultimately decided not to complete her credential because of the

time and cost associated with doing so. She had a great deal of successful instructional experience working with students ranging from early childhood to college and had worked with several cohorts of GPUTR residents and "traditional" credential students. She emphasized the stress imposed by the testing process as a factor in preventing promising teachers from entering the classroom and that she did not see much evidence that passing these assessments indicated a greater degree of preparedness.

Critiques of standardized assessments in K-12 schools as encouraging "teaching to the test" apply to teacher preparation programs as well. In California, teacher educators are rightfully concerned with preparing students to pass the edTPA, as it is required to teach in the state's public schools. The way that this assessment has influenced faculty decisions about their instruction and what to prioritize in terms of student knowledge mirrors K-12 California teachers' concerns about how high stakes tests based on the CCSS and NGSS can lead to narrowed curricula. A long-time Special Education faculty member who also had a great deal of administrative experience described how increased credentialing requirements made it difficult for universities to create blended programs and limited opportunities for collaboration, especially between pre-service "mainstream" teachers and those pursuing special education credentials. She believes that the creation of these types of professional silos early in teachers' careers negatively impacts their future students. In GPUTR, these divides make it even more challenging for the program to meet its goals of preparing both content-area and special educators for integrated STEM teaching.

The pressure imposed by these external credentialing pressures creates contradictions for programs and teacher educators who aim to promote social justice. For example, the instructor responsible for introducing the edTPA portfolio process to the GPUTR residents demonstrated the least well-developed understanding of social justice among the faculty with whom we spoke. He said "I define social justice by something that is done in the classroom. It is the understanding of the world around [us]." This oversimplified perspective, which effectively equates social justice with an awareness of "current events," encourages a separation of teaching practice from "real-world" experiences, rather than developing explicit connections between the multiple communities that shape and influence teachers' and students' lives. Although this instructor expressed dissatisfaction with the credentialing process, his critique centered on it as "tedious" as he believed taking tests was unrelated to the daily work of classroom teaching. His overall perspective did not reflect a structural understanding of the disproportional barriers faced by candidates from marginalized communities, or draw connections between how teacher candidates are assessed and how they are prepared to assess

students in their own classrooms. Another white professor offered a similarly unnuanced critique of the credentialing process: "I think it fits for California. I don't have a positive or negative feeling about the TPA. It seems to be fine [and] there are some benefits. You know, we wouldn't want [just] anybody to be a teacher." He described the overall approach as "inconvenient" but credited the state with "decent intentions." Both of these professors offered lukewarm criticism of credentialing as inefficient, but did not perceive it as unjust. Without their own developed critique of these systems, teacher educators reinforce these gatekeeping processes.

Overall, we find that the system of credentialing in California is counter to the models of social justice that guided this study, and creates barriers to entry for teachers who share backgrounds and identities with many students who attend local schools, who are primarily people of color living in lower income communities. In shortage areas such as STEM and special education, the negative impacts of these requirements are intensified. As the GPUTR program director noted, ". . .the credentialing process in California does not allow for the students who could have the most potential to get into places where they can have the most influence."

Implications for Practice

Given our awareness of the GPUTR program's existing resources, and a belief in the commitment of key faculty to developing its social justice focus, we see many opportunities for growth. Our first recommendation is for the program to identify a shared understanding of social justice to be implemented across the entire Gran Pueblo State University College of Education, not only GPUTR. Although different definitions of social justice exist, it is important that all stakeholders involved in the preparation of teachers in residency programs develop some shared understandings of what good teaching entails (Roegman et al., 2020). Because residents often take courses with other credential students, and instructors teach students in multiple programs, this broader approach will benefit all pre-service teachers. Research documenting how other teacher education programs have been reimagined and redesigned in ways that are cyclical, community-engaged, and reflective in nature offer useful conceptual tools for this process. Anagnostopoulos et al. (2018) propose a model that begins with conceptual redesign rather than starting with course sequencing or specific content. By beginning with the development of a shared understanding of social justice (Bhatnagar et al., 2016, offer an example of one college's approach to such a process), GPUTR will be prepared to then find concrete ways to embed social justice theory with STEM content in coursework, and to connect coursework to fieldwork.

Social justice focused teacher education programs must prepare teachers with an awareness of intersectionality (Delgado Bernal, 2002) and comfort with the "in between" (Sugimoto & Carter, 2016). In order to do so, teacher educators must themselves grapple with such in-betweenness and be able to articulate their own social justice understandings to one another and to their students. To this end, we recommend that faculty include statements that clarify their own positionality and philosophy of urban teaching and learning in syllabi and ask them to reflect on how the shared definition of social justice in education is embodied in their pedagogy as part of program review processes. We then encourage GPUTR to specifically consider how existing STEM content learning goals align with or contradict social justice teaching objectives, and address areas of disconnect. We also recognize that this is a methodologically, philosophically, and politically challenging task that requires more than a combination of existing approaches, but a fundamental rethinking of who and what STEM education is for. We heed Vakil and Ayers' (2019) statement that:

> Centering students' subject experiences, including their racialized and politicized identities, issues a challenge to STEM educational designers and educators to think beyond revised learning objectives or the inclusion of culturally relevant content in new curricula. This is too often a matter of using culturally relevant moments as a 'hook' to interest students without deeply reframing the underlying values, practices and purposes of STEM disciplines. (p. 456)

Blending theory with practice is a key goal of residency models (Solomon, 2009), and GPUTR faculty can contribute to important work in this area of teacher education by helping residents explicitly link their understanding of STEM, along with specific disciplinary and process skills, to their own experiences as learners and teachers and to social justice. Currently, residents learn a co-teaching model that connects special education and STEM content instruction, which is an excellent beginning—we recommend expanding such efforts to broaden the focus on social justice across the curriculum, and to deepen the way this theory is introduced. In this way, GPUTR can help residents develop context-specific knowledge that is not too narrow to transfer across settings (Williamson et al., 2016). New teachers must be supported "to maintain a vision of the possible" (Hammerness & Craig, 2016, p. 1253) and provided with opportunities to challenge their own beliefs and build new practical skills. The cohorted nature of GPUTR and its combination of a credential and a Master's degree could be used to structure residents' involvement in 2-year projects that would connect pre-service STEM educators and

university faculty with community activist led work. Such efforts are crucial in moving students and educators "from cynicism and despair to hope and possibility" (Hackman, 2005, p. 106) once they have truly engaged with an analysis of oppression. This approach may also avoid the challenges that can arise if narrowly defined core practices are used as justification for narrowing teacher preparation experiences (Neel, 2017), and provide support for a collective resistance to external credentialing procedures.

Finally, we support a disruption of the reliance on standardized assessments for teacher credentialing in California. Reform at the state level is particularly necessary for precariously-funded public institutions that serve students from "high need" populations. Teacher educators working within these universities have a responsibility to collectively speak out against the discriminatory impacts of these testing requirements, and to push back against the narrowing of their own curricula in accordance with these criteria.

Conclusion

This study examined how social justice was operationalized in the university preparation components of a STEM Urban Teacher Residency program in California. By focusing on the university's role in preparing residents, rather than the new teachers' experiences in their site placements, we highlighted the need for shared understandings across program delivery to aid in the development of novice educators. Although faculty overwhelmingly reported strong commitments to multiculturalism and diversity, we found limited evidence of deeper understandings of social justice, and that inconsistent presentation of social justice content across GPUTR coursework limits the program's present ability to prepare educators as advocates who confront oppression and work to dismantle systemic discrimination. Additionally, a heavy reliance on standardized assessments as part of teacher credentialing in the state of California creates an intense gatekeeping influence that constrains universities' capacities to embrace social justice goals. By combining existing expertise across STEM content and social justice theory, and connecting to community-based endeavors, however, GPUTR and other residency programs have the opportunity to make powerful change for pre-service educators and the K-12 students these teachers will serve. In their examination of a similar math and science focused urban teacher residency program, Garza and Werner (2014) noted: "crucial conversations among all stakeholders are needed for the purpose of generating ideas to connect theory and research to the situational context of the residency" (p. 212). By developing models that integrate rigorous STEM content knowledge with locally and historically

contextualized social critique and tools for change, such programs have the potential to support teachers in enacting justice-oriented practice in communities.

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References

Anagnostopoulos, D., Levine, T., Roselle, R., & Lombardi, A. (2018). Learning to redesign teacher education: A conceptual framework to support program change. *Teaching Education*, *29*(1), 61–80.

Anyon, J. (1997). *Ghetto Schooling: A Political Economy of Urban Educational Reform*. Teachers College Press.

Anyon, J. (2014). *Radical Possibilities: Public Policy, Urban Education, and a New Social Movement* (2nd ed.). Routledge.

Atwater, M. M. (2011). Significant science education research on multicultural science education, equity, and social justice. *Journal of Research in Science Teaching*, *49*(1), 1–5.

Bang, M., & Medin, D. (2010). Cultural processes in science education: Supporting the navigation of multiple epistemologies. *Science Education*, *94*(6), 1008–1026.

Barton, A. C., Ermer, J. L, Burkett, T. A., & Osborne, A. (2003). *Teaching Science for Social Justice*. Teachers College Press.

Basile, V., & Lopez, E. (2015). And still I see no changes: enduring views of students of color in science and mathematics education policy reports. *Science Education*, *99*(3), 519–548.

Bhatnagar, R., Kim, J., Many, J. E., Barker, K., Ball, M., & Tanguay, C. (2016). Are we making our social justice framework salient? Candidates' perceptions of urban teacher education program effectiveness. *National Teacher Education Journal*, *9*(2), 27–39.

Bhattacharya, K. (2017). *Fundamentals of qualitative research*. Routledge.

Boda, P. A. (2019). Conceptualizing the margins in science education: The limits of multicultural analyses. *Cultural Studies of Science Education*, *14*(2), 493–514.

Bondy, E., Beck, B., Curcio, R., & Schroeder, S. (2017). Dispositions for critical social justice teaching and learning. *Journal of Critical Thought and Praxis*, *6*(3), 1–16.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, *9*(2), 27–40.

Breiner, J. M., Johnson, C. C., Harness, S. S., & Koehler, C. M. (2012). What is STEM? A discussion about conceptions of STEM in education and partnerships. *School Science and Mathematics*, *112*(1), 3–11.

Butin, D. W. (2007). Dark times indeed: NCATE, social justice, and the marginalization of multicultural foundations. *Journal of Educational Controversy*, *2*(2), 1–17.

Butler, M. B., Atwater, M. M., & Russell, M. L. (2013). Introduction: Culture, equity, and social justice for science teacher educators. In M. M. Atwater, M. Russell, & M. Butler (Eds.), *Multicultural Science Education* (pp. 1–7). Springer.

Carr, P. (2008). Educating for democracy: With or without social justice. *Teacher Education Quarterly*, *35*(4), 117–136.

Convertino, C. (2016). Beyond ethnic tidbits: Toward a critical and dialogical model in multicultural social justice teacher preparation. *International Journal of Multicultural Education*, *18*(2), 125–142.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE.

Croom, M., Flores, T. T., & Kamberelis, G. (2019). Literacies of interrogation and vulnerability: Reimagining preservice teacher preparation designed to promote social justice in education. In R. Papa (Ed.) *Handbook on Promoting Social Justice in Education* (pp. 4–32). Springer Nature.

Dedoose Version 8.0.35, web application for managing, analyzing, and presenting qualitative and mixed method research data (2018). Los Angeles, CA: SocioCultural Research Consultants, LLC. www.dedoose.com.

Delgado Bernal, D. (2002). Critical race theory, Latino critical theory, and critical race-gendered epistemologies: Recognizing students of color as holders and creators of knowledge. *Qualitative Inquiry*, *8*(1), 105–126.

Delpit, L. (2013). *Other People's Children*. The New Press.

Dimick, A. S. (2012). Student empowerment in an environmental science classroom: Toward a framework for social justice science education. *Science Education*, *96*(6), 990–1012.

Fortney, B. S., Morrison, D., Rodriguez, A. J., & Upadhyay, B. (2019). Equity in science teacher education: Toward an expanded definition. *Cultural Studies of Science Education*, *14*(2), 259–263.

Garii, B., & Rule, A. C. (2009). Integrating social justice with mathematics and science: An analysis of student teacher lessons. *Teaching and Teacher Education*, *25*(3), 490–499.

Garza, R., & Werner, P. (2014). Preparing mathematics and science teachers through a residency program: Perceptions and reflections. *Teaching Education*, *25*(2), 202–216.

Gasman, M., Castro Samayoa, A., & Ginsberg, A. (2017). Minority serving institutions: Incubators for teachers of color. *The Teacher Educator*, *52*(2), 84–98.

Gatti, L. (2019). Learning to teach in an urban teacher residency. *Urban Education*, *54*(9), 1233–1261.

Gelfuso, A., Parker, A., & Dennis, D. V. (2015). Turning teacher education upside down: Enacting the inversion of teacher preparation through the symbiotic relationship of theory and practice. *The Professional Educator*, *39*(2), 1–16.

González, N., Moll, L. C., & Amanti, C. (Eds.). (2006). *Funds of Knowledge: Theorizing Practices in Households, Communities, and Classrooms*. Routledge.

Goodwin, A. L., & Darity, K. (2019). Social justice teacher educators: What kind of knowing is needed? *Journal of Education for Teaching*, *45*(1), 63–81.

Goodwin, A. L., Roegman, R., & Reagan, E. M. (2016). Is experience the best teacher? Extensive clinical practice and mentor teachers' perspectives on effective teaching. *Urban Education*, *51*(10), 1198–1225.

Guha, R., Hyler, M. E., & Darling-Hammond, L. (2017a). The power and potential of teacher residences. *Phi Delta Kappan*, *98*(8), 31–37.

Guha, R., Hyler, M. E., & Darling-Hammond, L. (2017b). The teacher residency: A practical path to recruitment and retention. *American Educator*, *41*(1), 31–44.

Hackman, H. W. (2005). Five essential components for social justice education. *Equity & Excellence in Education*, *38*(2), 103–109.

Hammerness, K., & Craig, E. (2016). "Context-specific" teacher preparation for New York City: An exploration of the content of context in Bard College's urban teacher residency program. *Urban Education*, *51*(10), 1226–1258.

Hammerness, K., Williamson, P., & Kosnick, C. (2016). Introduction to the special issue on urban teacher residencies: The trouble with "generic" teacher education. *Urban Education*, *51*(10), 1155–1169.

Hennissen, P., Beckers, H., & Moerkerke, G. (2017). Linking practice to theory in teacher education: A growth in cognitive structures. *Teaching and Teacher Education*, *63*, 314–325.

Herro, D., & Quigley, C. (2017). Exploring teachers' perceptions of STEAM teaching through professional development: Implications for teacher educators. *Professional Development in Education*, *43*(3), 416–438.

Hsieh, H., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, *15*(9), 1277–1288.

Hytten, K. (2015). Ethics in teaching for democracy and social justice. *Democracy & Education*, *23*(2), 1–10.

Joseph, N. M., Hailu, M. F., & Matthews, J. S. (2019). Normalizing Black girls' humanity in mathematics classrooms. *Harvard Educational Review*, *89*(1), 132–155.

Kelley, T. R., & Knowles, G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education*, *3*(1), 1–11.

Klein, E. J., Taylor, M., Onore, C., Strom, K., & Abrams, L. (2013). Finding a third space in teacher education; Creating an urban teacher residency. *Teaching Education*, *24*(1), 27–57.

Kokka, K. (2018). Radical STEM teacher activism: Collaborative organizing to sustain social justice pedagogy in STEM fields. *Educational Foundations*, *31*(1-2), 86–113.

Kozan, S., Blustein, D. L., Barnett, M., Wong, C., Connors-Kellgren, A., Haley, J., Patchen, A., Olle, C., Diemer, M. A., Floyd, A., Tan, R. P. B., & Wan, D. (2017). Awakening, efficacy, and action: A qualitative inquiry of a social justice-infused, science education program. *Analyses of Social Issues and Public Policy*, *17*(1), 205–234.

Kumashiro, K. (2018). Foreword to special issue: Why and how STEM education matters in social justice movements. *Educational Foundations*, *31*(1-2), 5–6.

Ladson-Billings, G. (2006). From the achievement gap to the education debt: Understanding achievement in U.S. schools. *Educational Researcher*, *35*(7), 3–12.

Laws & Guidance, Elementary & Secondary Education, Sec. 2312, Definitions (2004). https://www2.ed.gov/policy/elsec/leg/esea02/pg28.html

Lipman, P. (2011). *The New Political Economy of Urban Education: Neoliberalism, Race, and the Right to the City*. Routledge.

Luft, J. (2012). Subject-specific induction programs: Lessons from science. *National Society for the Study of Education*, *111*(2), 417–442.

Madkins, T. C., McKinney de, & Royston, M. (2019). Illuminating political clarity in culturally relevant science instruction. *Science Teacher Education*, *103*(6), 1319–1346.

Marco-Bujosa, L. M., McNeill, K. L., & Friedman, A. A. (2019). Becoming an urban science teacher: How beginning teachers negotiate contradictory school contexts. *Journal of Research in Science Teaching*, *57*(1), 3–32.

Maulucci, M. S. R. (2012). Social justice research in science education: Methodologies, positioning, and implications for future research. In B. Fraser, K. Tobin, & C. McRobbie (Eds.), *Second International Handbook of Science Education* (pp. 583–594). SpringerLink.

Matias, C. E. (2016). "Why do you make me hate myself?": Re-teaching whiteness, abuse, and love in urban teacher education. *Teaching Education*, *27*(2), 194–211.

Maxwell, J. A. (2013). *Qualitative Research Design: An Interactive Approach* (3rd ed.). SAGE.

McDonald, M. (2005). The integration of social justice in teacher education. *Journal of Teacher Education*, *56*(5), 418–435.

McDonald, M., Kazemi, E., & Kavanagh, S. S. (2013). Core practices and pedagogies of teacher education: A call for a common language and collective activity. *Journal of Teacher Education*, *64*(5), 378–386.

McGee, E. O. (2016). Devalued Black and Latino racial identities: A by-product of STEM college culture? *American Educational Research Journal*, *53*(6), 1626–2662.

Merriam, S. (2009). *Qualitative Research: A Guide to Design and Implementation* (3rd ed.). Jossey-Bass.

Milner, H. R. (2012). But what is urban education? *Urban Education*, *47*(3), 556–561.

Morales-Doyle, D. (2017). Justice-centered science pedagogy: A catalyst for academic achievement and social transformation. *Science Education*, *101*(6), 1034–1060.

Neel, M. (2017). Making sense and facing tensions: An investigation of core practice complexities. *Teaching Education*, *28*(3), 257–278.

Nichols, S. L., & Brewington, S. (2020). Preservice teachers' beliefs about high-stakes testing and their working environments. *Education Policy Analysis Archives*, *28*(30), 1–35.

Papay, J. P., West, M. R., Fullerton, J. B., & Kane, T. J. (2011). *Does Practice-Based Teacher Preparation Increase Student Achievement? Early Evidence from The Boston Teacher Residency* (No. w17646). National Bureau of Economic Research.

Patton, M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. *Health Services Research*, *34*(2), 1189.

Rasmussen, J., & Rash-Christensen, A. (2015). How to improve the relationship between theory and practice in teacher education. *Education Research, Policy & Practice*, *14*(3), 213–230.

Reagan, E. M., Chen, C., & Vernikoff, L. (2016). "Teachers are works in progress": A mixed-methods study of teaching residents' beliefs and articulations of teaching for social justice. *Teaching and Teacher Education*, *59*, 213–227.

Ridgeway, M. L. (2019). Against the grain: science education researchers and social justice agendas. *Cultural Studies of Science Education*, *14*(2), 283–292.

Rodriguez, A. J. (2015). What about a dimension of engagement, equity, and diversity practices? A critique of the Next Generation Science Standards. *Journal of Research in Science Teaching*, *52*(7), 1031–1051.

Rodriguez, A. J., & Morrison, D. (2019). Expanding and enacting transformative meanings of equity, diversity and social justice in science education. *Cultural Studies of Science Education*, *14*(2), 265–281.

Roegman, R., Reagan, E., Goodwin, A. L., Lee, C. C., & Vernikoff, L. (2020). Reimagining social justice-oriented teacher preparation in current sociopolitical contexts. *International Journal of Qualitative Studies in Education*. Advance online publication. https://doi.org/10.1080/09518398.2020.1735557

Rossman, G. B., & Rallis, S. F. (2017). *An Introduction to Qualitative Research* (4th ed.). SAGE.

Saldaña, J. (2013). *The Coding Manual for Qualitative Researchers*. SAGE.

Schenkel, K., Barton, A. C, Tan, E., Restrepo Nazar, C., & Flores, M. D. G. (2019). Framing equity through a closer examination of critical science agency. *Cultural Studies of Science Education*, *14*(2), 309–325.

Sleeter, C. E. (2017). Critical race theory and the Whiteness of teacher education. *Urban Education*, *52*(2), 155–169.

Solomon, J. (2009). The Boston Teacher Residency: District-based teacher education. *Journal of Teacher Education*, *60*(5), 478–488.

Sondel, B., Koch, J. G., Carrier, S., & Walkowiak, T. A. (2017). Toward a theory of teacher education for justice-oriented STEM. *Catalyst: A Social Justice Forum*, *7*(1), 38–52.

Subramaniam, K. (2013). Minority preservice teachers' conceptions of teaching science: Sources of science teaching strategies. *Research in Science Education*, *43*(2), 687–709.

Sugimoto, A., & Carter, K. (2016). Novice teachers' narratives of seeing the spectrum from a lens of social (in)justice: Preservice' teachers' well-remembered events of gender-based pedagogical and policing practices in elementary school settings. *Curriculum and Instruction Faculty Publications and Presentations*, *32*, 1–7.

Suriel, R. L., & Atwater, M. M. (2012). From the contribution to the action approach: White teachers' experiences influencing the development of multicultural science curricula. *Journal of Research in Science Teaching*, *49*(10), 1271–1295.

Tindle, K., Freund, M., Belknap, B., Green, C., & Shotel, J. (2011). The urban teacher residency program: A recursive process to develop professional dispositions, knowledge, and skills of candidates to teach diverse students. *Educational Considerations*, *38*(2), 28–35.

Tuck, E., & Gorlewski, J. (2016). Racist ordering, settler colonialism, and edTPA: A participatory policy analysis. *Educational Policy*, *30*(1), 197–217.

Vakil, S., & Ayers, R. (2019). The racial politics of STEM education in the USA: Interrogations and explorations. *Race, Ethnicity, and Education*, *22*(4), 449–458.

Vossoughi, S., & Vakil, S. (2018). Toward what ends? A critical analysis of militarism, equity, and STEM education. In A. I. Ali & T. L. Buenavista (Eds.), *Education at War* (pp. 117–140). Fordham University Press.

Welsh, R. O., & Swain, W. A. (2020). (Re)defining urban education: A conceptual review and empirical exploration of the definition of urban education. *Educational Researcher*, *49*(2), 90–100.

Welton, A. D., Harris, T. O., La Londe, P. G., & Moyer, R. T. (2015). Social justice education in a diverse classroom: Examining high school discussions about race, power, and privilege. *Equity & Excellence in Education*, *48*(4), 549–570.

Williamson, P., Apedoe, X., & Thomas, C. (2016). Context as content in urban teacher education: Learning to teach in and for San Francisco. *Urban Education*, *51*(10), 1170–1197.

Yin, R. K. (2013). *Case Study Research: Design and Methods* (5th ed.) SAGE.

Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race, Ethnicity and Education*, *8*(1), 69–91.

Zeichner, K. (2016). Advancing social justice and democracy in teacher education: Teacher preparation 1.0, 2.0, and 3.0. *Kappa Delta Pi Record*, *52*(4), 150–155.

Zembylas, M. (2005). Science education: For citizenship and/or for social justice? *Journal of Curriculum Studies*, *37*(6), 709–722.

Zollman, A. (2012). Learning of STEM literacy: STEM literacy for learning. *School Science and Mathematics*, *112*(1), 12–19.

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