Experience Bridging

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U.S. schools have become much more intensely segregated over the last four decades. A large portion of schools designated as in need of improvement are highly segregated, highly minoritized schools, which have mostly or entirely white faculty—called *mismatch schools* here. Teachers use imperfect mechanisms to form impressions of their students, which can lead to systematically biased expectations and resultant less effective instructional choices. If teachers do not plan to look, students may have untapped "funds of knowledge" that aren't used to build new understandings (Gonzalez, et al., 2005). Every student brings experiences to school that have the potential to shape new learning. Over more than a decade working in mismatch schools, I noticed a large number of teachers at some schools may underuse these experiences, which leads those students to learn less than they otherwise might.

In this dissertation, a set of teachers in the midst of a curricular reform teach newly created integrated STEM units in a California district. Using improvement science, partners worked to increase experience bridging—the use of students' life experiences for learning. Teachers used a newly introduced tool, student experience inventories, to gain knowledge of students' experiences pertinent to STEM content. I find that teachers varied in using the tool and combined it with other approaches to learn about students' experiences with content. I also find that teachers describe a number of promising learning mechanisms at play using these experiences. These include drawing on familiarity, building knowledge, establishing rapport, and changing their examples. Two outlying mechanisms that are related to learning include creating class dynamics where students

can use these experiences and a teacher's belief in students' capabilities. Teachers also describe using the prompts to gain benefits in engagement and to reduce student anxiety about being wrong, which may have a more complicated connection to learning more. One implication of the study is that student experience inventories, revised in part based on the insights of the teachers who used them, will be part of integrated STEM units disseminated nationally.

Table of Contents

List of Tables

List of Figures

Dedication and Acknowledgments

I am profoundly grateful to my wife Sarah, a constant source of inspiration. Your myriad accomplishments are always in the service of others, and you make contributing to human knowledge fun every day. I love writing, talking, and thinking about education, medicine, research, art, politics, faith, love and anything else with you. I also wish to celebrate the contributions of our children, Preston and Sidney. Watching you both learn and teach me has given me boundless energy for writing and thinking about how we all learn. I am driven by your joy and insight. Preston, your questions motivate me to know more and I model my professional disposition after your capacity to be calm, thoughtful and just. Sidney, your inventiveness and storytelling helps me think of how to communicate, and I am moved by your enthusiasm as you have literally watched me work throughout this pandemic. Also—thanks for sharing your naming skills (Pleasa Hills!).

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I also owe a debt of gratitude to every mentor educator, colleague and student with whom I have been lucky enough to collaborate. My advisor encouraged some very personal reflection in writing this document, and I have enjoyed revisiting the influence of, among others, Martha, Helen, Robert, Erica, Rubye, Juan, Trinetta, Robel, Mussye, Bemnet, Flor, Mamadou, Rosemary, Julia,

1.0 Introduction

In the United States, most schools organize levels of education into grades of students of approximately the same age. Students bring a similar *amount* of experience with them, even if the types of experiences differ. How teachers use students' experiences is not merely a matter of individual decision-making. Instead, it is determined socially. Schools elevate some experiences as germane to learning, while schools ignore or marginalize other experiences (Dou & Cian, 2022; Emdin, 2021) Teachers often learn about the experiences of students using methods of their own creation. What teachers learn about the lives of students, and what they do with what they learn, may make a difference in how much a student learns.

In this dissertation-in-practice, I encourage the use of a practice I refer to as *experience bridging*—a systematic method of using students' experiences to make new meaning aligned to academic standards (Buillion & Gomez, 2001; Gonzalez & Moll, 2005; Ladson-Billings, 1995; Lee & Buxton, 2010). As a technical assistance provider working primarily in school districts and state departments of education, I worked to find a practical method for encouraging experience bridging. I created a tool to help generate the kind of information connecting students' experiences and academic content that I thought teachers might use. I am curious what meaning teachers make about this practice. I use improvement science to explore the introduction of this practical tool in one school district. By learning about what meaning teachers made from this practice, I was able to strengthen implementation of a broader curriculum reform initiative. I also use the reflections from a purposive sample of thoughtful teachers to consider my role in the larger educational system in pursuit of a more just educational system.

1.1 Broader Problem Area

My work with schools usually includes a survey of teachers in the opening months. The survey includes a number of items designed to elicit perceptions of the organizational conditions of the school and district. Some of the questions intended for teachers ask about curriculum and instruction. In school after school, I noticed a pattern in survey responses that puzzled me. Teachers would exhibit high agreement that what they teach is important to students' futures and aligned to state academic standards. Teachers would show a much lower level of agreement with the idea that what they teach is relevant to the lives of students. Taken together, this suggests that some portion of the staff did not see the state academic standards as relevant to the lives of students. This incongruity has multiple possible explanations. A portion of teachers may critique the standards, while others may have ideas about the inapplicability of school to the lives of the students they teach. As I continued my work in schools, I began to look for evidence of how exactly teachers got to know about the lives of students.

What I noticed was that teachers were often on their own—some made up surveys, some relied on informal conversations, and some kept a strong separation between personal and school information. I seldom witnessed teachers using district, school, or curriculum tools to collect information. If such tools were in the curriculum, they were in the form of open-ended prompts (e.g., write a memoir). There was not much in the way of direction for what teachers should look for or what they should do with it.

The schools in which I work are not representative of all schools in the United States. They are a subset of American schools, in nearly every case designated by their state as in need of improvement. I have worked with Southern schools and Western ones, those in the Great Plains and those in New England. The demographics of the students vary by the particularities of the

migration pattern of the immediate area of the school—more Latino in Nevada and Nebraska, more Asian in New England. Yet a particular American pattern has been present everywhere—the student body is almost entirely either Black or Latino students, and the majority of the school's educators are white.

Nearly eight in 10 American teachers are white, while fewer than five in 10 American students are (U.S. Department of Education, 2019a; U.S. Department of Education, 2019b). Many of the schools with which my organization works are highly segregated, highly minoritized schools, which have mostly or entirely white faculty—what I call *mismatch schools*. As I explain in greater detail in Chapter 3, I use the term *mismatch schools* to refer to any *school* that has a predominantly white staff and a predominantly minoritized population of students.

In the mismatch schools I have worked in, a substantial minority of teachers view the standards they teach as irrelevant to the students' lives. I almost always survey teachers near the beginning of a partnership. In school after school, teachers agreed with statements about whether what they taught was aligned to state standards. Fewer teachers agreed that what they teach is relevant to the lives of students. Students often see it differently, seeing the content as relevant and important to their futures. In focus groups and interviews, students frequently told me about which teachers knew details about their lives. If teachers do not plan to look, students may have untapped "funds of knowledge" that are not used to build new understandings (Gonzalez, et al., 2005). Every student brings experiences to school that have the potential to shape new learning. A large number of teachers at some schools may underuse these experiences, which leads those students to learn less than they otherwise might.

Five million or so students are concentrated in what states designate as the lowest performing, often segregated, schools (Hurlburt, Le Floch, Therriault & Cole, 2011). Absence and

deficit define these low performing schools. While the particular formulas vary, each state identifies these schools through measures of absence and deficit: The lack of attendance, low participation in testing, too few seniors graduating, or not enough correct answers on standardized academic assessments. Students attending such schools could have their experiences valued and even incorporated into instruction (Gonzalez & Moll, 2002; Moll, 1992). Personal and deep knowledge of students may help teachers build on students' existing competencies. Teachers may also foster students' intrinsic motivation (Jones, Jones & Vermette, 2013).

Schools that both design around personalization and observe increases in student outcomes are characterized by student agency, flexibility in the learning environment, the integration of social, emotional and academic development, and a commitment to increasing teachers' knowledge of their students (Basham, et al., 2016; Bill & Melinda Gates Foundation, 2014; Connor, et al., 2017; Loyd, et al., 2017; Pane, et al., 2015). Further, these schools find ways to communicate with students about their progress in meaningful ways and rely less on rank-and-sort competitive grading.

Describing schools negatively (as in crisis, in need of improvement, or failing) weakens public support for schools (Kendall-Taylor, 2009). New frames regarding education reform are more likely to build support for public schools (Bales, 2010; Bales, Kendall-Taylor, Lindland, O'Neil & Simon, 2012). A "remodeling" metaphor makes reforms seem less drastic, and a community-focused emphasis on the future benefits of shared educational improvements can help. Kansas, as an example, is addressing political will through a universal, design-based approach to school change predicated on what is needed for the future, and including relevant, personal experiences as core principles (Kansas State Department of Education, 2021).

A universal approach to design may help sustain attention and investment in these highly segregated schools. It is also worth thinking about some of what makes the experience of attending these schools different, and why the characteristics of personalization may be beneficial. More than half of students in U.S. schools are Black, Hispanic, Asian, or two or more races (U.S. Department of Education, 2019b). Many of these students attend highly segregated, "high-minority" schools with mostly or entirely white faculty.

There are a large number of these particular kind of mismatch schools—designated as low performing, with mostly or entirely white staff, and with a predominantly Black and/or Latino student body. They are, however, still a small minority of schools overall in the United States. Therefore, those who make curriculum tools and materials have no particular reason to have these schools especially in mind. To the extent that the experience of attending a mismatch school differs, typical systems to develop curriculum or change practice are not necessarily going to work. Curriculum produced by publishers responding to an incentive to produce materials for the widest audience will not have mismatch schools in mind. As recent news articles have attested, pressure is applied through the political process to approve materials that deny the reasons mismatch schools even exist (Archie, 2022; Ray & Gibbons, 2021). A disproportionate number of Black and Latino students attend a mismatch school, but the vast majority of all U.S. students do not. Even charter schools, which in many places open to serve the same students who may have attended somewhere designated in need of improvement, may try to replicate practices found in what they perceive as other successful schools (Lubienski, 2003).

In the low-performing schools throughout the country where I have worked, white faculty describe the standards they teach as irrelevant to the lives and the futures of the nonwhite students they serve. It is not always clear that there are methods available for teachers to learn about

students' experiences, however. In an interview I conducted in a Nevada middle school, a student compellingly described how one teacher asked the class some questions about their lives to get to know them. This was contrasted with frequent complaints about other teachers who "think they know us." This was not the first time I had heard that phrase used to describe a callous set of assumptions about what students did in their free time or what they cared about. It was the first time that I connected this getting-to-know-you practice with the responses on the survey. It occurred to me that the gap in survey responses was driven by a minority of teachers—and hearing the way students described their most caring teachers compared to others got me thinking about why the curious teacher had to act on his own to better get to know students.

It seems that in mismatch schools, at least some teachers do not value or incorporate the experiences of their students into their teaching. A substantial minority of teachers in these schools view the content likely to serve as a gateway to future opportunities as irrelevant to the students' lives.

1.2 Background

I arrived at the University of Pittsburgh in the fall of 1998, committed vaguely to the pursuit of justice and equality and without a sense of how that could occur. I left as a graduate in 2002 with several peer mentors and a deep respect for the field of community organizing. My decision to join Teach for America was a somewhat misguided attempt to embed myself in a community being denied justice in the United States.

The first school at which I taught was particularly diverse. Approximately two-thirds of the student body were the children of recent immigrants from a variety of Central American and

African countries, while the other third of the student body was comprised of African American children with multi-generational ties to that neighborhood in Washington, D.C. While the staff of the school as a whole was predominantly white, the teachers on my Grade 5/6 team were racially diverse: two African American educators at the end of the hall with a combined eighty years' teaching experience, one younger African American teacher, one Jamaican American teacher, one Panamanian American, a Chilean American counselor and me, one of three white teachers, and the only straight white man. I was also the youngest teacher on the team by more than a decade, a 22-year-old in his first home outside of the Pittsburgh area. I watched how the teachers shared mentorship for students, and how students found their ways to those relationships. I experimented with how to exert my own influence: supporting colleagues in union fights, visiting students in the hospital, coaching the soccer team, and forging relationships with the students who were not connecting with another team member. Mostly, I decided that I was unlikely to make a real difference as an organizer if I was not a somewhat better teacher.

After a graduate program at the University of Pennsylvania, I accepted my second teaching position in Baltimore City. I spent seven years teaching middle and high school in Baltimore, experiencing some success inside the classroom. However, it was inconsistent and in the midst of frequent changes in leadership and assignment. In multiple years, my students were the highest scoring on state tests—which generated the most notice from school administrators. I also felt like I made a dramatic difference for a few students each year in terms of their relationship with schooling in general, seeing that as a more rewarding but also more nebulous form of success.

In 2017, a former student posted about his memory of my teaching him from a decade before on social media, "Now that I am older I feel like he was trying to tell us something without getting fired." I responded with appreciation at the remark, which I took as a validation of my

attempt at a socio-politically conscious pedagogy. I knew my students perceived how power worked in our school and city and felt a need to be truthful about how I saw things. I was also acutely aware of the racist and homophobic experiences many adults recall in their middle school classrooms. I felt compelled to add a memory of a teacher resolutely on their side for any student who would one day need it. Yet my pedagogy was uneven and mostly learned through trial and error, picked up by happenstance and luck through informal networks of mostly Black mentor educators. By the end of my time in Baltimore, I was selected through a peer-review process as a model teacher.

I did not at the time realize quite how rare my path was as a young white teacher. Teach for America tends to place small groups of teachers together in a school. I was the only member of my cohort sent to a school without another Teach for America corps member. While others were surrounded by young teachers, my mentors were veteran Black women. Five of the six principals I have had were Black women, and the sixth was a Black man. All of the senior leadership on my union negotiating team were Black women. I treaded carefully around what felt like uncomfortable praise for caring about Black children. I am confident that on at least one occasion I was professionally favored based on my gender, with one prior principal wanting more male role models.

Nearly all of my professional allies, foes, mentors and mentees continued to be Black women. The educators who surrounded me were too diverse in temperament and style for me to draw any sweeping conclusions about their influence on my practice and worldview. Over time, however, I came to expect Black power and leadership. As a result, I find the absence of Black leadership in other parts of the country conspicuous.

I experienced frustration at what I perceived as a limit to my effectiveness. Students could easily be subject to exclusionary discipline outside of my time with them, or have a grade or score used as a reason to deny them access to good instruction. So I also tried to influence the broader education system while also teaching. I was elected as a union leader in Baltimore, worked in the central office during summers, and helped craft policy beyond my classroom. I noticed that much of the thinking took place in organizations external to my district, and when I moved to Boston, I took a job in one of those organizations. I spent the early part of the non-profit phase of my career bringing my perspective as an educator experienced in the Baltimore, Philadelphia and Washington public school systems to our projects. As a stakeholder and an advocate, my perception of being outspoken and white is that I was often perceived as helpful. While I occasionally had to watch the degree to which I spoke alone instead of with Black colleagues, my voice was often welcome in part because it was that of a straight, white man echoing what other advocates were saying about our schools.

In my current role providing technical assistance for a national organization, I have changed course. I now work predominantly in districts and schools with more white educators in positions of power, compared to the districts in which I taught. The schools and districts that are identified in need of improvement are compelled, if indirectly, to receive external support. I am aware of the tension that exists as a white man from elsewhere imported into a community to "help" a school mainly serving Black and/or Latino families. As a result, I continue to adapt the way I approach this work based on my perception of what earned and unearned power I am afforded in each interaction based on my position and social identity. As someone who is expected to bring expertise, I attend to precision in my work. It is not enough to contribute and follow the

lead of others, as I am expected to help schools, districts, and states decide on their next actions. It is part of what brings me here—increasing my capacity for scholarship.

My perspective as a doctoral student and researcher now is someone who is looking to make an impact at addressing racism in American education. I have now spent longer in my current role than I spent as a classroom teacher. I want to build a more scholarly approach to some of what I have found vexing about the experience of the particular schools in which I have worked. My professional and personal history causes me a rooting interest in the cities that remind me of the places I have spent my career. For the coherence of my own life's work, I acknowledge that I have a perspective that shapes how I interpret conversations and evidence. I have a sustained professional interest in pursuing a more just educational system for Black children in U.S. schools in particular. That interest has also intersected with professional pursuits related to more just systems for other students of color, LGBTQ students, and students identified as disabled.

1.3 Statement of the Problem of Practice

The mere existence of segregated schools is a problem. Students' experiences in these schools are the particular problem I address here. In mismatch schools, some teachers do not know about the experiences of their students, and therefore miss chances to incorporate those experiences into their teaching. A substantial minority of teachers in mismatch schools view academic content as irrelevant to the students' lives.

1.3.1 Inquiry Questions

Two inquiry questions guide this project. The first is: What meaning do teachers make of the practice of experience bridging? In order to influence instruction, teachers will have to not only use the provided tool to gain input from students, but turn that information into teaching that differs from what they would otherwise have provided. Teachers may have long had strategies for getting to know students, but I am curious about the reactions that come from a systemic imprimatur.

The second inquiry question guiding this project is: How do teachers respond to what they learn about students? Teachers may use the experience inventories to start conversations with students, but it is not clear that the conversation alone will produce value. It is worth considering whether surfacing the experiences of students may increase the amount the students learn.

Answering these two inquiry questions puts me on a path to consider the next steps for this instructional practice. To make a positive difference, experts in the organizations that promote and advance teaching practice, and leaders in schools and districts will need to perceive this method of getting to know students as worthy of emphasis. It is also worth thinking about whether and how the experience inventory tools will find their way into the hands of teachers. Without my own organization's adoption of the approach into requests for proposals and scopes of work, it is unlikely to be something that will get into the hands of a sufficient number of teachers to draw any lessons.

In order to understand whether the creation of experience inventories makes a positive difference, I focused on how teachers used the inventories to alter practice. While there are many related questions, it is not worth refining the inventories if teachers are unwilling to use them to adjust instruction in any case. The argument to experts and leaders to emphasize this idea will be

enhanced by data showing that teachers found them useful in their planning. Altered instruction is the basis for this theory of improvement, and is therefore my focus.

1.4 Overview of the Inquiry

In a selection of mismatch schools, I introduced an instructional practice I call experience bridging, an idea drawn from integrating the funds of knowledge students possess and responsiveness to students' cultures with cognitively-based instruction (Gonzalez & Moll, 2005; Ladson-Billings, 1995; Lee & Buxton, 2010). I was interested in learning what teachers do with the prompts and training we have offered in implementing the strategy. I interviewed a purposive sample of teachers that were trained to use our student experience inventories, a set of prompts about students' lives specifically aligned to an academic unit. I selected teachers who engaged with the strategy to learn more about what happens when a teacher uses it. I learned about how they used the tool (e.g., survey, conversation), what they learned about their students, and how they believe students learned. I have used this information to refine the inventories and prompts for future users, and the variation in teacher methods for learning about the content-related experiences of their students sets up my future work in this area.

1.5 The Role of Technical Assistance in Improving Instruction

The Community Training and Assistance Center (CTAC) is a 43-year-old non-profit organization founded and headquartered in Boston. CTAC provides technical assistance, research

and public policy support in the fields of education and community development. The mission of the organization is to address the root causes of poverty. In the earliest days of the organization, private foundations provided a substantial portion of the funding, and most of the work was in community development. CTAC now works mostly in the education field and receives funding through federal grants and via school districts and state education agencies directly.

There are 10 full-time and 21 adjunct staff members. The full-time staff is currently the least racially diverse in the organization's history, with two Asian and eight white full-time staff. The adjunct staff, with nine people of color, and the board are more racially diverse. The organization is a designated minority-controlled non-profit due to the composition of the board of directors. Since the organization's inception, the board has always had a majority of people of color in total and in leadership positions.

The organization's chief executive officer is also the founder. As a result, he has deep relationships with many members of the board of directors. A chief field officer manages day-to-day operations. A chief finance officer completes the senior leadership structure. The organization is relatively flat. I am one of three full-time directors. There are also two research staff members, one program specialist and an administrative manager. Each full-time staff member leads projects with other directors, leadership staff, research staff, or adjunct staff as team members. The entire staff collaborates on many projects and internal development work.

CTAC also partners with other organizations with staff structures for a specific purpose. The federal Comprehensive Center system provides technical assistance to state education agencies. Over ten years, I have worked as staff for three regional Comprehensive Centers, and as one center's liaison to the national Center on School Turnaround.

Each state agency, school district, school, or charter organization also represents an organizational context for my work. Each entity has norms, policies, and laws that govern the relationships with partner organizations and constrain or direct my influence.

My current role as a staff member at CTAC and one regional Comprehensive Center constitutes my vehicle for proposing changes in state policy or in teacher practice in individual districts and schools. There are multiple filters between our organization's ideas and actual implementation in a school setting. Grant-funded activities are limited to commitments made in order to obtain the funding, and contracts stemming from a request for proposal are similarly constrained by the obligations defined in a scope of work. Those who manage grants and contracts serve as filters who occasionally limit access to stakeholders, especially parents and students. The invisible filter of client satisfaction complicates my ability to act on a commitment to equity and justice. If continued access depends on the satisfaction of those entrusted with the resources inside schools and districts, then the status quo is reinforced.

The structure of the main federal education law constrains innovation by design. The Every Student Succeeds Act (2015) contains a provision requiring that expenditures on school improvement must be evidence-based. CTAC relies on an independent evaluation of our school improvement process (Clark, 2019). As a result, any future work must align with our prior work's findings. In at least one way, this is not a constraint. My organization's history of moving from community development to education means that we maintain certain principles of building the capacity of those affected by an issue at the center of our approach.

1.6 Stakeholders

In order to effect changes in schools, I must consider the perspectives of three sets of stakeholders: those within my organization, those in the schools' communities with whom I partner now or will in the future, and those whose perspective also matters to those school communities.
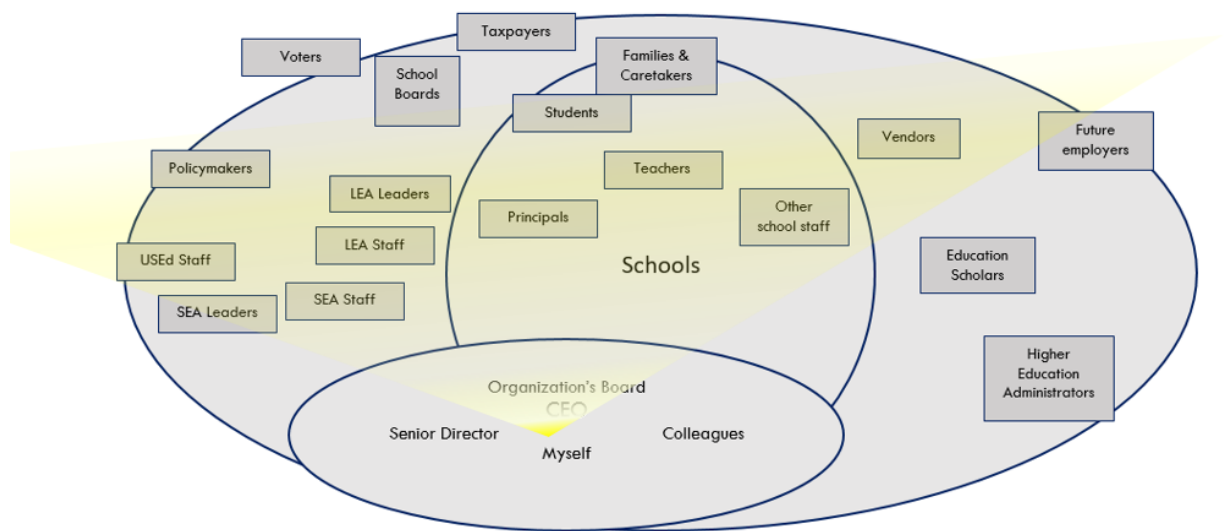
Figure 1 Stakeholders, from my vantage point

In figure 1, I have displayed my universe of stakeholders. Those partially in a circle represent groups whose attention is divided among several topics potentially apart from education. On the left side of the oval, I have charted external influences on schools with some formal authority. On the right, those with less formal authority. In the circle, I have represented a single school district in California (see Chapter 3 for my explanation of why this district). In the small oval at the bottom, my organization, which works both directly with schools and with external influences on schools. I have included my vantage point represented as a triangle, showing my

limited field of vision as certain key stakeholders partially obscure my view of the perspectives of others, and other stakeholders are at the periphery of my field of vision given my only occasional need for their inclusion.

1.7 Summary Description of the Study

The teachers in mismatch schools feel daunted by cultural competence, but wish they could do better, in my experience. They think they have to learn the cultural practices of the "others" they teach. However, there is a way to be culturally responsive regardless of how much knowledge you possess. Gonzalez and colleagues (2005) pose this question: "How do we know about the knowledge [children] bring without falling into tired stereotypes about different cultures?" (p. 8). I aim to change teacher practice by changing teacher knowledge, and to do so in a way that does not produce a burden of knowledge acquisition on teachers. Teachers are often the recipients of numerous interventions intended to counteract a wide range of negative influences on learning. Given the omnidirectional influences on teachers described by Bryk and colleagues (2017), expecting more of teachers without providing commensurate support seems likely to fail.

I use a Plan-Do-Study-Act cycle, using improvement science in an educational context to learn about the repercussions of introducing a change idea (Hinnant-Crawford, 2020). I both refine the specific idea regarding the pedagogy needed in mismatch schools as well as learn broader lessons about my role and influence. In Chapter 2, I provide an overview of literature relevant to both the change idea and the context for my inquiry. In Chapter 3, I describe the plan I created and followed for learning about the change idea in a particular school district in California. In Chapter

4, I describe my findings. In Chapter 5, I discuss the findings, and the implications for me, for the rest of an improvement science cycle, and for future research.

2.0 Review of Supporting Knowledge

Mismatch schools, defined in Chapter 1, are overrepresented among schools identified as the lowest performing in the United States. These schools have large numbers of white educators, some of whom may miss the chance to connect content to the experiences of students. Using students' funds of knowledge may increase conceptual understanding of specific academic content. It may also alter teachers' perception of the relevance of the content to their students' lives.

2.1 Existence of mismatch schools.

In 1980, American students were roughly evenly split into rural, urban and suburban schools. By 2014, more than half of American students attended an urban school. While urban schools have seen the greatest increase in students living in poverty, increases in poverty are apparent in rural and suburban schools as well (Verdugo, 2018).

Over the same time period, American students are increasingly foreign-born. Much of the increase in urban school enrollment has come from immigration, and foreign-born students also represent a larger share of the population in rural and suburban schools. As city school enrollments increased dramatically over the last generation, native-born Black American students were leaving for the suburbs, moving from eight to 12 percent of suburban enrollment, while declining from a quarter of the urban student population to just over 16 percent. (Verdugo, 2018)

Looking at rural, urban, and suburban data, Black students have spread out. Yet more than one in three Black students attend a school with 90-100% Black student enrollment (Orfield, 2014). The number of highly segregated schools for Black students tripled between 1988 (the high water mark for integration) and 2013 (Orfield, 2016). Latino segregation has also dramatically intensified (Orfield, 2016). Further, there is an increasing degree of correlation between concentrations of poverty and racially isolated student bodies (Orfield, 2016). Far fewer white children attend entirely white schools compared to the pre-civil rights era, however. While U.S. schools have become more "diverse," they have paradoxically become much more intensely segregated.

The most intensely segregated schools (with more than 90% Black or Latino students) have the most significant proportion of teachers of color (Institute of Education Sciences, 2019). However, teachers of color are not evenly distributed across the increasing number of schools serving more than 90% students of color. The teaching staff in schools serving 90% or more students of color is still majority white (Ingersoll, 2011).

2.2 Overrepresentation of mismatch schools identified as underperforming

More than 15,000 U.S. schools met the criteria to receive a School Improvement Grant (Hurlburt, et al., 2011). At least five million students are concentrated in these lowest-performing schools. More than 85% of the lowest-performing thousand schools are segregated "high-minority" schools (Hurlburt, et al., 2011). Efforts over the last decade to improve outcomes for these students by improving their schools have met with some success (Dee, 2012; LiCalsi,

Citkowicz, Friedman & Brown, 2015; Sun, Penner & Loeb, 2017). However, many schools have not improved (Dragoset, et al., 2017; Heissel & Ladd, 2018).

2.3 White teacher-Black student dynamic

The demographic categories I use in this paper are not genetic or biological. As social descriptors of physical characteristics, social relationships, and cultural and geographic heritage, the terms for racial and ethnic groups differ. These differences reflect choices by researchers and writers and changes in the conception of "membership" in a given group over time. The repercussions of these socially constructed categories warrant consideration. I use "Black" with a capital "B" to refer to a diverse group of people of African descent in U.S. schools whom themselves use the descriptor as a marker of cultural affiliation. I also use Black when the researcher or source material refers to the group by that name, whether capitalized or not. Black people "share a specific set of histories, cultural processes, and imagined and performed kinships" which distinguishes this group from the social construction white (Dumas, 2016, p.13). I use Latino to refer to a diverse group of people who trace family connections to the pre-U.S. southwest or southern portion of this continent, Central or South America, or when people use this descriptor themselves. Otherwise, I refer to groups with the most specific usage possible, or as they are referred to by the writer or researchers when that is unclear. These usage choices are consistent with the style manual of the American Psychological Association (American Psychological Association, 2020).

Students do better academically when they have what one researcher terms "race-congruent" teachers (Dee, 2004; Egalite, et al. 2015). This is possibly due to teachers' capacity to

incorporate cultural references and other culture-specific tools in instruction (Birenda & Chait, 2011). Other explanations include descriptions of racially congruent teachers as "role models," or point to differences in expectations (Dee, 2004; Ferguson, 2003). Using experimental techniques, research shows teachers exhibit racial bias (Ferguson, 2003, p. 478). Instructionally, this takes the form of differential expectations for students' potential. There is a considerable and quantifiable gap in the expectations that non-Black teachers, in particular, have for Black students (Gershenson, 2016). Several downstream instructional repercussions may occur due to differential expectations, including the time teachers allocate to students and the way students' motivation might be affected by the teachers' signals.

Students who share racial characteristics with their teacher report finding their assignments more interesting, having better communication with their teachers, and feeling more cared for (Egalite & Kisida, 2018). These elements of a different experience may hint at additional instructional reasons why race-congruent student-teacher matches appear beneficial. Race is socially constructed, so the mechanisms for these benefits are likely social also. The relational interactions of students and teachers predict increases and decreases in math achievement (Battey et al., 2018). White teachers who struggle to see the potential of Black students may not fully comprehend the past experiences of those students.

2.4 The educational experience of students in mismatch schools

Teachers are often unaware of what experiences students have had with the content they are assigned to teach. This is particularly acute in schools with racial mismatches between students and teachers, a situation more likely in highly segregated schools. Addressing this problem may

21

lay the groundwork for strengthening student-teacher and family-teacher relationships by rearranging the relationship between families and schools (Gonzalez & Moll, 2002).

The creators of the "funds of knowledge" articulated their approach as a contrast to the world of high-stakes testing, accountability, and scalable school improvement strategies (Gonzalez & Moll, 2002). Gonzalez and Moll describe the techniques they use as ethnographic tools that balance power between students and teachers, putting teachers in a position traditionally reserved for students—learners. Providing accessible entry points to the thinking associated with the approach may increase student agency and power while simultaneously improving student performance on the metrics related low-performing schools (Rodriguez, 2013).

Students need to perceive science and engineering content, for instance, as relevant and connected to their vision of the future. They are capable of drawing on experiences in order to increase their motivation and success (Basu & Barton, 2007; Wilson-Lopez, et al. 2016). Teachers likely need help in how to unlock stories related to understanding specific academic content. Broad topics that teachers and students can mutually explore help situate the teacher as a learner, and students and their families as people whose experiences will shape teaching (Gonzalez, Moll, & Amanti, 2005).

Learning about the funds of knowledge students possess occurred initially in the context of predominantly Latino groups of students. However, when considering both my experience in primarily Black and primarily Latino schools, as well as the increasing segregation of both groups of students, I wonder if the two experiences may be related. While much of the literature around the difference of the expectations focused particularly on Black students, I wonder if these insights apply to multiple scenarios in which teachers may be consciously or subconsciously "otherizing" the students they teach. Gonzalez (with Moll & Amanti, 2005) helpfully eschews references to

culture, and instead describes funds of knowledge as concerned with focusing on cultural practices—the things households actually do and how they think about what they do. This practical view of culture could help avoid the presumption of group coherence and foster intercultural similarity—something potentially applicable everywhere where racism pervades the relationships inside U.S. classrooms. In particular, as Latino Americans and Latino and other immigrant groups are portrayed as an increasing racial threat, it is valuable to consider the similarities in the ways whiteness works across schools with different pathways to their segregation (Bell, 2021).

2.5 Knowledge as a necessary ingredient in learning

The purpose of schooling may be distinct from learning and is contested (Labaree, 1997). Measurable improvements in science, reading and math scores on standardized assessments are a priority in mismatch schools, partly because of the stigma and sanctions accompanying an improvement designation. Recent changes in the law allow for additional measures, such as those connected to social learning, to be included in how schools receive a designation (Every Student Succeeds Act, 2015). However, test scores continue to remain important. Therefore, to increase the likelihood of promoting changes appealing to the schools in which I work, I explore ideas that straddle theories of learning associated with standardized test score improvement and those associated with education as a strategy to pursue a more just society.

A cognitivist perspective on learning suggests that students build new understanding and knowledge using what they already know (Willingham, 2009). There are several strategies, such as K-W-L (Know, Want/Wonder, Learned) charts, which elicit what students already know and want from a unit, that teachers use to assist students in recalling items from their long-term memory

and moving them to working memory, which is necessary for new learning (Baddeley, 2017). This starts a sort of virtuous cycle, because students' interest is piqued by subject and domain knowledge, making it further likely that students will learn even more (Alexander, et al., 1994).

In several cases exemplifying culturally responsive teaching, authors mention and describe the interests of their students (Landsman & Lewis, 2011). Yet there are many times when drawing attention to something interesting to introduce additional relevance distracts students from thinking about what is necessary for learning (Willingham, 2009). Suppose an unrelated musician is included to increase interest in a math problem for instance. In that case, the student may well begin thinking about a favorite song, and no longer about the computation or logic needed to solve the problem (Willingham, 2009).

Neuman (2019) writes that "comprehension is about bringing what you already know to what you may want to learn" for which she offers a robust body of evidence (p. 12). Neuman (2019) says that "we do children harm when we assume that they have the background experiences to activate knowledge" (p.14). Yet harm lies assuming in both directions. Students can benefit from building knowledge through new experiences and drawing new lessons from their experiences but did not connect to academic content (Hattan & Lupo, 2020; Rutledge, 2021). The types of experience that may contribute to new knowledge and accelerate learning may be outside is traditionally associated with school (Emdin, 2021).

Therefore, it may be beneficial for someone with content expertise to think about the unfinished learning that may occur from students' experiences and how those experiences could be used to produce knowledge that would directly align with the learning required by the class. This could be a step to broaden the pool of educators who can serve as what Emdin (2021)

describes as those who are "the embodiment of merging worlds that society has deemed separate who showcases that they are actually deeply connected to each other" (p. 78).

2.6 Science-specific pedagogy

Teachers' actions to produce learning for one kind of academic content may not transfer to other content areas, and teachers are not necessarily equally proficient across content areas (Stronge, 2013). While some elements of relevance may influence learning generally, I am particularly interested in science, an important content area.

Black and Hispanic degree recipients are underrepresented in STEM areas, and Black and Hispanic professionals are underrepresented in STEM careers (Fry, Kennedy, & Funk, 2021). One of many potential antecedents is the performance of Black and Hispanic students in science. The 2019 NAEP, sometimes referred to as the nation's report card, showed a difference in the average eighth-grade science scale score by student group, with Black and Hispanic students scoring lower than white and Asian students (National Center for Education Statistics, 2019). In 2009, the average scale score for Black students was five points lower than that of Hispanic students, which was still 30 points lower than the average scale score of white students, with Asian students scoring one point lower than white students. In 2019, this gap somewhat narrowed, as the average scale score of Black and Asian students have increased by seven points, the average scale score of Hispanic students has increased by nine points, and the average scale score of white students has increased by three points (National Center for Education Statistics, 2019). Despite the narrowing of the gaps, a substantial difference remains. These data are best understood as evidence of opportunity gaps, as there are systematic differences in the STEM opportunities available to

minoritized students (Ortiz et al., 2019). Beyond missing potential economic opportunities that could narrow social inequality, science education is essential for the scale of collective action required to respond to ecological crises whose effects are being borne primarily by Black and Latino communities (Sharma & Buxton, 2018).

In schools where students are grouped by age cohorts, all students will have lived for approximately the same amount of time—meaning that students bring a roughly equal amount of experience. All students bring knowledge and cultural practices to academic settings (Lee & Buxton, 2008). What differs for students is the degree to which schools draw on students' experiences as something worthy of integrating into a formal academic setting. Lee and Buxton (2008) offer a three-part framework for equitable learning opportunities. Equitable learning can:

occur when formal schooling (a) values and respects the knowledge and experience students bring from their home and community environments, (b) articulates such knowledge and experiences with academic disciplines, and (c) offers educational resources and funding to support all students' learning. (p. 124)

Given these conditions, Lee and Buxton (2008) claim that students can learn challenging science material and achieve. Promising results have come from curricular approaches that align to these framework elements, though many approaches were tailored more narrowly to specific cultures or languages shared by groups of students (Lee & Buxton, 2008). It is, however, less practical to create materials that align to each student's culture in a multicultural classroom context.

Superficial connections to the lives of children may have the unintended effect of promoting shallow scientific investigation (Calabrese Barton, et al., 2005). Calabrese Barton and

colleagues (2005) found sophisticated thinking from students when creating a unit of study well-calibrated to both the habitual experiences of the students and the demands of a curriculum.

Science instruction that supports students' construction of knowledge through inquiry has been linked to improved performance on the NAEP science test for white students from what is described as an upper middle-class district (Schneider et al., 2002). This is not the context in mismatch schools. Instead, this is where students' experiences are more likely to be presumed relevant.

For this kind of pedagogy to work in mismatch schools, "finding and documenting bridging is an important task for educators," (Bouillion & Gomez, 2001, p. 879). This can include generating questions from students and their parents' experiences. Teachers vary in the degree to which they see culture as an influence on science learning, and may be only partially aware of how cultural practices and science interact (McDaniel, et al., 1995). Student pursuit of STEM fields may be tied to a "STEM identity" which incorporates other factors relevant to identity development such as "gender, ethnicity, home science support, parental education, and experiencing science talk in the home" (Dou & Cian, 2022, p. 458).

Some examples of culturally relevant science curricula attempt to raise student interest and even enable sociocultural-political critique (Johnson & Atwater, 2014; Ladson-Billings, 1995). Often, these examples are generated without a systematic way to inquire about possible student experiences upon which the class could draw. It is possible to instigate a STEM-identity with home experiences and without having a parent in a STEM career, and there may be a role for teachers in bridging those experiences to foster a STEM identity (Dou & Cian, 2020; Ortiz et al., 2019).

It is not clear that this mining potential connections for students is a particular priority for science teachers. Recent law emphasizes the need for evidence-based practices (Every Student

Succeeds Act, 2015). In particular, the law calls for "Level 3" evidence, a higher standard than any other part of the law, for interventions in schools designated as needing improvement, such as mismatch schools (Every Student Succeeds Act, 2015). The Institute of Education Sciences, which operate the What Works Clearinghouse, determines levels of evidence. The science page of the What Works Clearinghouse shows seven studies with positive or potentially positive findings with regard to the performance of students in science (U.S. Department of Education, 2012a, 2012b, 2012c, 2016, 2018; What Works Clearinghouse, 2021). Two studies involve the Knowledge is Power Program (KIPP), which targets mismatch schools and shows evidence of standardized test score increases in multiple areas (U.S. Department of Education, 2018). Another involves comparing the performance of students taught by teachers hired through Teach for America compared to students taught by non-Teach for America teachers (U.S. Department of Education, 2016). Three studies find effects tied to specific curriculum products (U.S. Department of Education, 2012a, 2012b, 2012c). The only study on What Works Clearinghouse that addresses teacher actions found positive effects for students of teachers who participated in an intensive lesson study and thought deeply about the particular content to be taught (What Works Clearinghouse, 2021).

The three recommendations of the Institute of Education Sciences for encouraging girls in math and science with level three evidence support all involve teacher action (Halpern, et al., 2007). This suggests that for populations of marginalized students, particular teacher actions may connect to improved learning. In the case of girls, the most supported recommendations include teaching a growth mindset, providing prescriptive and informational feedback, and sparking initial curiosity to foster long-term interest (Halpern, et al., 2007).

2.7 Prior experiences less frequently elicited in certain teacher-student racial pairings

Teachers' impressions of their students affect their instruction, and race is an important factor in how teachers form those impressions (Atwater, 2000; Tenenbaum & Ruck, 2007). Teachers differ in how much learning they expect of their students, and those expectations have a cascading influence on their instructional decisions (Rubie-Davies, 2007). Some teachers have lower expectations than may be warranted for all of their students (Hattie, 2009). African American and Latino students receive more negative feedback, and less praise, and are interacted with less often in classrooms (Cooper & Allen, 2009). Black students' mathematics achievement may have a connection with intense positive interactions, which may be an example of teachers countering a negative norm of lower expectations (Battey et al., 2018).

Some white teachers view the highly segregated schools in which they teach as explicitly racialized spaces (Bell, 2021). Due to the perception of difference, white teachers can react by either increasing attempted cultural connections superfluous to academic content or retreating from attempting any cultural connections. Indeed, some white teachers try to "forgo any and all forms of racial recognition" (Bell, 2021, p. 151).

2.8 Summary of Applicable Literature

Teachers use imperfect mechanisms to form impressions of their students, leading to systematically biased expectations and resultant less effective instructional choices (Bell, 2021; Rubie-Davies, 2007; Tenenbaum & Ruck, 2007). Racism operates as a constraint in forming impressions (Tenenbaum & Ruck, 2007). Teachers can make these errors across an entire class

(Hattie, 2009). The composition of some schools in the U.S. exacerbates the likelihood of these errors by concentrating "minority" students into certain classrooms with white teachers (Hurlburt, et al., 2011; Ingersoll, 2011). Specific and accurate knowledge of students' experiences that directly pertain to classroom content may increase learning (Baddeley, 2017; Willingham, 2009). Science teaching that builds on student experiences can improve outcomes for students; the link between teachers and students regarding those experiences is critical (Battey et al., 2008; Bouillion & Gomez, 2001; Calabrese Barton, et al., 2005; Lee & Buxton, 2008; Schneider, et al., 2002).

3.0 Theory of Improvement and Implementation Plan

My overall aim is to increase the use of student experiences related to academic standards in a way that leads to improved learning in multiple schools and districts in which I work by the summer of 2023. I am interested in whether school districts can send a meaningful signal about the importance of cultural responsiveness—as recognized through changed teaching practice—through the adoption of a practical teaching tool. In particular, I am interested in whether this practice is helpful in schools in which the student body is more racially diverse than the teaching staff—mismatch schools. I know that teachers have many ways of getting to know students. I was curious about how teachers react to a systematic nudge to engage students in this way. By learning about a single set of teachers in one particular context, and working with them to improve their experience, I am trying to transform an educational idea from an abstraction to something practically useful for teachers. Given that I was not looking for a representative sample of either schools or teachers, I did not look for generalizable knowledge about exactly how the practice should look in all settings. Instead, I intended to think more broadly about what form a practical application of the funds of knowledge idea could take.

To accomplish this purpose, I used a methodology from improvement science: a Plan-Do-Study-Act cycle (Hinnant-Crawford, 2020). As a scholar-practitioner, this approach enables reflection on the complex interplay of various elements of the educational system as a whole as I attempt to introduce a change.

Students do not always notice when teachers miss chances to incorporate their experiences into instruction. The nature of the need for teachers to make those connections is because they are needed for content students have yet to learn. Teachers can provide insight into how student

experiences are incorporated into instruction by reflecting on teaching choices made in the aftermath of adopting a new tool. Even when teachers did not use the tool as intended, our discussions provided valuable insight into how teachers see the interplay between learning and student experience.

There are constraints on the career and life choices of students who attend mismatch schools. Given the complex and multiple reasons why such schools exist, it was unreasonable to expect a single pedagogical change would drive substantial improvement in life outcomes. In Figure 2, I show how multiple changes might work together to address the problem I have described. Providing student experience inventories, and learning about how teachers use them, may help further refine other potential changes.

The likeliest path for demonstrating that providing experience inventories and encouraging experience bridging is a change that represents an improvement would come from a modest improvement in some aspect of learning as measured by standardized assessments, student work products, or post-graduate outcomes *when combined* with specific examples of connections of student experiences to improved classroom learning drawn from both teacher and student qualitative data. I intended first to determine what happens when teachers try using student experience inventories.

3.1 Theory of Improvement and Change

In the "plan" phase of a PDSA cycle, I created student experience inventories aligned to specific science instructional units in a medium-sized California school district. We enlisted teachers to revise and contribute to the student experience inventories by training teachers who

created the integrated STEM units. We further invited teachers to revise and modify student experience inventories during a district-wide training. Student experience inventories and the thinking behind them occupied one-sixth of the agenda of a day-long professional development experience before the school year. I was particularly interested in the extent to which teachers used the tools, and wished to notice how teachers altered their teaching in response to what they learned. In the "do" phase, teachers across the district taught integrated STEM units with student experience inventories included informing instructional planning and delivery. I then went on to "study" the teachers' experiences with the curricular tool by engaging in interviews with teachers regarding their use of the tools, the typical ways they learned about students' experiences, and their changes in teaching as a result of what they learned. I was also curious whether this mechanism for gathering information from students is replacing an existing mechanism, and whether the prompts represent both a change and an improvement. In the "act" phase of the PDSA cycle, I intend to modify the inventories themselves to improve the tools' usefulness to the participants. My organization will continue to make choices in collaboration with teachers about the units as a whole, and can reflect on teacher insights to consider the effects of adding student experience inventories.

AIM
In order to achieve this aim:

PRIMARY DRIVERS
We need to ensure:

SECONDARY DRIVERS
Which requires

CHANGE IDEAS
Ideas to ensure this happens

I aim to increase the use of student experiences related to academic standards in a way that leads to improved learning in multiple schools by summer 2022.

Curriculum Tools

Published material referencing student experiences.

Create and distribute experience inventories aligned to standards.

Assessment platforms with space to record experiences.

Modify platform capacity.

Instructional model

Leader(s) signal importance of initiating instruction with student experiences.

Convince opinion leaders to value, encourage, and promote processes or outcomes associated with relevant instruction.

How educators use models (e.g., engage/explore, KWL)

Provide professional learning encouraging and demonstrating how to draw on student knowledge.

Social expectations for where student experiences fit in school

Teacher perception that content is neutral/students' lives are a distraction

Provide professional learning on academic standards and student performance variation.

Family and student boundaries

Establish and promote norms and/or policies for responsibly using student experience information.

Skills of teachers to elicit the kind of information needed to make relevant connections

Deep content expertise; ability to see unorthodox experiences as connected.

Provide practice for teachers in making connections and share examples.

Teacher responsiveness skills

Provide practice for teachers at integrating open-ended prompts into routine use.

Figure 2 Driver Diagram

3.1.1 Expectations

I anticipated that half of the teachers who participate in creating student experience inventories would use them. I expected a smaller number, perhaps a quarter of teachers would use them and go on to adjust their teaching practice in ways they can articulate. These adjustments may include their selection of content resources, explanations, or metaphors and examples.

It was possible that some teachers would uncover novel experiences of students that enable them to a play a role in class they may not have otherwise played. For instance, a student's experience traveling, speaking another language, or having read material on the topic may give rise to some level of peer teaching, which can influence learning (Hattie, 2009). More likely, I

expected teachers to make generalizations about routine experiences that several students share that have affect the type of examples or illustrations a teacher chooses to use. For example, this could take the form of a teacher noticing that four students in her class regularly help with laundry in their homes, and so she used a folding sheets description when explaining the movement of a wave. This may result in the affective benefits associated with a teacher's immediate reaction to students while also resulting in a cognitive benefit as students make sense of the learning task that extends beyond increased motivation (Allen, Witt, & Wheeless, 2004).

I expected that teachers could get to know students in various ways. For the purposes of this project, I am most interested in how teachers can get to know students through the ways they describe their cultural practices (Gonzales, Amanti, & Moll, 2005). Teachers can also get to know students through their interests, identities, and academic accomplishments. Knowing about students can impact students' learning in the classroom as teachers help students see connections between experiences and new content and construct knowledge. Teacher knowledge of students also impacts teachers' planning, their instructional practices, and their selection of assessments. Teachers' knowledge of students can also influence their communication with parents, the broader community, colleagues, and administrators. I expected to hear examples of these influences from teachers.

I also expected that the discipline of listening would encourage more co-creation in the classroom. Positioning a teacher as a learner (about students' experiences) makes the classroom more democratic and shared. I expected teachers to perceive students as participants in shaping the curriculum when the habitual practice of student interviewing is included in instructional units.

3.2 Methods and Approach

To learn what meaning teachers make using experience bridging, I interviewed a purposive sample of teachers in a mid-sized California district. Each of the selected teachers (except one, which I discuss in more detail later in this chapter) had the opportunity to receive training in the technique and was responsible for teaching an associated unit integrating content in science, technology, engineering and mathematics. I use a general description of the district and use pseudonyms for the participants.

3.2.1 Participants

As part of a federal grant promoting educational innovation, my organization partners with a school district in California, which I will call Pleasa Hills. This district has more than 15,000 students, more than half of whom are Latino, while the teaching staff is more than 70% white. Part of the federal grant involves the creation of new integrated units in which students learn science, computer science, math, engineering, and language development concurrently. The units are to be distributed nationally. While other districts have used student experience inventories to drive experience bridging, this district presented an opportunity to consider this strategy in one particular academic context: New, integrated STEM units. These units represent an opportunity for teachers to add a new practice for gathering data about their students' experiences. I sought seven teachers whom district leaders or peers thought might have tried the strategy for interviews. I enlisted the help of district and grant staff, and those with relationships with teachers to refine the list to create a reputational purposive sample. This strategy will enable a group of influential teachers known for reflective practice to provide insights that can shape further study (Patton, 2015).

Learning about the change idea in the context of a small number of mismatch schools provided insights into the degree to which a change occurred, and in considering whether that change can be viewed as an improvement. Choosing a small number of sites had value because the instructional context for the interviewees was similar, and the varying approaches they took and the barriers they identified helped me think about how the practice of experience bridging addresses some aspects of the broader problem I have described. Prior work in exploring the effects of racial mismatch in students and teachers have used a similar approach in terms of identifying mismatch schools (Battey, 2018). The prior study characterized racial (mis)match between teachers and classrooms full of students, examining aspects of student-teacher interactions (Battey, 2018). Similarly, I am classifying entire schools as mismatch schools, theorizing that whiteness may operate systemically when the staff is predominantly white.

3.2.2 Intervention

Given my vantage point working in similar schools throughout the country, I am privy to patterns in the data we have collected that shed light on the particular experience of students in mismatch schools. It may be possible to improve the experience of some of these students by improving both the relevance and the depth of their learning. Using an experience inventory to enable teachers to incorporate student experiences into learning may activate teachers' thinking about the ways their students approach the content for their class.

Experience bridging begins with a set of prompts—no more than three to five per instructional unit—that invite conversation between teachers and students. In the years since asset-based funds of knowledge approaches have been tried, multiple methods for gathering knowledge

of what students do and how they regard it have been tried by teachers (Llopart & Esteban-Guitart, 2018). Asking a small number of prompts directly of students addresses one consideration from early funds of knowledge approaches: that home visits rest on the assumption that what we learn from adults may inform us about children. This approach recognizes that children create their own social worlds (Llopart & Esteban-Guitart, 2018). I intended for teachers to read these prompts and see them as a manageable way to open instruction. Upon using the prompts to collect data from students regarding their experiences relative to the course content, teachers could plan complementary experiences for students in cases where students have not had experiences that were useful for upcoming learning. This builds their background knowledge without redundancy. Meanwhile, teachers were also able to learn a bit about what students *have* relevant experiences, so that they can think about ways to connect new learning to those experiences or select materials that build on that knowledge.

3.2.3 Conduct of the Study Portion of the PDSA Cycle

I identified partner schools in Pleasa Hills that have received student experience inventories this school year. I created a purposive sample of teachers based, in part, on their reputation as reflective practitioners to learn about how teachers open to this instructional practice go about attempting to integrate it into their pedagogy (Patton, 2015). Participant teachers shared how they modified any aspect of instruction as a first step towards understanding whether activating funds of knowledge in this way is a positive change. In order to determine this, I contributed to the creation of experience inventories customized to each participating teacher's content area. I ensured their inclusion in integrated STEM units teachers were to try. I then asked questions about the usefulness of the experience inventories compared to their normal methods of personalizing

38

instruction for students. I used semi-structured interviews with participating teachers regarding the use of the tool after and during their teaching of the associated instructional units. I also included questions asking how they gather information about students compared to their usual practice to detect change. I posed questions regarding how the prompts were used, the characteristics of the interaction with students (e.g., conversation, survey), and ways teachers find a method for altering any instructional experience (e.g., examples, personalized texts).

The inclusion criteria for my survey population were any Pleasa Hills teacher at a school identified as a mismatch school who agreed to participate and tried teaching all or part of an integrated STEM unit that included a student experience inventory and agreed to an interview. My exclusion criteria included teachers who are unable to time a unit of instruction aligned to the window of the study and those who teach at non-mismatch schools.

I engaged a subset of seven teachers who taught new, integrated STEM units that included the intervention: an aligned student experience inventory. I have selected a sample of seven because the sample is sufficient to provide a range of insights that inform the "act" phase of an improvement science cycle. The purposive sample was selected not for its representativeness, but for its capacity to illuminate the mechanisms by which the change idea might practically lead to a differing experience for students in schools where this is needed. Saturation in qualitative research is a concept used by researchers to justify the discontinuation of data collection, for one of at least four purposes (Saunders, et al., 2018). For instance, no new codes would emerge even if additional interviews were conducted. This would make sense as a rationale for establishing the size of my interview universe for a more narrowly designed inquiry. Instead, I have chosen to focus on information-rich illuminative cases in a purposive sample (Patton, 2015).

Chris and Cary are high school teachers. Chris is in her third year, while Cary has taught for more than ten years. Alex, Sam, and Jordan are all middle school teachers. Alex is also in his third year of teaching, while Sam has also taught for more than ten years. Jordan is in her first year as a teacher. Hired mid-year, she did not have the opportunity to participate in the training on the use of the tool discussed. I also spoke with two elementary teachers: Terry, in her eighth year, and Ashley, a teacher of more than ten years who has taught integrated STEM units in both third and fifth grade. The teachers also brought with them a range of prior leadership experiences.

Table 1 Participating Teachers

Name	Level	Experience (years teaching, including this year)
Chris	High School	3
Cary	High School	10 +
Alex	Middle School	3
Sam	Middle School	10 +
Jordan	Middle School	1
Terry	Elementary School	8
Ashley	Elementary School	10 +

3.3 Analysis of Data

I analyzed the interviews by transcribing the interactions verbatim, using Zoom teleconference software. I then performed a content analysis of the transcripts, using a three-step

coding process (Patton, 2015). First, I used an inductive analysis to represent the fragments of speech from the interview responses with a discrete meaning. Next, I abbreviated the distinct ideas with a keyword or phrase. As often as was possible, I used a phrase used by the interviewee. Finally, I completed a third step in which I identified themes in the responses based on categories generated from the responses. In consultation with the dissertation-in-practice committee, I revised the wording of the inquiry question to reflect the breadth of the responses. I changed all the names of students, interviewees, and the district. I selected different names for each teacher—I looked through lists of common names during the eras in which these teachers may have been born and selected from among the names with ambiguous ethnic and gender associations. I have retained the pronouns used by the teacher to describe themselves, however.

I first searched for indigenous concepts in the transcripts and found some common language across interviewees, such as "home situation." For other concepts, I used analyst-generated codes (Patton, 2015). I represent my findings by describing the common organizational categories and themes that emerged in using experience bridging. In Chapter 4, I make use of direct quotes and stories from teachers about their thinking that provide examples of the emerging themes and outliers.

3.3.1 Limitations

Pursuing an instructional change revolving around cultural practices courts difficulty. Cultural responses to problems of structural inequity can misplace the blame onto students and stunt a conversation about why learning and accomplishment do not occur (Gorski, 2016). The practice of experience bridging is an attempt to operationalize equity and justice approaches that

draw on culture (Gorski, 2016; Ladson-Billings, 2006). To counter both essentialist ideas of student culture and systematic marginalization of minoritized students in STEM, experience bridging anticipates Gorski's observation that "we are failing to prepare ourselves to be responsive to who students *actually* are" (p. 223). Nevertheless, a limitation of responding to inequity with a culture-based response is that it invites digression.

Changes often lead to unintended and undesirable effects. I brought several concerns to the outset of this project: Does a focus on students' experiences reduce teachers' expectations, increase bias, or reduce teachers' teaching alignment to academic standards? Introducing a practice such as this may increase the satisfaction of all parties while obscuring that students are learning less. This risk is one I discuss in Chapter 5. It is also possible that increased attention to students' stories may increase frustrations or decrease the quality of relationships that may have otherwise lacked depth but remained cordial.

Teachers participating in a district that has committed to new curricular units may be more open than others to make changes in instruction. Because the teachers are not being selected for representativeness, these conversations will not produce generalizable knowledge about getting to know students, or the efficacy of this instructional tool. Instead, these conversations will illuminate only how these particular teachers use a new tool to gain knowledge of their students.

Notably, I expected teachers to either use, modify, or discard the tool. My early experience in trying to find willing interview subjects showcased that my intuition was limited. Engaging in interviews further complicated my understanding. In one case, a teacher said she had not used the tool and then later made reference to using it. Others claimed not to have tried it, but on hearing about it, they shared information that seemed aligned to having tried it. In short, using experience bridging occurred on more of a spectrum than I had anticipated.

Further, my role as an interviewer with a role in the project has the potential to influence the answers. I worked with one interviewee in delivering training. Other interviewees have played a role in developing materials and providing training in relation to this project and for other district work related to the project. Each participant could have altered what they shared based on their perception of what I was looking for—whether to be helpful or to remain consistent with previously taken positions about the project. I have no data to suggest participants made any specific alterations. In Chapter 5, I briefly discuss my interpretation of how my presence may have affected specific comments.

Finally, my organization must examine the opportunity cost. Could our capacity and resources have obtained more or more significant influence through another educational intervention? These questions are not directly addressed in this study, but are necessary considerations in light of the insights gained from the interviews.

4.0 Plan, Do, Study

In Chapter 4, I present the first three-quarters of a PDSA cycle, from the background planning in 2017 until the end of the study section in April 2022. Detailed planning for the PDSA began in July 2021. I used improvement science to introduce a change and learn about how that change affected a complex system. In Chapter 5, I discuss the implications of what I have learned for the broader project in Pleasa Hills, for my organization, and for me as a technical assistance provider. Pleasa Hills is a mid-size California school district whose leaders and teachers were part of many other streams of work to serve students in this time period. One important part of the backdrop to this PDSA cycle is that the district was navigating the difficulties of a global pandemic during the timeframe of the encounters I describe.

4.1 Plan

In 2017, a colleague and I sat at an airport restaurant with a long wait before our red-eye flights departed. We spoke about our desire for a simple definition of effective teaching that drew on what passionate teachers could work on and get better at together. We came up with nine quality teaching practices we had seen schools work on successfully with their whole staff (Rutledge, 2020). My CTAC colleagues and I looked for patterns in more than a dozen other definitions of effective teaching and spent a year fine tuning our work (Baltimore City Public Schools, 2020; Chicago Public Schools, 2018; Connecticut State Department of Education, 2017; Council of Chief State School Officers, 2011; Danielson, 2009; Lazarev, et al., 2017; Marshall, 2011;

Massachusetts Department of Elementary and Secondary Education, 2018; Marzano et al., 2013; National Board for Professional Teaching Standards, 2014; Newark Public Schools, 2013; New York State United Teachers, 2014; Teaching and Learning Solutions, 2007). My colleagues and I had worked together using many of these rubrics, while others had deep experience using the ones with which I was less familiar. I participated as a stakeholder to create Baltimore's instructional framework, an experience that shaped some of my thinking.

Figure 3 Quality Teaching Practices (Community Training and Assistance Center, 2022)

Over the next three years, we used this framing of teaching in our work in multiple locations. One of the practices is that effective teachers know students *and* content. The emphasis was on the idea that effective teachers don't just get to know students in order to build

relationships, and they don't just get to know students' academic weaknesses…they get to know what students bring to class that shapes their understanding. In addition, an important aspect of teacher effectiveness is content-specific pedagogical knowledge. This idea was inspired by funds of knowledge and the prevalence of prioritizing students' assets over their deficits (Gonzalez & Moll, 2002; Kretzmann & McKnight, 1993; Paek, 2008). While this particular practice overlapped with many related priorities, we had not seen it in action as a primary focus.

My CTAC colleagues and I also made a key distinction between systematic and interpersonal bias by creating separate categories for "counters learning barriers," and "fosters trusting relationships." Gorski (2016) points out the danger of an interpersonal focus on the systemic effects of bias and advocates for equity literacy. The "cult of culture impedes progress toward educational equity and justice" (p. 222) by blurring the diversity among students' experiences and deemphasizing injustice. Our thinking about knowledge of students tried to situate the teacher as an individual actor working to counter systemic marginalization of students. A systematic approach to gaining specific, and not essentialized, knowledge of students potentially lays the groundwork for more transformative collective action by educators and others, which I return to in Chapter 5.

In Pleasa Hills, we led teachers in creating integrated STEM units. Our desire to incorporate student knowledge into the units caused us to add a tool to each unit, which we called a student experience inventory. The prompts that we would add would be constructed to help teachers elicit experiences from students relevant to the specific academic content contained in each unit. We shared the idea with district staff, and they were supportive of the idea.

In order to facilitate the expanded use of the integrated STEM units, a full day of professional development was scheduled for prior to the start of the 2021-22 school year. As the

student experience inventories and related practice of experience bridging were new, a portion of the full day was devoted to training teachers on the purpose and use of the new prompts. The professional development day was divided into six sessions, and one 90-minute session was set aside for student experience inventories. The administrators in the district would receive a similar training one week prior to facilitate their capacity as STEM instructional leaders.

As part of the preparation for both the training and the creation of the inventories, my colleague created four criteria for a student experience inventory prompt. A well-crafted prompt should first be **experience-centered**. We planned to state explicitly that we did not want the prompts to serve as a pre-assessment of student content knowledge, but instead wanted the prompts to give us information about students' lived experiences, especially when they would influence how a student may think about the content. Second, we decided to share that the prompts should be **non-judgmental**. We planned to encourage teachers to emphasize that they were not looking for a "right" answer, and that teachers were to be in the position of learners—learning from the students' responses. We also suggested that quality prompts would be **accessible**. We envisioned encouraging teachers to stress-test their items against all of their students. If they could imagine a single student having no response whatsoever, whether due to disability, characteristics or circumstances—we would encourage revising the prompt. Finally, we wanted prompts that would be **divergent**. Open-ended items that led to many possible answers would yield more valuable information than a closed inventory of experiences that some kids shared and others had not.

4.2 Do

On July 28, 2021, my colleague hosted training for all of the administrators in the district. I participated via video conferencing software. My colleague was in the room with a team of co-facilitators from the district. I facilitated the 90-minute training on student experience inventories.

I began the session showing a video of Luis Moll explaining funds of knowledge and then provided a definition of a student experience inventory. I shared the criteria we prepared and we set the administrators loose to create prompts based on an example integrated STEM unit that they had been working with in other training sessions.

I participated virtually and could not circulate the room observing how the administrators were responding. My colleague texted me pictures of each group of administrators' chart paper as they crafted prompts. I provided real-time feedback based on the criteria. One group wrote, "Tell me about a time you were caught in the rain." I noted the way in which that was likely accessible, as it describes a common local occurrence and almost all students may have had the experience. I also noted that participants posed it in a divergent way, asking for stories, and that it did not have a right answer or call on a particular knowledge base. Another group created the prompt, "Why do you think some clouds rain on you and some don't?" I used this prompt to point out that while it would not require students to possess knowledge to answer, it worked more like a pre-assessment question that would elicit content knowledge and guesses, and less like the kind of prompt that would elicit experiences. I provided real-time feedback to all groups based on their draft prompts.

We used the responses we received from all of the groups in order to refine our offering for the entire district the following week. I finished preparing draft experience inventories for every group of teachers to use, so that they had some model ideas to push their thinking after trying to compose a prompt or two on their own. Further, we customized the training so that each participant

would be crafting or revising prompts for the specific content they would go on to teach during the year.

I convened a group of other trainers and shared slides and talking points so that a version of the training could occur in every room in the district's training plan. I participated virtually in the training of the district's seventh- and eighth-grade science teachers, and facilitated the training a second time, on this occasion helping teachers refine prompts specific to the units for seventh- and eighth-grade.

Our training team debriefed our experiences, and received informal positive feedback regarding the introduction of the practice of experience bridging and the specific tool, student experience inventories, that accompanied the practice. We ensured that all of the units, from Pre-K to Grade 12 (52 units in all) had an embedded student experience inventory. Each school had trained principals and STEM leaders who helped guide the teaching of integrated STEM units in every grade Pre-K to 8 and in the following high school courses: Algebra I and II, Geometry, Biology, Chemistry, and Physics.

4.3 Study

In February of 2022, I set out to learn about what meaning teachers had made from the practice of experience bridging. I discussed the teaching of the integrated STEM units with my colleague and four members of the district staff. I suggested that I wanted a variety of levels of experience and levels of effectiveness, and wanted discussions with teachers who had engaged with the newly created integrated STEM units. They also enlisted the advice of three teachers on special assignment with direct knowledge of which teachers were trying the units in schools.

Together, we compiled a list of 18 teachers with a reputation for thoughtfulness who met my inclusion criteria. Of the 18, five agreed to a conversation. I also learned of two additional teachers through my five initial interviews, leading to a group of seven teachers I interviewed in March and April of 2022.

In this dissertation-in-practice, I posed the question: What meaning do teachers make from the practice of experience bridging? I found that the seven teachers varied in how they used the student experience inventories. Some used the tool very formally to collect responses and bridge experiences and content. Others used it as a reminder to bridge experiences, a practice they already were undertaking. I also posed the question: How do teachers respond to what they learn about students? I further found that each of the seven teachers gained knowledge of students, and some of that knowledge reflected the cultural practices the tool was designed to elicit. Finally, I found that teachers were able to describe a number of ways that students learned, which I refer to as learning mechanisms here. I explain the insights of teachers in the context of the literature around how students learn.

4.3.1 Using student experience inventories

By design, experience bridging necessitates that teachers attune to occurrences in the lives of their students. But not just any experiences—several of the teachers shared how what students shared with them was atypical. Chris explained the difference between her typical get-to-know-students practice and the inventories we provided:

> I would always try to get into their experiences, but not in an organized way. You know, I would…I have warm-up questions and I still have more questions every day that kind of ask them more questions about *them*. But those questions don't always relate to science.

50

They can be kind of random. It's just not as uniform—like we are all going to answer these same questions and we are going to share them with each other. So how do we organize in a way that frames the unit we are about to start? *That* is new.

Alex also sees the inventory as distinct from his typical practice: "The way I see [Student experience inventories] is it is a way for obviously us as teachers to get to know the students around this particular topic." Sam's description of writing prompts underscores that this is a distinct method for learning about experiences:

My biggest aha was how hard it was to write them, right? Because you are trying to keep them very open so that everybody has an opportunity, right? The more narrow you make it, then you prohibit people who don't have prior knowledge…

In each of these quotes, the teachers reveal a fundamental understanding of the original purpose of student experience inventories as a tool to encourage experience bridging.

Chris, Alex, Sam, and Jordan all collected responses from individual students. Terry, Cary, and Ashley did not do so systematically. Ashley, however, describes systematically looking through the addresses of each child to infer something about their housing experience. Terry describes leaving the door open in the morning for students to come share individual stories.

Chris, Alex, Sam, and Jordan were also the only teachers who used the student experience inventory as designed. Terry said she did not recall seeing it, though midway through our conversation she remembered the tool and shared that she had used the prompts, though informally. While Cary's teaching had been the basis for one of the integrated STEM units, he was not teaching from the units as published, and had not seen the student experience inventories. Ashley said she picked and chose from among the unit components, and did not use the student

experience inventories. However, she was familiar with the tools' existence and used experience bridging as part of her teaching.

Terry and Ashley described students individually, offering stories of students by name and provided detail. Chris, Alex, Jordan, and Cary described students generally. Sam did both, going to his car part of the way through our interview to get a physical stack of individual student responses to characterize, while also speaking generally about the experiences of groups of students.

Ashley referred to the student experience inventory prompts as a "prior knowledge piece," similar to how Terry described the student experience inventory prompts as something that "gives me a really good sense of what they are coming in with what knowledge." Sam and Alex had the strongest recollection of the training about using student experience inventories. Sam accurately described the prompts as something that should not "prohibit people [who] don't have prior knowledge" from responding.

The district hired Jordan as a new teacher in October and so she had missed the training. As a result, she described using the prompts without any background. She said that her students found them "a bit remedial," and she struggled to explain why she was asking. She expressed a desire to have them more aligned to the content of the units—suggesting that like Ashley and Terry, she assumed the student experience inventory to be a form of knowledge pre-assessment.

None of the teachers *only* used student experience inventories in order to get to know students. Alex, in particular, described a classroom routine in which he and his partner teacher reserve the beginning of every Monday class to discuss students' weekends. He shared that every student would be listened to if they had something to share, even if it took the full class period. Jordan described administering an opening survey regarding travel, allergies, and pets to each of

her students. Cary described "walking around the room," and "getting to know [each student] as a person, what are their interests, you know, asking questions—letting them know that you care about them as a human being and not just as a student."

Terry expressed that in addition to her "door open in the morning" strategy, she embedded many strategies she had "personally acquired" and put them into place because the district gave her much autonomy. This experience seemed shared across the seven teachers. Therefore, our discussions about their knowledge of students, the effect of that knowledge on their teaching choices, and how students learned is drawn from multiple sources. The teachers draw on what they learned from the tool I introduced, as well as from their methods for getting to know students.

4.3.2 Knowing students' experiences

Student experience inventories are designed for teachers to pose to students based on the specific content of the integrated STEM unit. As a result, the questions teachers posed differed from one another. For a unit centered around combustion, "a lot of them talked about cooking but, like in the class they talked about usually something cultural and then they would get excited about whatever food," according to Chris. She went on to add that another set of students is "always excited to make a drug reference," for which the combustion unit provided good fodder.

Both Jordan and Ashley taught units that included water filtration and described individual students who had past experiences collecting water. Jordan shared, "We used to have to travel, one of them said, I think 10 or 15 miles to go get fresh water, and you know, we even now we still use it really sparingly." Ashley recounted,

> A couple years ago during our water filtration unit—this is one of my favorite stories—we
> were talking about how we clean water, and how do we know water is clean and safe to

use? And one of my boys who actually painted that picture for me one day [points behind her to a painting on the wall]….He was super shy and quiet, and closed in, and it was really hard to get him to feel comfortable or to participate. So we opened up our science notebooks and I had them write to the prompt, and he had this great picture and this great diagram and he had the water colors like on a testing strip, and I praised it when I walked around…when it came time to share with elbow partners first, he readily shared. And the part that really opened it up to the whole class's information was when it came time to share with the entire class, which is voluntary, he stood up and he shared. He knew, because he was an expert from that. And it was really cool, because I don't know that he ever felt like he was an expert and had anything to contribute at that level.

Here Ashley is describing the student as already an expert. The literature suggests there may be more to it than that. Even when a student is an expert, when that expertise is called on by a teacher, it helps the student articulate that knowledge within an academic discipline and allows for the merging of worlds, possibly allowing for deeper understanding (Emdin, 2021, p. 78; Lee & Buxton, 2008, p.124).

Alex recounted teaching a unit on insulation. He hadn't thought of the example at first, but then recalled a class discussion:

Especially the Mexican community that we have around here, you know a lot of their parents are in construction type jobs,…probably three out of four students who answered that day knew what it was because parents had either took them into an attic to work on something or they had insulation lying around their house because their parents use that.

Alex continued thinking about the world of shared work between parents and their children, describing his surprise at "skills that are great that we weren't really expecting 11-, 12-year-olds

to have," and the way in which children can participate with their parents when they work on weekends.

Hobbies (gymnastics, skateboarding, and gaming) all made it into examples. Three teachers used the word "situation," as in "life situation" or "home situation" to imply an underlying experience. Examples of students working jobs, traveling cross country, and having a mother that works evenings were shared by teachers. I also learned of a third-grade student who had survived cancer.

The design of the prompts was intended to help teachers focus on the habitual and regular routines of life: chores, commutes, and the events of daily life that Gonzales, Moll and Amanti (2005) term cultural practices. I heard some about cultural practices, and I also heard about sensational and exceptional stories, shared with the names of students. This included the lengthy walk to clean water, the cross-country road trip, and the student who had survived cancer. I realize that it was not until multiple reviews of the interviews and transcripts before I was able to characterize the relative balance of what was shared—exceptional stories are often more memorable. I discuss how this may play a role in a follow-up investigation in Chapter 5.

When routines were shared, they were often couched in generalities. In an illustrative example, Chris shared, "I have students in my class who are working all night five days a week." Ashley includes, "We have students that come all the way from some of our agricultural fields." These are potentially influential experiences sources for students, but I realized that whether they would be used in that way depended a great deal on how teachers thought about how exactly students learn.

4.3.2.1 Knowing students as "others"

The reason I have chosen mismatch schools as the context for this strategy is because of the particular experience of students in these schools. Therefore the possible examples of "otherizing" that occurred throughout the interviews seemed to be an important part of the data produced, exhibiting how whiteness worked in the context of these schools (Bell, 2021; Gonzalez, Moll, & Amanti, 2005).

I am drawn to note the types of generalizations that the teachers made about the students, whether or not the teacher identifies as white. I, as a white interviewer, opened the door to a set of observations that can be made by any teacher operating in the context of a mismatch school. I have chosen not to identify the speakers here, in part to consider the pattern itself, rather than attempt to parse specific alternate explanations one might imagine for each.

A portion of my theory about how the practice of experience bridging represents a change is that it encourages the kinds of responsive and specific observations about cultural practice that counter broad stereotypes (Gonzalez, Moll, & Amanti, 2005). I posed questions that I thought would uncover such observations, and yet I also elicited generalizations with vague language that may have revealed gaps in the teacher's knowledge of students. Every one of these statements rang very loudly in my ears, though I acknowledge that may be because of my perspective. The statements did not make up a large portion of the transcripts.

One of the statements is a cliché I have heard many times in one version or another. I am not sure if it is intended as a shorthand for a set of insights about the difficulty of the job, but I have found that it usually obscures more than it clarifies: "This is our toughest area of town."

Another statement stood out to me for the word choice: "A really ghetto calorimeter that they engineered…" The use of the word "ghetto" as an adjective to describe the work product of a group of students may have been intended casually, but it sounded jarring to me.

There were also statements that seemed to take demographics as destiny. These three statements filled in gaps in teachers' knowledge of specific students and assumed that ethnicity would be a useful proxy for experience:

Our students are Hispanic and I don't think they, you know, grow up kind of talking about these, you know, ecosystems and things like that as much as other ethnicities or groups might be exposed to that.

You might want to change them for different demographics and be able to pull on different demographic backgrounds to kind of say if this is more of a Middle Eastern community, maybe we could pull more ideas from here.

We have such a unique population here, you know with probably, what, 35% Hispanic, maybe primary Spanish speaking, so anytime we can be on our hands and things like that I think that's really beneficial for those students.

I heard the first comment in part as preliminary, and part of what the teacher was seeking to confirm or reject, but they all still seemed to belong to a pattern of remarks in tension with the spirit of experience bridging. The student experience inventory prompts are designed to render it unnecessary to use ethnicity or race to guess about which students can draw on experiences with manual labor or talk about ecosystems at home.

Two comments I noted seemed to specifically reveal a set of expectations, one on the front and the other at the end of a project:

My students are going to be very far removed from some of these very STEM-focused topics.

For that group, you know, it was fairly successful.

I have added the emphasis in the second comment because that was how I heard it. One can imagine very similar statements supported by data regarding opportunities. The statements still stood out to me as in tension with the project.

In two other cases, I heard statements that did not sound particularly stereotypical, but perhaps because the speaker was self-aware of some additional thoughts that they did not articulate, they used the words "assumption" and "stereotyping" causing me to take notice:

It tends to be our kids that ride the busses in, but that doesn't—that's an assumption on my…

I mean, it is stereotyping them a lot, but it is the working poor. It's, you know, It's a lot of…12% of my students are direct immigrants and then probably 80% are, like 70% would be second generation like their parents came here relatively recently, because it's okay they're young right and most are English language learners some degree between level one and level four.

Finally, there were two lengthy comments that seemed to flatten some perceived cultural differences:

They are just going to have a different view of a lot of concepts. Like I have to teach sex ed, and that might be a very foreign concept to many of them, or just having general conversations about the human body might be something I'm going to have to tiptoe around at first and get them to realize that this is a science class and that we have to still talk about

these things, so that's kind of where my mind first went was, how am I going to have to change my ideas of how I will teach them?

But for like a Middle Eastern community, they might, you know, focus more on just the different types of—because, usually their family are a little more science background. So they might know a little bit more about the chemical breakdown and things like that that go into that. I had a lot of students that already knew about the coagulants that were used. Which I found very interesting, because I didn't expect that at all, and I feel like in a Spanish community they might know more about…things like the different charcoals and different processes that would be filtering the water.

These comments seem to be describing an attempt at recognizing and attempting to accommodate cultural differences—but also left me puzzled about what element of students' experience the teacher thought mattered. In the interview, I tried to uncover more specificity, but was not particularly clear with my response.

The comments obviously differ greatly and some have multiple possible interpretations. However, each shows some level of the type of "otherizing" that is characteristic of mismatch schools. The comments in the aggregate contribute to an underlying concept: Some students have "something cultural," while the world of the school is neutral. Therefore even when a comment about Hispanic families is made by a Hispanic teacher, it sets the group of students on the other side of an imaginary fence from the world of the school. These statements provide some evidence that student experience inventories may be needed to counter the prevailing thinking in schools if they can be shown to work at a larger scale.

4.3.3 Describing learning mechanisms

The essence of the experience bridging strategy may be in what teachers *do differently* with what they learn about students. There may be some benefits in terms of relationship-building even without pedagogical adjustments. However, since the design of the student experience inventory is to surface students' experiences that relate to academic standards—that connection is paramount. Therefore, what I found to be the most valuable set of takeaways from the interviews are the ways teachers spoke about the learning benefits of students' experiences. This answers my second inquiry question: How do teachers respond to what they learn about students? It also further illuminates the meaning they made from the practice of experience bridging.

In the course of the interviews, teachers described what I am characterizing as nine "mechanisms" of learning. From a variety of comments, these are the ways that experience bridging worked. The first four align with how students learn science, and were described by multiple teachers: (1) **building knowledge**, (2) **drawing on student familiarity**, (3) **rapport**, and (4) **changing/using examples**. I also note that the fifth and sixth mechanisms were outliers, each described by a single teacher as an essential part of how learning worked in their class: (5) **class dynamics** and (6) **teacher beliefs**. Several teachers described the seventh and eighth mechanisms, but they give me pause. While (7) **student engagement** (particularly for unusual participants), and what I am calling (8) **no wrong answers**, may have benefits, I can see how these may either hinder or enhance learning. Finally, one teacher mentioned, and another implied, using (9) **inquiry**. I leave inquiry in a category of its own because the two depictions are different enough that I am unsure what to make of it. In the remainder of this section, I present the language teachers used to describe these mechanisms and the connections to the supporting literature on how students learn.

4.3.3.1 Building knowledge

The essence of the experience bridging strategy is to induce students to draw on experiences, including those not typically included in the realm of school, to enable more information in working memory and accelerate learning complex topics (Baddeley, 2017; Emdin, 2021; Hattan & Lupo, 2020; Willingham, 2009). Unlike a strategy in which we "activate prior knowledge," this strategy calls for activating a memory and making new meaning from it.

Alex described it this way:

We give those students [a student experience inventory] question, and it gets their brains going—it gets them thinking about something they don't necessarily know about. And so, you know that wheel starts turning they can come up with their own ideas and we kind of get an idea of what they know where their thoughts are at.

This describes a method for the teacher to understand prior knowledge and serves an exercise to encourage students to prepare for learning by bringing relevant memories forward for use in understanding new information.

Sam exhibited an understanding of the importance of knowledge building to instruction, but did not make the connection to using the inventory to launch it. Sam said, "We did a pre-model with card stock and that really helped their conceptual understanding of run and rise," when describing a unit involving building ramps for buildings compliant with the Americans with Disabilities Act. He continued, "That really got them thinking about it, and then it was cool to have the personal experience..." Ashley explained that "I'm not in charge of the information. That is what it is. I'm not in charge of it. I am in charge of presenting information for them to form their ideas." Chris shared that she often uses direct instruction in 20-30 minute segments to build new

knowledge, but found experience bridging helpful in planning supplemental, high-interest activities that repeat that knowledge.

4.3.3.2 Drawing on student familiarity

Schools can signal that families are an important source of information about academic topics (Gonzalez, Moll, & Amanti, 2005). Teachers can serve as what Emdin (2021) describes as "the embodiment of merging worlds that society has deemed separate who showcases that they are actually deeply connected to each other" (p. 78). For Alex, Ashley, and Jordan, parent expertise catalyzed classroom discussion and activity.

Ashley shares: "The kids in the farms probably have a really good idea about why water is important. They have a really good ideas about the bees and the species of their natural resources, because literally their hands, or their parents' hands, are in that process." Alex drew the parallel between the students whose parents had "taken them into an attic" to the expertise needed around heat transfer.

Jordan described an energy conversation in which a student volunteered that his father worked for Tesla, which "he was able to get everybody kind of talking about it which was really great, while in the next period, it was crickets." In this case, however, she said it did not connect to the content she was trying to teach: "Unfortunately, the downside was it didn't connect to the actual content we were covering." When the student experience inventory prompts pulled on the right experiences, however, Chris described that they worked this way: "It set them up to be more receptive to the information because it kind of proved to them that you have some kind of experience with this topic."

4.3.3.3 Rapport

Sam and Jordan both used the word "rapport" when describing how experience bridging causes learning. Sam described how the student experience inventories functioned this way: "It kind of makes everybody come together, you know, kind of social emotionally before getting into this work, which is important because when you are working with people, you have to build rapport, right?" Sam shared this statement after he described a moment regarding an experience where a student shared building a Lego tower that Sam had himself built with his daughter. He shared a picture. When teachers and students are made aware of specific similarities they share, especially in mismatch schools, dramatic increases in student achievement have been noted (Gehlbach, et al., 2016).

Jordan also shared the connection she perceived between using student experience inventories and establishing rapport:

> A teacher has never asked me what my home language is. They don't ask me those sorts of things, and so I think it initially gave me kind of that connection of oh, maybe she cares more about something other than science. She cares about if I can understand what she is talking about. So I think it really did make that nice connection for them, and I have a really good rapport with everybody, and I think I was very nervous coming with having [substitute taught] before and being a brand new teacher, I was a little nervous about making those connections and it has been really nice that there was that nice connection there.

Neither teacher explicitly connected this rapport to a benefit in learning, but as this is theorized as an element of why students improve performance with racially congruent teachers, it is worth considering this as a potential learning mechanism (Egalite & Kisida, 2018). It may also have

benefits for teacher-student relationships for Black and Latino students, a key in mismatch schools (Gehlbach, et al., 2016).

4.3.3.4 Changing/using examples

The practice of giving examples is an obvious, if understudied, strategy teachers use to help students grasp science concepts (Oliveira & Brown, 2016). Ashley explained, "My belief is that we're a class family and we share, really, but we also respect different experiences. We honor that." This aligns with the first of three parts Lee and Buxton (2008) identify in a framework for equitable science teaching: a classroom that values and respects the knowledge and experience students bring from their home and community environments. The co-creation of examples, built in a respectful way out of inputs from students, represents one part of why they work well.

When attempting to increase the cultural relevance of instruction, examples are often the first thought for teachers. Chris said that the student experience inventories "definitely helped me select examples and videos that would connect with more of [my students]." Jordan described wishing that the prompts had been customized so that we would be "able to kind of pull on different demographic backgrounds" at each school. She expressed the idea that examples customized by demographic group "would really help [me] be able to relate it to them a little bit more." Jordan anticipated that "I expected that I would have to change my perspective of what they would think is a norm or what they would have as a base of knowledge." Alex, in describing the biodiversity unit, shared

> You know as we go through if there were a certain species of animal that maybe everyone knew about or was interested in that gets affected in some way I figure I could use that in the biodiversity talks and kind of focus on that species…

Alex used other examples to connect to students. Still, his thinking demonstrates that a very reasonable use case for the inventories is to help generate examples for use in class.

A second part of why examples work well is not just for the respect they demonstrate for students, but for the specific relevance to the understanding represented in the academic content. Sam shared two examples of using student experiences: a skateboarding hobby and an interest in Legos that emerged in the student experience inventory in a unit called "Rig Up a Ramp," featuring the construction of a ramp suitable for people using wheelchairs. He described the iteration involved in both experiences—skateboarders and Lego builders frequently tinker and repeat and try something different to get what they want. Sam was drawing on the Next Generation Science Standards, which depict learning occurring in three dimensions, including Science and Engineering Practices, simultaneously (NGSS, 2013). Students do not just learn to iterate and use engineering and design generally, but they do so in service of a particular problem—energy transfer. In this unit, what makes the content integrated is that they are also bringing in computational thinking as they use programs to reflect and adjust based on speed data and draw on their mathematical learning of slope. Each of these related topics and disciplinary approaches is mutually reinforcing. When Sam was able to find naturally occurring elements of students' lives in which they acted as engineers do, he helped them have room for more formal thinking about the other aspects of the problem.

4.3.3.5 Class dynamics

"I made it okay for him to take that risk. And because our class dynamics are what they are in any given year, he felt safe enough to share that with his peers." Ashley invokes class dynamics alongside the word "because." She takes direct responsibility for enabling a student to share

something that, in her estimation, contributed to his learning and his sense of his expertise. When pressed to explain what actions she took to create these dynamics, she explained:

> I really lower the filter on right and wrongness in terms of that information…there's no red pens. I don't even react to their sense-making. That is *their* notebook. There's always one or two that are much more ready to volunteer. Hopefully, that shows the classroom environment is a safe space.

Ashley further explains the importance of creating an environment in which students regularly share and update their understandings both out loud and in notebooks: "There is no censure on what they're saying…they can share their misconceptions and I'm not reacting in a negative way." I return to this strategy when I describe "no wrong answers" later, as I think they differ for important reasons.

4.3.3.6 Teacher beliefs

Sam offered an ingredient in learning that was an outlier in the data. He stated the importance of a teacher's belief that students were capable of the academic demands of the curriculum. He described the students of his school, and his belief in them this way: "I love being with them because they can do the work, they really can, but you have to start from a place of belief that they can do it, right? And I think a lot of adults lose that somehow." I have included it because it fit what I was considering as a learning mechanism. I do not have any evidence about what actions Sam or other teachers took based on their beliefs about student capabilities. Certainly beliefs about student capabilities have been shown to influence instructional decisions, and therefore learning (Hattie, 2009; Rubie-Davies, 2007).

4.3.3.7 Student engagement

Chris, Alex, Sam, Terry, Jordan, and Cary described student engagement. For Alex, engagement was a recurrent theme: "It's been pretty interesting and the engagement we're getting out of it." In describing using the student experience inventories, he had engagement at the top of his mind: "Using the experience inventory is when I get information, find out, you know, what students' likes and dislikes are; what truly engages and more than anything, I can use that information…." Therefore, it is not a surprise that engagement shows up again in his description of successful teaching. After learning about the experience students had with games and Minecraft, he put it to use: "Every single student, when we were doing the Minecraft education portion, were locked in to what they were doing, and that was probably the first time, all year you know, we had seen 100% of almost every single class."

Sam mentioned "getting everyone involved." In describing a modified version of a student inventory he created, Cary shared, "at least they're going to be maybe more engaged than they would be." When I pressed Jordan on how she knew students were learning, her explanation, too, turned towards a measure of engagement: "I was actually surprised at how many were willing to stay in like something like sex ed; that they weren't opting out of it."

Chris described engagement most thoroughly, and returned to the idea several times. Engagement was key to her interpretation of the success of the integrated STEM units overall: "I got really good engagement from all of my students and that is not always the case first period; I teach an English Learner Chemistry." Chris, in particular, kept referring to the engagement of students she found particularly difficult to reach as a critical element of how experience bridging caused learning: "I feel like the disadvantaged students who are often hard sells—they liked being asked about their own experiences. You know, did they pass my class? Maybe not. But the

questions at least got them thinking, and I could probably get them to think about science, even, (for a little bit), which is a win for them."

Chris characterized the influence of the experience inventory by emphasizing how it works for a particular group of students that she typically struggled to engage: those learning English as an additional language. She described one class this way:

Half that class is typically non-participants, so they just won't turn in anything and they actually all answered the questions. Maybe a couple of them didn't write anything down, but if I call them, they still told me their experience, and actually the ESL students were the most excited to talk about their own experiences because a lot of them share the same cultural experiences, so that was really enjoyable.

Chris also described experience bridging as valuable for who she described as "introverted, quiet, kids." She said, "I feel like no one makes eye contact with them for a whole day really, you know? And that is their whole goal, is to be unseen, but I think it is refreshing to get some actual quality attention." Terry also saw the value of engaging students she thought were typically less engaged: "They are able to contribute at a level that they feel like they can't in other academic areas so that's always very rewarding."

Given the outsized attention paid to engagement, one may think it is the most important aspect of learning. It may well be an important part of a virtuous cycle in learning, but engagement alone is as likely to foster understanding as to mask misunderstanding—though tasks such as managing the class for safety may become easier (Alexander, et al., 1994; Baddeley, 2017; Landsman & Lewis, 2011; Willingham, 2009).

4.3.3.8 No wrong answers

Chris emphasized that the integrated STEM units, "let [students] succeed without actually having to get the right answer." She further explained, "…they get credit for being an engineer, not for being right, which I think they really enjoy and their grades are looking pretty hot at the end of the first unit and that always makes them feel more positive."

This is an indirect theory of learning, in which students first increase their confidence, which enables them to learn more through some other mechanism, perhaps because of increased participation. However, because cognitive effort is difficult, increased enjoyment alone can also correspond to less learning (Willingham, 2009). Despite the counterintuitive relationship with student success, several teachers mentioned it positively. Sam contributed: "They are like scared that they are going to say something wrong, and I am like there's no wrong answers here, right?" Sam explains that to him, this lowers the effect of a filter, "getting everyone involved, showing them that everyone can be a part of this thing." For Sam, success in the units belonged to anyone who was "just trying stuff out."

Terry also described, "Kids that have it like my Jacklyn, who is struggling with math, you know they come alive and they engage." To Terry, Sam, and Chris, participation is a necessary ingredient for learning. The student experience inventory prompts and the integrated STEM unit itself, by encouraging students to apply science knowledge iteratively, promoted increased participation by not having wrong answers. This, as Chris described, reduced student anxiety: "It's not anxiety-inducing to them; they can't really get that wrong."

I have included this mechanism in a different category from what Ashley described as "class dynamics," even though I suspect that they come from a similar foundation. Ashley described lowering rightness and wrongness as a strategy to enable students to persist in making

meaning based on carefully sequenced activities and opportunities for reflection and metacognition. Meanwhile, Terry, Sam, and Chris, pointed out that sharing experiences didn't have wrong answers, which increased the happiness of students. It may well be that because I had not yet interviewed Ashley, they were describing something similar that I failed to catch. The key distinction that occurs to me reflecting on the answers as a whole is that it is crucial what happens with "wrongness." All of these teachers seem to understand that it is an important element of learning, but it could be troublesome if wrongness ends with the "pretty hot" grades Chris described and nothing further. Ashley's description of the related mechanism implies how wrongness can be embraced by students on the way to new learning.

4.3.3.9 Inquiry

Inquiry belongs in the category of possible learning mechanisms that emerged in my interviews. Sam explicitly identified himself as providing an "inquiry-based approach" to teaching. He shared an example: "I don't frontload them with information…they're going to discover with … a card sort what slope is all about,…then they'll figure out what the formula is by the end of it and I'll say yeah, you guys got it right."

At least one study has found gains in using inquiry for white students (Schneider, et al., 2002). Several meta-analyses show greater effects on science process skills and affinity than knowledge (Hattie, 2009). It may also be the case that the boost in critical thinking attributed to inquiry may be more salient in situations where students had not "previously been encouraged to think in this way," (Hattie, 2009, p.209). Drawing on data across 54 countries, a study finds a negative relation between inquiry and science achievement, and a positive association between inquiry and dispositions such as interest, enjoyment and motivation (Cairns & Areepattamannil, 2019). The mixed picture of the effectiveness of inquiry has many possible explanations. Among

these explanations are that inquiry works best with some academic concepts and not others, or that it works for students in some situations and not others.

Another possible explanation for the mixed picture of effectiveness is that teachers use something broadly called "inquiry" quite differently. Ashley's refrain of "that is not my place" during our interview suggests that she takes a different approach to teaching from Sam that might also be considered under the heading of "inquiry." For Ashley, "Gradually, hopefully, [the students] are reforming their concepts or adjusting and editing the concepts." For Sam, even when he described having students "discover" a formula, he said he pairs it with what he described as "direct instruction." I did not leave my interviews with a clear sense of how any of the teachers in Pleasa Hills define or use inquiry, or whether that is likely to lead to increased learning. It is possible that an effective form of inquiry consists of several of the mechanisms teachers described working in concert.

4.4 Plan, Do, Study Chapter Summary

Pleasa Hills is implementing a district-wide P-12 STEM initiative. A total of 52 integrated STEM units were created and taught by teachers with the help of my organization. Experience bridging is a teacher practice that builds on the specific experiences of students to produce new learning. In order to promote the practice of experience bridging, a tool called a student experience inventory was added to each unit. Teachers and district administrators had 90 minutes of training at the beginning of the year specifically on the addition of this tool.

Seven teachers reflected on getting to know students using multiple strategies. Five of the teachers used the tool specifically, and two other teachers used related practices to elicit specific

experiences for students connected to content. Teachers learned about relevant experiences with cooking, skateboarding, gaming, building Legos, household water use, insulation, tool use, and more that they used in their lessons. Teachers also made some generalizations about students as proxies for when they did not gain specific knowledge.

Teachers described a number of promising learning "mechanisms" at play when they used these experiences. These included drawing on familiarity, building knowledge, establishing rapport, and changing their examples. Two outlying mechanisms that related to learning included creating class dynamics where students can make use of these experiences and a teacher's belief in students' capabilities. Some combination of these mechanisms may be articulating a viable approach to inquiry-based teaching. Teachers also described using the prompts to gain benefits in engagement and to reduce student anxiety about being wrong, which may have a more complicated connection to learning more.

5.0 Learning and Actions

5.1 Discussion

Several teachers in Pleasa Hills Unified School District use a mix of informal and systematic strategies to form impressions of their students. Teachers used a newly introduced tool, student experience inventories, to gain specific and accurate knowledge of students' experiences that directly pertain to STEM content. Teachers can improve science outcomes for students by building on the students' experiences (Bouillion & Gomez, 2001; Calabrese Barton, et al., 2005; Lee & Buxton, 2008; Schneider, et al., 2002). The teachers made sense of experience bridging by expressing a belief that it may have increased learning. This is possible, given that it may have caused students to use experiences in working memory to produce new understanding (Baddeley, 2017; Willingham, 2009). Teachers provided examples of students drawing on their experiences in ways that could have enhanced their learning. More examples were shared illustrating benefits of the inventories as instruments to boost engagement. The presence of a few comments that seemed to "otherize" students indicates that teachers may benefit from thinking of student experiences in a new way.

Sam described *how* exactly learning occurred by sharing the sequence of the student experience inventories, the slope knowledge building inquiry activity, the direct teaching that followed, the guest speaker, and the project that involved building a ramp. However, the learning he described was for the class and not connected to drawing on the experience of any particular student. Ashley, on the other hand, was able to characterize the way in which one student was able to use expertise to build his own understanding of water filtration and that of his classmates. Alex

was also able to describe the excitement and familiarity with tools of a small number of students and the way that led to better design choices in a heat transfer unit.

The most promising learning mechanisms described were the student familiarity, the knowledge building, rapport, and changing examples. Ashley's outlying description of class dynamics, which shared some elements in common with "no wrong answers" may have promise as well. The mechanisms were all described as actually playing a direct role in learning in at least one instance. In drawing on familiarity, however, it is important to note that the two teachers who carefully planned to draw experiences connected to content found them valuable. A student who shared about his father's workplace excited the class, but did not help produce any new learning. Therefore even in cases where one of these learning mechanisms led to learning, that learning was conditional based on the teacher's practice.

In the case of student engagement especially, but also no wrong answers, these mechanisms may have benefits unrelated to learning, such as improving students' disposition towards science or the teacher. However, those benefits could either accentuate or hinder learning.

I keep returning to one captivating phrase that seems to link the mechanisms identified by teachers—Ashley's refrain, "That's not my role." When I asked her what that phrase meant to her, she responded:

> That's not my place…oh, I am not in charge; the information—that's what it is. I'm not in charge of it. I'm in charge of presenting information for them to form their ideas. And I'm in charge of setting up the learning sequence that, hopefully, can give them what they need to adjust their thinking.

Many teachers view themselves as gatekeepers of valuable information. Ashley's perspective intrigued me, even though it seemed contradictory at first glance. To present information or set up

a learning sequence, but not be *in charge* of the information seemed unusual. The implication for experience bridging is that the information exists independent of the teacher, and may already reside with students.

Ashley described this approach to teaching as "really hard in the beginning," suggesting that it requires discipline and is counterintuitive. I wonder if the tool must come with more training about the practice of experience bridging. Drawing from some of these interviews, I can see the contours of the listening, reacting, and learning from students that the practice requires. The combination of describing respect and value for the experiences students bring, along with the specificity that Alex was able to elicit using the prompts may serve as the foundation of another iteration of the tools necessary to promote this promising practice.

When members of the public at large are asked detailed questions about the U.S. education system, they default to a "tangible triad" of actors they hold responsible for all educational outcomes: parents, teachers, and students (Bales, 2010). They tend to explain failure as a lack of caring on the part of one of the actors (e.g., families just don't care), and when pushed on that— will shift the simplistic explanation to another actor (e.g., students don't care these days). This is an overlapping problem with the fact that both members of the public and educators think of student motivation as both an outsized explanation for student learning and a personal trait or choice (Levay et al., 2019).

Research on how science learning actually occurs suggests that motivation plays a role, but motivation as a goal has real weaknesses (Alexander et al., 1994; Baddeley, 2017; Landsman & Lewis, 2011; Willingham, 2009). Teachers and students alike can have an enjoyable shared experience in a class with an entertaining activity. Describing the relief felt when students who never turn anything in showed interest in the student experience inventory is disconcerting. If the

experiences go unused, the act of soliciting them could reinforce the gap between the student and school. Even topics interesting to students used in a school context have the chance to compete with, rather than enhance, learning (Willingham, 2009).

Incorporating experience bridging in the midst of a curricular reform means that participating teachers thought deeply about academic standards. The teachers whose observations about the relevance of academic standards to the lives of students piqued my curiosity did not share this context. The nature of the conversations with teachers in this inquiry assumed the relevance of standards to the lives of the students. Indeed, I directed respondents to provide specific illustrations of these relevant connections. As a result, I do not know about what perceptions the participating teachers might have held with regard to academic standards had I structured a more open-ended inquiry into practice and knowledge of students. This inquiry focused on the meaning teachers made once the district promoted experience bridging.

School districts can send a meaningful signal about the importance of cultural responsiveness—as recognized through changed teaching practice—through the adoption of a practical teaching tool, but it seems they must do so loudly and often. Teachers have many ways of getting to know students, but even those who use other strategies saw the tool we provided as distinct. The insights shared by these teachers will enable future training to distinguish this tool more explicitly from other methods of getting to know students, setting teachers up to use experience bridging.

5.2 Act

In order to determine what actions make sense in the first PDSA cycle, I consider the answers to my inquiry question. What meaning did teachers make from experience bridging? The inventories alone were not enough to provoke thinking aligned with the literature about what may cause learning benefits for students. The training, even in a small amount, seemed to make a difference in terms of teachers' capacity to elicit experiences from students useful in learning. Many teachers have methods for getting to know students. The more the teachers with whom I spoke understood the prompts, the more they saw them as distinct and useful to their practice.

Students responded to the prompts with stories from their lives in ways that teachers can understand. With the exception of the teacher who did not know why she was asking, teachers were able to get widespread participation and collect experiences that they were able to recount. In order to support teachers to characterize this information individually more often, collection tools and techniques would likely be helpful.

It is not clear whether experts in the organizations that promote and advance teaching practice, and leaders in schools and districts perceive this method of getting to know students as having enough potential to warrant emphasis. In order to lay the groundwork for encouraging widespread adoption of this practice, I focused on the impact of the prompts (and the practice) on instruction. I think a framework for the practice will be a logical next step to showcase *how* changed practice improves learning for students. The framework would draw on some of the research that counters an exaggerated sense of the importance of motivation (Levay et al., 2019). It would also tie together some of the most effective learning mechanisms described in the interviews: the role of the practice in knowledge building, drawing on student familiarity, and classroom dynamics that value students' lives.

For the combustion unit, I plan to revise the prompts to emphasize habitual experiences. This may draw teachers away from focusing too heavily on increasing motivation, and more on the knowledge students possess that they may have yet to examine in an academic context. Currently, an item asks students to describe an experience of something going from warm to cold (see Appendix B). I would replace that item with one that draws more explicitly on household experiences with food and water.

In the "Rig Up a Ramp" unit, all of the prompts contain the word ramp (see Appendix C). I would like to draw on a broader sense of students' experiences with inclines and ambulation with family and friends. Prompts that draw on how and with whom students get around in their lives may be better suited to this task.

This is the blueprint, then, for the act portion of the PDSA: enhanced training, modified tools with sharper prompts more ready to use, and the creation of framework to show how the practice works. Some of the suggestions that I received from teachers throughout this process will be simple to enact—and align precisely with the first two elements of this blueprint. Chris and Terry suggested simply making the training available more than once. Sam suggested a fillable form for each of the units. I plan to build on the training given the insights from the interviews. The training did seem to make a difference, even for those who didn't remember it well. Each of the teachers who used even a modified version of the approach seemed to have a positive experience with it. The only exception appeared to be the new teacher, who missed the training entirely. Revised student experience inventories will appear in the units disseminated nationally, and accompanying training materials will be necessary as part of the dissemination strategy.

A second PDSA cycle would be more effective if it were timed to better coincide with the implementation of a single unit, which last six-eight weeks. If the training for the student

experience inventory tool were provided at the same time as training on experience bridging, teachers would be more deeply aware of how what they were being asked to do could result in learning. This training could directly precede the teaching of the units. I also plan to pepper the training with examples and illustrations drawn from the insights of the vanguard teachers.

5.3 Next Steps

With one 90-minute training and the insertion of a one-page tool into an innovative curriculum unit, multiple teachers were able to alter their practice. The group was not representative, and so the proof of concept does not extend further than that. However, the observations and reactions of the seven teachers provide substantive data for revision for another PDSA cycle that could coincide with a more formal study.

A subsequent study of experience bridging will be necessary to determine if the practice adds value to the experience of students in mismatch schools. I propose an experimental study of the practice. In this study, teachers are grouped at the time of the training, and for which data is collected during and immediately after the teaching of the unit. The perspectives of students in both treatment and control classrooms would also add insight. A key element of this future study could investigate the benefits for teachers of systematic approaches to learning about student experiences. It is possible that more sensational and exceptional experiences are more noticeable or memorable for teachers than routine cultural practices, and are more likely to be used. Does using a student experience inventory alter the balance of what teachers use in instruction, and does it make a difference?

This study could be part of a mid-phase version of the federal grant promoting educational innovation, which would bring together multiple districts and implementation sites using the integrated STEM units alongside an expanded site-based STEM Instructional Leadership Team structure, which could provide ongoing support to participating teachers.

As the practice is refined and we learn more, there is an opportunity for collective action to make a more transformative difference. I limited my second inquiry question to how teachers responded to what they learned in the context of their teaching, but broader responses are possible. Considering how the systematic exclusion of students' experiences in academic contexts might be countered, other than individually, is beyond the scope of this inquiry.

5.4 Reflections

I reflect on change from the vantage point of someone providing technical assistance for a national organization. The schools and districts with which I work are often compelled to receive my support. I reflect on what my presence brought to the data itself—what kinds of examples may have been included or omitted based on what others perceive about what I will want to hear. For example, I think invoking a "tough" neighborhood is intended to convey what is assumed to be a shared understanding of how teaching students who have experienced poverty is different from standard depictions of schools in the United States. I was not always clear that my motivation in this project was to encourage thinking about how the specific experiences affect learning, even those experiences *associated* with poverty—and to consider them in a non-judgmental way. I consider all of my interpretations as a white man from elsewhere imported into a community to "help" a school serving mostly Black and/or Latino families. I'm also aware that the racial

composition of my colleagues, and the type of organization of which I am a part, will play a role in the kind of peek I get into the thinking of the seven teachers generous enough to share their insights with me. There is somewhat of an information asymmetry when I work with teachers, because while after I credentialize myself they are aware I understand the professional norms of teaching, many teachers are unaware of how technical assistance providers spend their days. To a small degree, I perceive that teachers, including some of those I interviewed, want to demonstrate their expertise to me. Part of that demonstration seems to be showcasing a lack of naïveté. In the United States, my perception is that many teachers use language that equates teaching students of color with toughness. This may account for some of the characterizations shared with me.

Attempting to address racism in U.S. schools is what I stated is my intention. My organization's mission is to address the root causes of poverty. While there is a great deal of overlap in how my personal mission and my organization's mission play out in practice, they are not the same. My perspective shapes how I interpret conversations and evidence—and how I conceive of projects. I reflect on my sustained professional interest in pursuing a more just educational system for Black children in U.S. schools in particular. This has often led to projects involving making schools and districts more just for other students of color, LGBTQ students, and students identified as disabled.

In Pleasa Hills, this takes the form of learning about and responding to the science educational needs of a diverse group of predominantly Latino students. I am reflecting on the specifics of this case to take four more lessons with me: as a scholar-practitioner, as a change agent, and as a technical assistance provider.

Everything is more nuanced than I expect. I began this project thinking of using the tool we created as a binary: you either did use it or you didn't. Instead, I heard about seven gradations

of implementation—and I suspect there would have continued to be more had I searched for additional interviewees. The leader of the last school district in which I taught once said to me, "I don't believe in fidelity of implementation, I believe in forces." I laughed at the time, but have come to see wisdom in the statement. Fidelity is unlikely to occur in implementation, especially when my contributions are among several and competing with other influences on teacher decision-making. Each of its users will modify any change I introduce, and I will be better off thinking at the outset about changes that survive such adaptation and retain value for students.

Professional development really does have to be ongoing. I can repeat the cliché in my sleep: professional development works best when it is job-embedded and ongoing. When I get to work in a district or school, a different set of considerations takes over. For what do we have time? What are all the needs? The calendar fills with content we know to be critical and new ideas find a smaller share of time, in this case, that led to light recollection of the substance of the training. When the interview reminded them of the purpose of the prompts, multiple teachers nearly expressed glee at the chance to go back and make use of them. I have been on countless panels lately, and the easiest way to launch head nodding is to talk about how tired and stretched thin teachers are. And so we often talk ourselves out of taking up their valuable time. Yet teachers like support—and one of my takeaways is that even a tiny amount makes a difference.

Well-crafted questions are worth the effort. I built a whole teaching strategy predicated on asking relatively simple questions of students. I have spent the last decade encouraging schools, districts, and states to listen to every stakeholder systematically. How? Through questions of all types: survey questions, interview protocols, and focus group prompts. And yet the rigorous attention to detail that this PDSA cycle required caused me to think differently about how to orient

a listener and be precise, non-judgmental, accessible, divergent, and experience-centered with my questions. I reflect on the necessity of following one's own criteria.

In addition to crafting questions, I reflect on the benefits of listening to the responses. A common issue I observe in classrooms is teachers who step on their best questions. By that I mean that they ask a very thought-provoking question, and before any of us have a chance to hear a student's response, the teacher rephrases the question to reduce its cognitive demand. I realize that I do similar things in interviews. In part, that is because my usual role as a technical assistance provider often calls for collaboration and I respond with enthusiasm to ideas shared by interviewees to build common ground. There is also a benefit, it seems, to staying silent a bit longer and allowing a respondent to take an answer wherever they see fit, without my nudges. That seems to provide respect to the person's ideas to whom I am listening and may also strengthen a relationship while expanding the range of ideas in my work.

Principles of improvement science inform adaptive leadership. Early in the program, the tools associated with a PDSA seemed eerily familiar. After all, I had led many schools through the same root cause analysis and fishbone tools that I was now being asked to use. Then the idea of adaptive and technical change came up, and it felt like the content of the program stood in a great tension (Heifetz & Laurie, 1997). Adaptive change required action and lived in complexity, while PDSA seemed like a tool for technical and predictable change. In the years since hearing about adaptive change in this academic program, I have heard it constantly in my work. How was this (old) idea suddenly everywhere? I reflect on what has changed: my role and responsibilities within projects. As I work more with leaders, I see more of my work as adaptive in nature. Yet the discipline of research and scholarship brings rigor to my thinking. I conclude by reflecting on the

83

shared space between deep, purposeful listening and the kind of leadership for social change I admire and wish to emulate.

5.5 Implications

School and district leaders can consider the experience of these seven Pleasa Hills teachers as they seek specific strategies to increase learning through cultural responsiveness. Students, specifically those attending mismatch schools, would benefit from drawing on their own experiences to build new knowledge. These students will learn more from teachers who build rapport and use relevant examples. Experience bridging is a practice that can encourage all of those learning mechanisms. Teachers are often the audience for an enormous set of intended reforms and changes. The preparation of student experience inventory prompts can occur by others. However, I would recommend professional learning about the purpose and use of the prompts and the experience bridging practice.

For educators, academics, and activists who have tried to change students' experience in the most highly segregated U. S. schools, the past year in Pleasa Hills offers a glimpse of some of what can occur when a strategy for cultural responsiveness is deeply embedded in curricular reform. This was not an anti-bias training or even an approach that attempted to walk through the front door with an asset-based view of students' lives. The approach takes for granted that all people have culture and all people have cultural practices. Those cultural practices are a vital source of potential learning and interpersonal connection. Experience bridging will not eliminate the existence of mismatch schools, but it could improve learning for the students who attend them.

Appendix A Interview Protocol

Inquiry Questions	Protocol Questions
What meaning do teachers make from the practice of experience bridging? How do teachers respond to what they learn about students?	I am interested in learning about how you get to know students, especially for the integrated STEM unit you are teaching. Can you tell me about your experience with the unit this year?
	There was a set of prompts for students with the label "Student Experience Inventory." What is something you remember about the training to use those prompts? What is something else you remember?
	Tell me about how you normally teach [combustion].
	How did you plan to use the inventory?
	What were you hoping would happen?
	How did students respond to the prompts?
	What happened that you didn't expect?
	What about your practice did you change after using the student experience inventory?
	How does it compare to the last time you taught [combustion]?
	Often, the prompts generate information about the routines of students, like about how they get from place to place or what they do around meals. You had prompts about a fireplace, for instance, or heating something up. However, sometimes teachers learn about things students have done that might set students apart and make them feel like an expert on a topic, like having been to a museum. How does that compare to your experiences?
	What did you already know about students' experiences?
	How had you learned that?
	I am interested in learning about how you get to know students, especially for the integrated STEM unit you are teaching. Can you tell me about your experience with the unit this year?
	How do you think students feel about your class after this unit? How do you know that?

	How do you think your students feel about you after this unit? How do you know that?
	How did the unit end up? What did the students produce? What role did the prompts play? What does using these prompts do for student learning?
	What else should I know?

Note that topics and examples (e.g., [combustion]) were changed based on the units taught by the interviewee.

Appendix B Student Experience Inventory for "Convert with Combustion" Unit

Student Experience Inventory

      Teachers can use the following prompts with students prior to the beginning of the unit or early in the unit in order to learn about students' experiences that relate to the unit. Teachers can make informed instructional decisions based on this learning, enabling tailored opportunities for students to make their own meaning.

Student Prompts

- Describe something that you have seen burning (for example, have you witnessed a campfire, or have you seen a fire in a fireplace, or your latest action hero being blown up in a movie).

- Describe an experience of something going from warm to cold.

- What methods or objects have you used to heat something up?

- Name something that is useful. Name something that is not useful.

- Describe an experiment that you've done either at home or at school

Aligned Learnings

- Responses to the first item provide insight into students' experiences with combustion reactions. (HS-PS1-2, HS-PS3-3)

- Responses to the second and third items provide insight into students' experiences with heat flow. (HS-PS3-4)

- Responses to the fourth item provide insight into students' experiences with deciding if something is useful/relevant to a specific need. (HS-PS3-3, HS-PS3-4)

- Responses to the fifth item provide insight into students' experiences with experimental design. (HS-PS3-4)

Appendix C Student Experience Inventory for "Rig Up a Ramp" Unit

Student Experience Inventory

Teachers can use the following prompts with students prior to the beginning of the unit or early in the unit in order to learn about students' experiences that relate to the unit. Teachers can make informed instructional decisions based on this learning, enabling tailored opportunities for students to make their own meaning.

Student Prompts

- How have you seen people using a ramp to help them in their lives?

- What have you noticed about ramps that are taller compared to those that are shorter?

- What made a ramp that you have seen or used easier or more difficult to use?

Aligned Learnings

- Responses to this item provide insight into students' experiences with ramps.

- Responses to this item provide insight into students' experiences with height being a function of length. A-REI.3.1

- Responses to this item provide insight into students' experiences with how slope affects work required. A-CED.2

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