CHAPTER 1

PREPARING TEACHERS FOR DEEPER LEARNING

The best employers the world over will be looking for the most competent, most creative, and most innovative people on the face of the earth and will be willing to pay them top dollar for their services. . . . Beyond [strong skills in English, mathematics, technology, and science], candidates will have to be comfortable with ideas and abstractions, good at both analysis and synthesis, creative and innovative, self-disciplined and well organized, able to learn very quickly and work well as a member of a team and have the flexibility to adapt quickly to frequent changes in the labor market as the shifts in the economy become ever faster and more dramatic.

—New Commission on the Skills of the American Workforce, 2007

[At Bank Street] it's about . . . giving children the tools to be thinkers and to understand big ideas and make connections and be communicators and work collaboratively, or work independently, and have a multifaceted approach to learning and really enjoy it. It seems powerful that you're preparing children to be lifelong learners and be curious. It seems really applicable to life in the twenty-first century, when you're not going to need to rely on a foundation of facts, but more about how to manage the information that is accessible and how to determine for yourself what is interesting, how to ask questions, and guide your investigations.

—A Bank Street College teacher candidate, 2016

In a world where knowledge and new technologies are growing at an exponential rate, the economy is changing rapidly, and education matters more than ever for individual and societal success, there is an ever-increasing need for well-prepared teachers who can help all children learn for the complex world they are entering.

In the last decade, mountains of reports have been written in countries around the world about the need for more powerful learning focused on the demands of life, work, and citizenship in the twenty-first century. The process of managing decisions and solving social and scientific problems in contemporary democracies is growing ever more complex. In the early 1900s, when our current school system was designed, only 5 percent of jobs required specialized knowledge and skill; today about 70 percent

of jobs are "knowledge work" positions that require the ability to acquire and use specialized information, manage nonroutine tasks, and employ advanced technologies. Between 1980 and 2015, the number of jobs requiring high levels of interpersonal, critical thinking, management, and communication skills increased by 83 percent, while the number depending on manual labor or routine skills increased by only 18 percent, and there were many more of the former types of jobs than the latter.[1]

We see this shift as well in the proliferation of difficult decisions that families and communities grapple with every day, and in the increasingly complicated issues that citizens are asked to understand and consider in ballot measures and in elections of public officials. Thriving in such conditions of social and political complexity also requires the ability to acquire and use specialized information, manage nonroutine tasks, and employ advanced technologies, as well as navigate the increased diversity of people and ideas encountered every day.

Furthermore, the nature of work, life, and citizenship will continue to change ever more rapidly. The World Economic Forum report *The Future of Jobs, 2016*, notes that in many industries and countries, the most in-demand occupations or specialties did not exist ten years ago, and the pace of change is set to accelerate.[2] The challenges of a rapidly changing economy are made more complex by global migration, highly visible inequalities, and the increasingly dramatic effects of phenomena like climate change and ever more world-threatening conflicts. This means that twenty-first-century communities and citizens need to forge constructive, democratic relationships and fair resource-sharing strategies in a shrinking and interdependent world.

Thus, the new mission of schools is to prepare students for jobs and ways of life that do not yet exist, using knowledge that has not yet been discovered, creating ideas and solutions for products and problems that have not yet been identified, using technologies that have not yet been invented. Employers and civic leaders have increasingly called for K–12 schools to fulfill this new mission by equipping graduates with "twenty-first-century skills"—the abilities to engage in high-level reasoning, transfer knowledge and solve problems, and understand content and how to apply it.[3] Going even further, young people must know how to research new information and ideas, analyze and evaluate that information, and synthesize it and produce new analyses, ideas, solutions, and products. In doing so, they need to be able to collaborate effectively with others and communicate their ideas in many forms, assess and improve their own work, and be resourceful and persevering in the face of social, political, and scientific challenges.

To meet these demands, virtually all states have enacted more ambitious standards for learning tied to new curriculum expectations and assessments. These standards expect students to master more challenging subject-matter content as well as to think critically, create more sophisticated products, and solve complex problems, rather than merely to perform routine tasks. The standards press for deeper understanding of academic content and for students' ability to apply that content, while acquiring and integrating new knowledge on their own. Learning to do these things requires far more than rote recall of facts or application of rules and algorithms.

Since it is now widely accepted that teacher quality is a critical component of a successful education, it is clear that much of the burden of meeting these new demands will fall on teachers. Yet teachers must do more than adapt their instruction to fulfill the broad vision of a twenty-first-century education; they are also being asked to achieve these goals for *all* children, not just a small minority who have traditionally been siphoned off into gifted and talented programs or advanced courses. At the same time, the very diverse group of students in today's schools has more wide-ranging needs than ever before. Because schools have both expanded the range of students they educate and included more of them in mainstream classrooms, teachers encounter more students with language and learning differences. And as child poverty has grown to the point where a majority of children in public schools now come from low-income families, educators must support learning while also helping children deal with homelessness, food insecurity, and lack of medical care, as well as frequent violence in their communities.[4] Teachers in many communities need to work as professors of disciplinary content, facilitators of individual learning, assessors and diagnosticians, counselors, social workers, and community resource managers.[5]

The need for such teachers is especially great where schools are the critical lifelines for students' success. It may not take much training to teach children who are already skillful learners; who are supported by affluent, highly educated parents whose language and culture match those of the school; and who can afford tutors, summer enrichment programs, and trips to museums and vacations around the world to supplement instruction. But these outside-of-school supports are the exception rather than the rule in most public schools today.

If much is being asked of teachers, then much is also being asked of teacher preparation programs, and in this complex and multifaceted context, the field of teacher education faces a dual challenge. Teachers who are unable to teach in ways consistent with the development of twenty-first-century skills will not succeed in providing their students with the deep,

engaging, flexible, and broadly applicable learning experiences associated with those skills. Moreover, teachers who lack the skills to reach *all* students—including students without rich supplementary learning opportunities and supports outside of schools—will not be adequately prepared to meet the goals of twenty-first-century education. Therefore, a vital question confronts teacher educators amid the rapid changes in society and schooling: How can we prepare those who enter the profession to *teach for deeper learning*—and, in so doing, to *teach for equity and social justice* as well?

This book describes seven programs of teacher education that have organized themselves to meet the dual challenge of teacher preparation for both deeper learning and equity. There is much to be learned from these programs, as well as from others like them around the country that are engaged in such work. The programs differ from one another considerably in their surface features—such as size, sector, and type of institution—but they share a deep structure shaped by their common understandings of how people learn and their common commitments to a just society that focus them squarely on preparing teachers to teach diverse learners equitably.

The seven programs' various structures and practices provide useful and concrete examples of how a diverse set of institutions is preparing teachers to meet the demands of twenty-first-century schooling; understanding their various features could be helpful for improving many other programs. However, it is the deep structure they share—their coherent grounding in how children and adults learn and develop, with an insistence that the opportunities for such development be available to each and every student and teacher—that carries the most profound lessons about what it takes to prepare teachers to enable deeper learning for all children.

A FRAMEWORK FOR UNDERSTANDING TEACHER PREPARATION FOR DEEPER LEARNING

Deeper learning, as we elaborate more in this section, is both a new and an old idea, rooted in the findings of research on learning over the past century, yet also aligned with the needs of twenty-first-century students. Classrooms where deeper learning is the goal are ones in which challenging academic content is paired with engaging, experiential, and innovative learning experiences. Such experiences equip students with the skills to find, analyze, and apply knowledge in new and emerging contexts and situations, and prepare them for college, work, civic participation in a democratic society, and lifelong learning in a fast-changing and information-rich world.

What does it mean to teach in ways that prepare children and young people for the twenty-first century? And what does it mean to prepare teachers to teach in these ways? Answering these questions requires us, first, to consider what outcomes we seek—what we expect today's students to know and be able to do. We then must determine what learning experiences can lead to these outcomes, drawing on the rich understanding of learning that has developed over more than a hundred years of research and practice. Next, we must identify what teaching practices produce those learning experiences. Finally, we must examine what kinds of teacher development opportunities enable teachers to engage in these practices, developing the knowledge, skills, and dispositions necessary to bring twenty-first-century learning to all students.

What Educational Outcomes Do We Seek?

Three kinds of student outcomes are embedded in these new expectations and are widely viewed as critically important for contemporary education. These encompass cognitive abilities, social and emotional capacities, and the moral and ethical dimensions of a purposeful life.

The first set of outcomes pertains to *what students can do* with what they know and learn: they must be able to understand concepts deeply enough and have sufficiently developed inquiry skills that they can seek out, understand, and combine knowledge in many ways, and can apply what they know to novel, complex problems in different real-world situations. This means that they need to learn in ways that make content knowledge generative and transferable.

The second set of outcomes pertains to *how* young people approach what they are learning and doing—the set of co-cognitive skills (sometimes called social and emotional skills) that support successful work that is both individual and collective. These include abilities to organize and manage one's own work, to take and use feedback to continually improve it, to persevere and be resilient in the face of setbacks or obstacles, and to communicate and collaborate effectively with many people in multiple ways. These outcomes depend on building students' capacities for self-regulatory and executive functioning, their personal and social awareness and responsibility, and positive mind-sets and beliefs about self and school.[6]

The third set of outcomes pertains to *why* students are learning. We want young people to develop a sense of purpose and personal efficacy that derives from equitable treatment and is powered by a sense of social justice focused on how to improve one's own life and that of others in the community. Taking into account the *why* of learning means paying attention, not only to the

needs and interests that students bring to school, but also to how schooling relates to who they are, where they come from, where they want to go in life, and what systemic challenges they may face along the way.

These capacities are increasingly essential to a full, rich, contributing life that also allows for engagement in the modern economy and society. Strong evidence has emerged that opportunities to engage in activities focused on these interrelated aspects of student development result in deeper understanding of core academic content, higher graduation rates, and higher rates of postsecondary enrollment and persistence.[7]

What Type of Learning Leads to These Outcomes?

Clearly, the new demands posed by the rapid expansion of knowledge in today's world and the growing demand for high-level reasoning, communication, and interpersonal skills cannot be met through passive, rote-oriented learning focused on basic skills and memorization of disconnected facts. Neither can they be met with provincial thinking or an inability to engage new ideas and diverse people.

Realizing today's ambitious goals requires dramatically different approaches to learning than those that dominated for much of the twentieth century. Those approaches were shaped by behaviorist theories associated with early work in educational psychology, particularly that of Edward L. Thorndike. In this view, learning was conceptualized as acquiring a predetermined body of knowledge and skills that were transmitted by others, primarily through a process of conditioning. Stimulus-response theory, for example, conceives of the learner as passive and assumes that if a learner's correct response is rewarded, he or she is more likely to repeat the response—that is, to learn.

Although "deeper learning" has gained currency recently as necessary for acquiring twenty-first-century skills, it is not a new type of learning. The underlying ideas harken back to conceptions of education propounded by Jean-Jacques Rousseau in the eighteenth century, Friedrich Froebel in the nineteenth, and John Dewey at the turn of the twentieth century, among others. All of these philosopher educators argued for experiential, reflective forms of education that enable critical thinking and production and expression of ideas, rather than rote learning. Dewey argued that, in contrast to memorizing secondhand information, learning is essentially an active mental process of problem solving and making sense of one's experience through action. Dewey conceived of learning as purposeful, complex, emergent, and inherently social. For Dewey, such learning equips students to perceive and to act upon the world in ever-growing ways, matching their

purposes and goals to the materials and situations at hand to navigate real problems and issues.

Others also came to this concept of learning. Close observers of children, such as Maria Montessori in the early 1900s and Jean Piaget and Lev Vygotsky in the 1930s, devoted themselves to understanding how children develop cognitively and concluded that engagement within a social environment is a key to learning. Montessori created methods to help children work both together and independently through practical play and hands-on tasks to reach deeper levels of understanding. She believed that carefully observing children and addressing individual needs and interests would help each child reach his or her potential.[7] Piaget viewed children as independent learners and as having an inherent ability to make sense of the environment they observe and experience, including relationships with others. He noted that children think in fundamentally different ways from adults and their thinking *develops* as they make sense of experiences. Vygotsky saw social experiences and mental processes as deeply connected and interrelated. He concluded that learning and problem solving occur in the interactions *between* a learner and others. Social participation, he argued, does far more than provide external stimulation for thinking; rather, it is actually part of one's own thought process and can help a child develop, as well as express, ideas.[8]

Research on learning experienced a cognitive revolution in the mid-twentieth century, in which scholars from psychology, linguistics, and anthropology challenged behaviorism with studies examining the mind and how it made meaning, work that became the field of cognitive science. In later decades, learning research took another new turn with the emergence of sociocultural theories as researchers such as Roland Tharp and Michael Cole showed that social and cultural contexts determine learning and that knowledge emerges through social and cultural activity during community participation.[9]

Psychologists such as Kenneth Clark and, later, Claude Steele examined the relationship between social contexts and cognition and advanced our understanding of how learning and development can be negatively influenced by stereotypes and deficit views of minoritized cultures. They were joined by researchers like Geneva Gay, Gloria Ladson-Billings, and Carol Lee in discovering protective factors such as affirmation, removal of stereotype threat, and cultural, racial, or ethnic socialization, which can positively shape features of the larger ecology in which learners are situated.[10]

Together, this work gives us a complex and nuanced picture of learning. We know that learning occurs as people try to make meaning of the

world and use what they have learned in new situations. Learning occurs through the social interaction of people, problems, ideas, and tools within specific contexts as people get feedback from their actions and about their ideas. It is culturally embedded, developed both neurologically and psychologically through relationships and experiences. That is, each experience influences the possibilities and frameworks for future learning. Usable learning requires conceptual understanding that can be transferred to new and novel situations, and it emphasizes the meaning that students bring to their experiences and the essential role their lives and communities play in providing context, value, and resources for the learning process. Importantly, the work on the relationship between culture and learning has revealed, in the words of Harvard researcher Jal Mehta, "the pluralism of different approaches to learning deeply," as "in every religious or ethnic community there is some tradition through which people learn deeply."[11]

Modern learning theory also emphasizes the situated and social nature of meaning-making, by which "mind, behavior, perception and action are wholly integrated."[12] The science of learning indicates that humans learn more effectively when they are not anxious, fearful, or distracted by other pressing concerns; when the learning is connected to their prior knowledge and experience; when they are actively engaged; and when they have a reason to care about the content they are learning and can use it to deepen their understanding and to solve real questions or problems.

Finally, people's beliefs or perceptions about intelligence and ability—both generally and in relation to themselves personally—affect their cognitive functioning and learning. Identity development is a key part of learning—how people see themselves as learners and where they feel competent matter for where they exert effort and what they believe they can do.

How Can Teaching Practices Create Deeper Learning Opportunities?

For teachers to create these kinds of deeper learning experiences for children, they need to learn a set of principles and pedagogies that will allow them to bring these opportunities alive in the blooming, buzzing classrooms they will create and manage. The National Academy of Sciences summary, *How People Learn*, drew on the learning sciences to identify three fundamental and well-established principles of learning that are particularly important to guide teaching practices:[13]

1. *Students come to the classroom with prior knowledge that must be addressed if teaching is to be effective*. If what they know and believe is not engaged, learners may fail to grasp the new concepts and information

that are taught, or they may learn them for purposes of a test but not be able to apply them elsewhere, reverting to their preconceptions outside the classroom. This means that teachers must understand what students are thinking and how to connect with their prior knowledge if they are to ensure real learning. Children's developmental and learning trajectories vary as a product of the interactions of their attributes and social contexts as well as in their development over time.[14] When students from a variety of different cultural contexts and language backgrounds come to school with different experiences, they present distinct preconceptions and knowledge bases that teachers must learn about and consider in designing instruction.

Teachers who are successful with all learners must have tools and practices to learn about their students' different ways of learning, prior experiences and knowledge, and cultural and linguistic capital. Teachers can learn about the strengths and needs of individual students through techniques such as regular check-ins and class meetings, conferencing, journaling, and classroom surveys, and by meeting with parents as authentic partners to learn about their students' lives and learning strategies and to create more coherent, well-reinforced learning opportunities between home and school. These moves can help create environments where students feel culturally respected as well as emotionally and intellectually safe. Many studies have documented the positive effects of practices like these that foster developmentally informed, meaningful relationships among students, parents, and staff.[15]

2. *Students need to organize and use knowledge conceptually if they are to apply it beyond the classroom.* To develop competence in an area of inquiry, students must not only acquire a deep foundation of factual knowledge, they must also understand facts and ideas in the context of a conceptual framework or schema and organize knowledge in ways that draw connections among ideas and facilitate retrieval and application. This means that teachers must be able to structure the material to be learned in ways that help students fit it into a conceptual map and teach it in ways that allow application and transfer to new situations.

The teaching strategies that allow students to do this integrate core concepts derived from the structure of the discipline with the modes of inquiry specific to the discipline—such as scientific investigation, mathematical modeling, literary analysis, historical inquiry, or artistic performance. Teachers carefully select materials and offer explanations to provide a sense of the big ideas and how they are connected, structuring hands-on inquiries that engage students actively

in using the material to make sense of how concepts build on each other and fit together. Teachers use multiple and varied representations of key concepts that make them vivid and accessible, stimulating applications and problem solving of increasing complexity as students' understanding of the domain grows.

3. *Students learn more effectively if they understand how they learn and how to manage their own learning*. A "metacognitive" approach to instruction can help students learn to take control of their own learning by having a set of learning strategies, defining their own learning goals, and monitoring their progress in achieving them. Teachers need to know how to help students self-assess their understanding and how they best approach learning.

   Through modeling and coaching, teachers can teach students how to use a range of learning strategies, including the ability to predict outcomes, to create explanations to improve understanding, to note when they are confused so as to seek clarification, to activate background knowledge, to plan ahead, and to apportion their time and attention. Successful teachers provide carefully designed "scaffolds" to help students take each step in the learning journey with appropriate assistance, and these vary for different students depending on their learning needs, approaches, and prior knowledge.[16]

   Teachers can support metacognition when they use multiple forms of assessment that reveal aspects of students' understanding for the purpose of guiding instruction and student revisions of their work. These include self- and peer assessments that allow students to evaluate work against criteria or a rubric, as well as exhibitions and other occasions for students to receive feedback and revise their work. Providing time and opportunity for formal reflection and discussion about students' insights builds their metacognitive capacity as well. Teachers can encourage students to elaborate, question, and self-explain, which deepens their understanding of *how* to learn as well as of *what* they are learning.

In sum, effective teaching activates students' prior knowledge, connects to their experiences, scaffolds the learning process, is adaptive to students' needs, incorporates applications to real-world situations, and helps students reflect on and improve their own learning processes. In classrooms teaching effectively for deeper learning, an observer is likely to see students' work on the walls—as well as images and materials—drawing connections to students' lives, experiences, and cultures and tapping learners' passions,

identities, and motivations. The teacher creates a positive environment by communicating respect and support for each student, offering culturally responsive examples and materials, and supporting each student's sense of belonging by acknowledging his or her talents, work, and contributions in a variety of ways. The observer sees students engaged in rich instructional conversations that allow them to ask questions, explain their ideas, and probe the ideas of others.

The observer is also likely to see engagement of learners in challenging, inquiry-oriented learning tasks that involve disciplined inquiry and experimentation, using aspects of choice to support student agency. These tasks—which may be structured as projects or problem-based learning—demand analysis, synthesis, and evaluation of ideas in order to produce new products, ideas, or solutions. They are often collaborative, with clear student roles that students have been taught to undertake, designed with multiple entry points and enacted with supportive guidance, scaffolding, and feedback. Students have opportunities to revise their work in response to feedback; this helps them to develop a growth mind-set and confidence in their capacity to improve their competence. They bring an inquiring mind to their work, along with a set of cognitive and psychological tools that allows them to find and use resources—including each other—to figure things out and to solve problems that are motivating and meaningful to them.

HOW CAN PROGRAMS PREPARE TEACHERS TO TEACH FOR DEEPER LEARNING?

If teachers are to be able to teach in ways that reflect the outcomes we desire for students, which are informed by historical and current understanding of the workings of learning and are consistent with practices that can support deeper learning, then teacher preparation has a high bar to meet. Teachers must learn how to teach ambitious subject matter in ways that support higher-order thinking skills and students' abilities to transfer and apply their knowledge. They must learn to teach students who learn in different ways and whose prior knowledge reflects diverse cultural and linguistic traditions and experiences. They must learn to help students acquire basic skills while they also learn to invent and inquire. They must learn to teach language and literacy skills across the curriculum. They must learn to work effectively with parents and colleagues to assemble the resources and motivations needed to help children make progress.

Helping teachers learn to practice in these ways requires both coursework and clinical work that, together, help teachers understand students

and how they learn while also developing skills and tools to organize and manage these kinds of rich learning experiences. Behind the scenes, teachers must also be keen diagnosticians and deeply reflective about what they see happening with student learning each day, so that they can respond to the dynamic process of learning for understanding.

Because students are not standardized and teaching is not routine, learning cannot be achieved through a single set of activities that presume uniformity in human experiences and approaches to learning, as scientific managers have hoped since the late nineteenth century. In a world of human diversity and cognitive complexity, teaching that aims at deep learning requires sophisticated judgments about how and what different students are learning, what gaps in their understanding need to be addressed, what experiences will allow them to connect what they know to what they need to know, and what instructional adaptations will be needed to ensure that they can reach common goals.[17]

In fact, the more common the expectations for achievement are across a wide range of students, the more personalized must be the teaching strategies for reaching these goals. If teaching is uniform, assuming a single mode and pace of learning, learners who start at different places and learn in different ways will end with equally diverse levels of achievement. This is currently the case in the United States, where the range in school outcomes is much wider than in many other countries.[18] As John Dewey noted in 1929 in his *Sources of a Science of Education,* the better prepared teachers are, the more their practice becomes differentiated in response to the needs of individual students, rather than routinized:

> Command of scientific methods and systematized subject matter liberates individuals; it enables them to see new problems, devise new procedures, and in general makes for diversification rather than for set uniformity. . . . This knowledge and understanding render (the teacher's) practice more intelligent, more flexible, and better adapted to deal effectively with concrete phenomena of practice. . . . Seeing more relations, he sees more possibilities, more opportunities. His ability to judge being enriched, he has a wider range of alternatives to select from in dealing with individual situations.[19]

If teachers are to figure out how to help learners who begin and proceed differently ultimately reach similarly challenging outcomes, they will need to be able to engage in thoughtful experimentation, insightful interpretation of complex events, and knowledge-rich reflection, combined

with a wide repertoire of strategies that allows them to continuously adjust their teaching based on student outcomes. This means that teachers must become "adaptive experts" who can not only use routines that help them work with greater efficiency, but also use their knowledge to innovate where routines are not enough—to figure out what the problems are when students are not learning and to adapt materials, teaching strategies, or supports accordingly.[20] Adaptive experts also know how to continually expand their expertise, knowledge, and competencies as needed to meet new challenges. Preparing teachers who can learn *from* teaching, as well as learn *for* teaching, is one of the key challenges for teacher education today.[21]

What Experiences and Processes Prepare Teachers for Deeper Learning?

As we have discussed here, the ideas that Dewey advanced a hundred years ago—and which many researchers and progressive educators have been working on since—have emerged continually in multiple theoretical frameworks that describe teaching, learning, and teacher preparation, culminating in the current calls for deeper learning for a twenty-first-century education for all students. We call on these and other related frameworks in the chapters that follow to illuminate the work of the programs we studied. Building on knowledge from the learning sciences, we define teaching for deeper learning as having the following five dimensions, which also create goals for teaching:

1. *Learning that is developmentally grounded and personalized.* Learning experiences build on prior knowledge and experience, and account for learners' active construction of new knowledge. Learning connects to who students are as well as to what they already know, attending to both cognitive and socioemotional realms, and school tasks are designed to be scaffolded according to students' needs, intrinsically interesting based on their experiences, and appropriate to their level of development.
2. *Learning that is contextualized.* Learning experiences recognize that people develop as they use the tools and symbols of their cultural contexts to make sense of the world and their experiences in it. Learning builds on students' personal, cultural, and linguistic knowledge, and is embedded in meaningful contexts and applications. Learning is connected to students' experiences and is based on a deep understanding of these contexts for development as well as ongoing communication and connection with parents, caregivers, communities, and the world beyond school.

3. *Learning that is applied and transferred.* Learning experiences enable students to apply and transfer content knowledge to novel and complex problems, with abstract and theoretical ideas tightly connected to real-world problems and settings through challenging, authentic activities that promote mastery learning and critical thinking. Clear standards and performance feedback, including the use of both formative and summative performance-based assessments, promote complex cognitive development.
4. *Learning that occurs in productive communities of practice.* Learning is an active, interactive, constructive, and iterative process. Well-designed and well-tended social interactions allow students to support or scaffold one another's learning, combining their different knowledge and experiences into the collective knowledge and experience of the learning community, and helping students to move from peripheral to core participation in subject-matter learning connected to real-world activities. School and classroom communities are built on an ethic of caring, offering supports for social/emotional development, trusting relationships, and restorative practices to create suitable environments for student learning.
5. *Learning that is equitable and oriented to social justice.* Learning experiences are designed to meet diverse students' needs, to reach all students, and to teach them well. All students have access to rich, supportive curriculum experiences that acknowledge and incorporate their social locations and "status" in the larger society, and that are constructed with an awareness of race, class, gender, and other social characteristics that shape student experiences. Teachers consider students' unique identities as strengths and resources; they link social justice values to principles of learning and development by working explicitly to ensure that all students are supported, taking a critical stance, and avoiding deficit thinking.

These features of deeper learning experiences echo Dewey's approach to pedagogy and that of the progressive educators over the past century. Because of his view of students as active, social beings who bring their own purposes to learning, Dewey devised an approach to schooling that provided engaging experiences for students, leading to deep content knowledge, understanding, and an ongoing disposition toward openness to new learning, all consistent with what he saw as preparation for a full life in a democratic society. Dewey's picture of engaged learning also included

teachers, who would develop curricula and manage new types of schools, working together across classrooms and disciplines to produce powerful and meaningful learning.

Like the other key features that define teacher preparation's alignment with deeper learning, the prioritization of equity in access to deeper learning is not new. In addition to being embedded in the concepts and practices advocated by Dewey and progressive educators over the past century, there is also a long tradition of support for deeper learning experiences in the Black community. Historian James Anderson has documented that teachers in post–Civil War African American schools incorporated the culture and experiences of their students into their curriculum and their instruction. They used pedagogy that encouraged students to question what they read and to engage in critical thinking and problem solving. They allowed students to work in small groups.[22] These early African American schools were using what scholars now term culturally responsive teaching and a multicultural curriculum, as well as other instructional practices that are culturally congruent for African American students.[23]

Moreover, early in the twentieth century, W. E. B. DuBois and his colleagues in the NAACP argued for a liberal arts curriculum for African American students. Since that time, civil rights groups have battled against persistent efforts to emphasize lower-level, skills-based curriculum in schools serving student of color.[24] More recently, these ideas have taken the form of culturally relevant pedagogy, which Geneva Gay has described as the multidimensional, empowering, and transformative use of "cultural knowledge, prior experiences, frame of reference, and performance styles of ethnically diverse students to make learning more relevant to and effective for them. . . . It teaches to and through strengths of the students. It is culturally validating and affirming."[25] These ideas are also evidenced in the efforts to ground instruction in schools serving Latinx students and other students of color in the rich "funds of knowledge" and cultural practices that students bring into classrooms.[26]

However, today's school and classroom practices are mostly incompatible with the conditions under which students can achieve the ambitious twenty-first-century outcomes through deeper learning. The reality is that most schools and teaching practices remain organized along industrial, rational, top-down lines first laid out by scientific managers at the beginning of the twentieth century.[27] Dedicated to management, measurement, and efficiency, these reformers promulgated the practices of what Tyack and Cuban have called the "basic grammar of schooling," a system heavily

influenced by behavioral theories of learning.[28] From this perspective, the teacher's job is to transmit knowledge in small chunks, provide constant rewards or reinforcement, monitor (test) whether chunks of knowledge have been learned, and reteach whatever was missed. Passive, rote-oriented learning focused on basic skills and memorization of disconnected facts has been and remains dominant practice today. Tradition and standardization trump new ideas and diversity. Even today, in the wake of both the cognitive revolution and the recognition of sociocultural influences on learning, schooling continues to follow industrial-era models. Indeed, in an era of mass, high-stakes assessments, top-down control, and the simplistic learning associated with test preparation, it seems that the theories and practices of the early 1900s are alive and well in the early 2000s.

Additionally, to the extent that deeper learning experiences are found in some elementary and secondary schools, they are largely restricted to the most advantaged students within and across communities. Despite increasing awareness of the critical need for such learning, instruction for lower-income children and students of color has been more focused on developing "basic skills"—in part because of the pressures that have accompanied test-based accountability policies.[29] Yet "deeper learning," as the Alliance for Excellent Education put it, "will do little for our economy and democracy unless it is accessible to every student."[30]

To remedy this unevenness, and to meet the challenge of providing deeper learning for all students, these practices must be extended to schools that reflect the growing diversity, and increasing needs, of the US public school population. In public schools today, students of color are in the majority,[31] more than half come from low-income families,[32] almost 10 percent are English language learners,[33] and over 13 percent receive services under the federal Individuals with Disabilities Education Act (IDEA).[34] Accordingly, equity must be prioritized and a social justice orientation adopted to implement deeper learning practices at scale and for all students.

THIS STUDY AND THIS BOOK

In the ensuing chapters, we describe how seven programs are creating and evolving ways to prepare future teachers for twenty-first-century student learning. We examine these programs through the lens of contemporary learning sciences, and we focus on the ways that their values and practices align with the five dimensions of deeper learning, as well as the ways they create the opportunities and experiences such learning requires.

In our research, we asked both how teacher candidates learn to provide these kinds of opportunities and experiences for children, and how the programs offer these kinds of opportunities for the candidates themselves. We also sought to understand the implications of the work of these programs for the creation of policy and practice that can expand and support efforts at preparing teachers for deeper learning and equity.

The programs, spread across the country from New York to California and from Milwaukee to southern Texas, are in public and private institutions of higher education, operate at the undergraduate and graduate levels, and range in size from small to very large. They include recently launched innovative alternatives as well as long-standing models of teacher education that reflect a century's worth of progressive practice. These are the sites of the seven programs:

- Alverno College, Milwaukee, WI
- Bank Street College of Education, New York, NY
- High Tech High's Intern Program, San Diego, CA
- Montclair State University, Montclair, NJ
- San Francisco's Teacher Residency, in collaboration with the University of San Francisco and Stanford University in San Francisco, CA
- Trinity University, San Antonio, TX
- University of Colorado, Denver, CO

To identify these sites, our research team started by asking experts in the field of teacher preparation, as well as those who have experience working with new teachers, to nominate teacher preparation programs aligned with the principles of deeper learning we have articulated. The team then carried out an iterative process of background research on nominated programs to narrow down possible sites, looking at evidence about the program's outcomes as well as its practices. The final step was to consider geographic and program diversity. We wanted a sample of cases that included a cross-section of program types and locations so that teacher educators and policy makers could find multiple routes of access into this work.

We examined these programs through interviews with participants, observations of their practices in courses and schools, surveys of graduates, and document review. (See appendix A for a summary of the methodology.) In the rest of the book, we describe the themes that emerged from these intensive studies, along with the practices we discovered that support

candidates in learning to teach for deeper learning. One of the key insights from this work is how the pedagogies candidates experience in their own courses and clinical work themselves model deeper learning strategies, and how teacher educators engage in their own forms of inquiry and deeper learning to create such programs.

Chapters 2 through 4 describe the challenges all of the programs face and the basic features they have created to meet these challenges. Chapter 2 discusses the dilemmas of preparing teachers for deeper learning, describes each of the programs in brief, and identifies some of the key commonalities we discovered across the programs. Chapters 3 and 4 identify the core curricula and key practices we found across programs that support teacher candidates' learning of deeper learning pedagogy.

Chapters 5 through 9 dig into the details of how these programs are aligned with each of the five dimensions of teaching deeper learning: learning that is developmentally grounded and personalized (chapter 5); learning that is contextualized (chapter 6); learning that is applied and transferred (chapter 7); learning in productive communities of practice (chapter 8); and learning that is equitable and oriented to social justice (chapter 9). They show how the teacher candidates teach for deeper learning and describe how they learned to teach that way.

The final two chapters turn to the broader concerns of institutional structures and practices, and the types of policies that would be needed to support such teacher preparation at scale. In chapter 10, we describe the institutional supports the programs have created to enable these kinds of highly focused, clinically intense programs, including their values, leadership, allocation of resources, and partnerships with K–12 schools and districts. In chapter 11, we offer a summary and conclusions about the critical features of program design, as well as the policy levers and supports needed for scaling this kind of preparation so that it is available to all teachers entering our schools.

To launch our account of these remarkable programs, we offer this description of one teacher education course embedded in the San Francisco Teacher Residency program, a partnership of the San Francisco Unified School District, the United Educators of San Francisco, Stanford University, and the University of San Francisco. The program, which prepares residents for urban classrooms in the city's highest-need schools, is focused on deeper learning for all children, enabled by candidates' commitment to equity and social justice and the sophisticated skills they learn to enact that commitment.

Deeper Learning in Action: Collaboration and Interdisciplinary, Inquiry-Based Learning

As the University of San Francisco Curriculum & Instruction (C&I) class begins late on this Tuesday afternoon, there's an air of anticipation among the twelve students in the room—all of them teacher candidates in the San Francisco Teacher Residency program. Today is a special day: it's one of two classes all year in which the math and science C&I courses are combined for a class session focused on interdisciplinary learning.

The lesson is designed to engage the math and science students in a hands-on interdisciplinary activity in which the teacher candidates work together on an example of a math/science inquiry-based task: in this case, figuring out what affects the period of a pendulum. The instructor, Laura Hodder, introduces the lesson by very simply stating, "I want you to figure out how this works," after which she shows a short video of pendulum waves. The room falls silent as the teacher candidates focus on the graceful movements of weights on strings moving through various patterns in a circle, a sort of dance. As Laura engages the students in a brief discussion of potential explanations for the pendulum wave, they are intrigued and want to figure this out.

Laura, the science instructor, and Nathan, the math instructor, explicitly model for their students how to set up strong collaboration practices for their students. They review the norms for this activity—reminding students that they should ask each other questions and that everyone must participate—and then explain that each group's goal for today is to figure out what variables affect the swinging of a pendulum. Students are divided into three groups of four, with two math and two science candidates in each group. Two-thirds of the class are teachers of color, and three-quarters are women. Each member of the group is assigned a role card, which describes the responsibilities for the role: facilitator, resource specialist, measurement expert, data recorder.

This strategy for organizing group work is also taught in the Stanford Teacher Education Program—the other university partner—as part of a course on complex instruction, a research-based approach to collaborative learning developed, piloted, studied, and widely disseminated by Elizabeth Cohen and Rachel Lotan.[35]

The students spend the next hour or so developing and testing their hypotheses. In Group 1, a student suggests a hypothesis: "As the string gets longer, everything gets slower." Others follow. After the group decides on which hypothesis to test, the students decide how to measure the variable. One student says that they should "use the timer to measure the time it takes for a washer to go from one side and back." A math teacher candidate says that they should measure the swinging of the washer as many times as possible so that the measure is more accurate. A science candidate responds that "gravity is constant and air friction is small," and therefore she doesn't anticipate that the swinging pendulum will slow down with additional swings.

(continues)

Nathan and Laura circulate around the classroom, observing and asking questions of the groups. In Group 2, the students hypothesize that as mass increases, the period between the swings will decrease. Even though Laura knows that this group's hypothesis is incorrect, she shows no signs of doubt to the students and has them proceed to test their hypothesis.

Group 3 is testing their hypothesis that as mass increases, the period between the swings will decrease. They decide to place the pencil with the washer and string between two tables to reduce any friction that might be caused by the rubbing of the table. One student holds a protractor to ensure that they measure from the same angle for each of the group's observations; another student times each swing; a third student watches the string and tells the timer when to start and stop timing, and a fourth student creates a table and records each of the observations. All the students are engaged and collaboratively solving how to most accurately test their hypothesis.

Group 2, which is testing their hypothesis of whether mass contributes to the period, is done collecting its observations and begins to graph the data. The group discusses what should go on each axis and the scale. Laura asks the group, "What did you find?" One student responds that they found that "as mass increases, the time increases, and the period decreases." Laura asks, "So I'm curious if you believe your data." The students say they do. Laura follows with, "What if I told you that you discovered a new law of physics?" The students laugh when they realize that Laura is pointing out that their data are flawed. Laura refocuses the group and says, "My question is, do you believe in your data, or do you believe there are other variables that you have not accounted for that suggest that you have not discovered a new law of physics?" The students begin discussing the variables that they did not account for. For example, one math candidate says, "The angle could have been off because of human error, but that is why we averaged multiple observations to help factor for human error." The group decides to retest their hypothesis, and brainstorm ways to make their measurements more accurate.

After the activity, Laura leads the students in a debrief in which she explains, "This is your opportunity to think about the lesson not only as students, but as teachers." To aid in more structured reflection, each group is given a worksheet that asks questions about how this lesson's content, as well as disciplinary practices and pedagogy, is divided between math and science. As groups reflect, they identify the different content applied in this lesson, such as units for math, scientific method for science, hypothesis. Students continue and begin to realize that much of the content overlaps. One group starts writing down the middle of the sheet (on the line dividing math and science), clearly understanding the overlap, or commonality, between the two disciplines. For example, one group discusses that equations model relationships (which may be more "science-y"), but they are also fundamental to math. After class, Laura shares that one of the major goals of this lesson is to break down the stereotypes that each of the disciplines has about the other—so that, for example, science students can see that "math can be messy."

The final hour of the two-and-a-half-hour class is focused on teacher collaboration. Nathan and Laura provide an example of a math and science lesson that they

collaboratively created to teach the Fibonacci sequence and the golden ratio, and then ask students to partner with a member of the other discipline to develop their own lesson together. The math/science teacher pairs engage in rich and challenging brainstorming sessions. A science teacher pulls out the Next Generation Science Standards for her seventh-grade science students, and the math teacher takes a look and shares how the math standards might overlap. One math/science pair, who had recently interviewed together at a middle school to teach math and science as a team, shared with their tablemates the interdisciplinary lesson they had developed for their demonstration lesson: an experiment to determine the area of human skin by wrapping a student in paper.

Another math/science pair developed a lesson on functions from both a mathematic and a scientific perspective, using an inquiry-based approach, in which students analyze factors influencing the number of fish in a pond. The lesson would require students to analyze how the number of fish might go up or down depending on a number of variables, such as the time of year and whether it was fishing season, and to recognize trends and make predictions.

The brainstorm session forces the math and science teacher candidates to grapple with the challenges of interdisciplinary lessons. One student notes that it is challenging to ensure that they are not just creating a "strong math lesson with weak science content" (such as only using the scientific process) or a "strong science lesson with weak math content." But the activity also succeeds in breaking down barriers between the two cohorts of teachers and enables them to identify the similarities between the disciplines. A conversation between a math teacher and a science teacher in response to the question "Why do we teach math/ science?" captures some of their learning:

Math teacher: To make sense of problems in the real world.

Science teacher: I feel like I could say the same thing about science. What about math makes it so important to learn?

Math teacher: So that students can reason abstractly, and quantitatively . . . that's one of the reasons we teach math. Math builds problem-solving skills, such as what steps do you use to solve a problem, practicing logic . . . these are life skills.

Science teacher: In science, we are trying to answer questions, make sense of things. We see a lot of similarities with math . . . taking an approach and being able to apply it to a lot of other circumstances in life . . . being able to look at all the things you observed and be able to see patterns from that, leading to higher-level thinking. I think that science helps to make sense of the real world around you. Something really important about science is learning how to use the scientific method, so if I can't figure out the answer to a problem, I have an approach that if something happened, I could try to re-create it and figure out what caused the problem, or at least eliminate things that didn't cause the problem.

Math teacher: Math does a similar thing: we propose questions, and we hypothesize.

The class plunged teachers into the type of intellectually challenging, inquiry-based science lesson they will eventually construct for their own students, and—through example—showed them how to scaffold learning and deepen the inquiry using productive questions, evidence-based collaborative learning models, and opportunities for reflection. And with these inquiries and reflections, teaching careers for reflective, inquiring teachers are launched. The remainder of this book explores how such teachers learn to do what they do.