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.