

# Rethinking Learning: What the Interdisciplinary Science Tells Us

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Theories of learning developed in education and psychology for the past 100 years are woefully inadequate to support the design of schools and classrooms that foster deep learning and equity. Needed is learning theory that can guide us in creating schools and classrooms where deep learning occurs, where learners' full selves are engaged, and that disrupt existing patterns of inequality and oppression. In this article, we build on recent research in education, neuroscience, psychology, and anthropology to articulate a theory of learning that has the potential to move us toward that goal. We elaborate four key principles of learning: (1) learning is rooted in evolutionary, biological, and neurological systems; (2) learning is integrated with other developmental processes whereby the whole child (emotion, identity, cognition) must be taken into account; (3) learning is shaped in culturally organized practice across people's lives; and (4) learning is experienced as embodied and coordinated through social interaction. Taken together, these principles help us understand learning in a way that foregrounds the range of community and cultural experiences people have throughout the life course and across the multiple settings of life and accounts for learning as set within systems of injustice.

**Keywords:** cognitive processes/development; diversity; equity; learning environments; learning processes/strategies; mixed methods

Understanding learning has been a core task of psychology and education for over 100 years. How we theorize the nature of learning has direct implications for the ways we teach, how we arrange classrooms and other learning settings, and how we organize schools and institutions of learning, from preschool to higher education and beyond. Given heightened concerns about the deep structures of racial inequality in our schools (Love, 2019), as well as the increasing mismatch between how schools teach and the ways young people learn (Darling-Hammond, 2010), attending to how we theorize learning is highly consequential. Put simply, we cannot create schools with more equitable learning outcomes without learning theory that supports us in understanding why existing approaches to teaching and learning are not working to move toward equity. We need learning theory that can guide us in creating schools and classrooms where deep and equitable learning occurs, where all learners' full selves are engaged, and where existing patterns of inequality and oppression are disrupted.

Recent interdisciplinary sciences of learning research (Nasir et al., 2020) provides important insights into the social and cultural nature of learning and can be encapsulated by the RISE

principles, in which learning is viewed as follows: (1) Rooted in evolutionary, biological, and neurological systems; (2) Integrated with other developmental processes whereby the whole child (emotion, identity, cognition) must be taken into account; (3) Shaped in culturally organized practice across people's lives; and (4) Experienced as embodied and coordinated through social interaction. This essay elaborates these four principles, drawing on scholarship and findings from the recently published *Handbook on the Cultural Foundations of Learning* (Nasir et al., 2020) as well as other scholarship in the field. Key to our argument is that these principles put the cultural nature of learning at the center, and in doing so, help us understand learning in a way that foregrounds the range of community and cultural experiences people have throughout the life course and across the multiple settings of life, and accounts for these sociocultural processes in learning as set within (not apart from) systems of

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injustice (Esmonde & Booker, 2016; Peele-Eady & Moje, 2020; Rosado-May et al., 2020; Warren et al., 2020).

Importantly, we recognize that the forces that continue to reproduce inequitable systems, structures, and access in education include more than simply how we conceptualize learning. The forces that shape schooling are deeply political in nature at the local, state, and federal levels, and schools themselves are politicized institutions. This is evident in our contemporary moment as well as over historical time. In the late 1950s, whole school districts were shut down post the 1954 desegregation order, as Whites in power elected to have no public schooling at all rather than integrate (McGee, 2021). The standards-based accountability movement in the 1990s and 2000s was also highly politicized, whereby the states and the federal government focused on equity outputs in the form of student standardized test scores by subgroups rather than on equity inputs, such as the growing funding gaps in public education (Darling-Hammond, 2010). Today, we are seeing an ideological attack on equity efforts in schools and districts in many states with the demonization of critical race theory, resulting in state laws prohibiting teachers in many states from teaching with an honest lens on history (Sawchuk, 2021; Wong, 2021). There is no doubt that political forces are critical determinants and limitations of what happens in schools.

However, learning theory is an important instantiation of some of the ideological beliefs that also play out in the political arena—for instance, theories that view intelligence as fixed also tend to see it as a property of Whiteness (Lee, Nasir, et al., 2020). Thus, it is a critical undertaking to ensure that our theories of learning align with our equity goals. Beyond that, we must also galvanize the political will to align our systems with these theories of learning.

## Learning Theory and the Design of Instruction

Scholars have identified three waves of learning theories with different framing assumptions (Greeno, 1998). Each provided lenses that foreground some learning phenomena and background others, often with problematic neglect. In the 1940s to 1950s, behaviorism reigned—Thorndike’s classical conditioning conceived of learning as resulting from associations formed between stimuli and responses; associations (“habits”) are strengthened or weakened by the nature and frequency of stimulus-response pairings. In Skinner’s operant conditioning, humans are shaped to act in particular ways according to schedules of reinforcement and punishment of the consequences of their actions. The 1960s and 1970s provided cognitivism; humans were modeled as active minds employing processes of constructing, storing, retrieving, and modifying symbolic representations of information. In the 1990s, sociocultural theory rendered learning as transformations of participation and identity, coupling learning “how to know and do” with learning “how to be.”

Each of these frameworks has spawned distinctive pedagogical approaches (e.g., consider “skills training” and “project-based learning”) with attendant approaches to the structures of classrooms and to the relationships between teachers and students. From a behaviorist perspective, learning is the accumulation of

facts and skills, learned through processes of reinforcement (e.g., behavior management charts). The teacher’s job is to provide information and reinforce its retrieval. From a cognitivist perspective, learning is best cultivated by active exploration in the service of real-world tasks (e.g., project-based learning), and teaching young people how to learn is critical to them developing the habits of mind to manage their own learning. A sociocultural perspective would further suggest attention to the social context of teaching and learning, sensitivity to questions of belonging, bias, and inclusion, and respect for the range of “repertoires of practice” (Gutiérrez & Rogoff, 2003) that students bring to the classroom and a focus on the social routines and connections that support learning. Each framing and approach contributes partial truths; human beliefs and behaviors are shaped by patterns of feedback, people do actively make sense of and construct representations of the world, and they do participate as embodied beings in culturally situated activity systems. Needed is a theory of learning that integrates these insights (Lee, 2017), and one that supports us in understanding and reimagining the current oppressive systems of education and settings of learning.

One recent effort at such an integration has been from the Science of Learning and Development Alliance (Cantor et al., 2018; Darling-Hammond et al., 2020; Osher et al., 2018). This collaborative has integrated findings from multiple disciplines to support a complex perspective that views learning as cutting across cognitive, socioemotional, identity, and social dimensions. Similarly, recent work on deeper learning seeks to understand the conditions that bring about conceptually rich learning (Darling-Hammond & Oakes, 2019; Mehta & Fine, 2019). We seek to build on and expand that important work here, in two ways. First, we illuminate how learning is fundamentally cultural, not simply as an additive layer (viz., “the cultural context of learning”), but at each and every level, cultural processes interact with learning—from the biological and neurological mechanisms to systems of power and ideology. Second, we highlight that understanding and theorizing learning in this way not only provides better science but also critically contributes to understanding and remediating racial and other forms of educational inequality.

It is critical that any theory of learning be equipped to support the education of a diverse student body (by which we mean students of various racial/ethnic groups, including those differently abled and those with nonconforming gender identities) in the context of a segregated and inequitable society. Too often, classrooms reflect a commitment to cultural hierarchies where diverse ways of being, knowing, and doing are viewed as deviant and necessarily inferior (Annamma & Booker, 2020; Spencer et al., 2020). This dynamic draws on and perpetuates deficit perspectives and reproduces inequalities throughout systems of education (Dixon-Roman et al., 2020; Howard, 2020). Classroom instruction is also driven by constrained notions of what it means to learn in the disciplines, drawing hard lines between learning in and out of school, and narrowed versions of what counts as disciplinary learning (Nasir et al., 2006). For instance, Vakil (2020) documents the differences in learning outcomes in computer science when approached instrumentally as a technical task of learning to code versus as a sociotechnical activity rooted in specific contexts and communities. Broadening what counts

as relevant to learning, attending to whose experience is taken up in schools in the disciplines, and supporting a nuanced understanding of race and marginalization creates the possibility for expansive spaces for new learning to happen (Ladson-Billings, 2009; Love, 2019).

### **Building Blocks of a Contemporary Theory of Learning**

Needed is a theory of learning that draws on cutting-edge science, and which supports us in opening up spaces for potential and providing an expansive experience for learners. Such a learning theory rests on several key propositions:

#### *Learning Is Rooted in Evolutionary, Biological, and Neurological Systems*

The first proposition roots our understanding of learning in the evolutionary, biological, and neurological systems through which it takes shape. Cultural processes are central to each of these systems. Specifically, while evolution has been historically conceptualized as the way biological organisms change over generations (by chance and by necessity), more contemporary perspectives view evolution as both the evolution of biological organism, and also the evolution of the institutional and cultural niches in which that organism operates (Packer & Cole, 2020; Turner, 2000), and how these intersect. From this perspective, culture is the medium through which humans adapt to varying conditions of life with the attending impacts within and across the time scales of human biological systems. To be human is to learn, because learning is an inherently adaptive process.

Human adaptability is underscored by evidence from the neurosciences, which finds that not only are human brains malleable, but the brain is also quite social, in being wired to learn from implicit and observational stimuli (Lee, Meltzoff, & Kuhl, 2020). Furthermore, the social brain “expects” and is modified by social interaction. Studies show that language learning, for example, is profoundly influenced by social others in the child’s context. While very young children have the capacity to learn any language, such learning has a critical period, and once the brain adapts to the language(s) that have developed, closing off synapses and eliminating myelination, learning a new language is much more difficult (Lee, Meltzoff, & Kuhl 2020). Social input is key and interacts with biological processes to produce learning. In fact, without social and cultural experience, the brain does not develop normally. And brain development and cultural experience influence one another recursively (Lee, Meltzoff, & Kuhl, 2020).

Learning is also enhanced or impeded by emotion. In one study with very young children, findings showed that babies responded selectively to situations with emotional valence, skillfully imitating (and choosing not to imitate) in order to avoid incurring observed anger on the part of an adult (Lee, Meltzoff, & Kuhl, 2020). Studies with adolescents similarly showed the intertwining of emotion, learning, and brain function (Immordino-Yang, 2016). Specifically, research has shown that “the brain network that supports social-emotional aspects of personal memory, future-oriented thinking, and conceptual

understanding deactivates during task-oriented focus” (Immordino-Yang, 2016, p. 211). What this means for learning is that it is crucial for adolescents to have non-task-oriented time, that is exploratory, interest-driven, and reflective in order to facilitate their emotional resilience and investment in learning.

Another telling example of the intertwining of culture and biology in development is the learning of students diagnosed with learning disabilities (Artiles et al., 2020). There is clearly a biological aspect of many types of learning disabilities, having to do with particular brain characteristics, and yet the learning of students with disabilities is situated within the cultural space of classrooms, and set within institutions (schools, districts) with rules, norms, and logics. Such systems diagnose disabilities and prescribe teaching and learning practices to which students are exposed—practices that have tended to reinforce racial hierarchies and ableism. For example, privileged parents sometimes push to have their children diagnosed to attain school services for their children. At the same time, children of color are disproportionately diagnosed with disabilities, with school personnel too often conflating disabilities with behavioral issues and denying students opportunities to take advanced coursework (Annamma & Booker, 2020; Artiles et al., 2020). Thus, systems of power shape the learning experiences of students and how diagnoses of disabilities interact with those experiences.

These points underscore how learning is a pervasive and fundamentally human activity that arises out of our biological need to be connected to social others and to adapt to the environment. Our brains are hardwired to learn implicitly and observationally from others, and to do so from a place of emotional connection. Furthermore, culture and biology interact in multiple and consequential ways (Lee, 2010). Expanding our understandings and conceptions of the diversity of kinds of competencies that matter is essential to an expanded view of human learning and development.

If we took this principle seriously, schools and classrooms would prioritize connection, would provide opportunities for authentic explorations and interest-driven learning, would attend to the racism and ableism built into our systems and institutions, and would practice radical and consequential inclusion.

#### *Learning Is Integrated With Other Developmental Processes Whereby the Whole Child Across Developmental Domains Must Be Considered*

Learning is also integrated with a range of developmental domains, including cognitive, social, emotional, and identity processes. Furthermore, development in these domains is constituted by individuals’ participations in a range of different and overlapping cultural practices (Rogoff, 2003; Saxe, 1991; Spencer et al., 2020). And importantly, membership in marginalized gender, racial/ethnic, disability status, language proficiency, and immigration status groups can mean that one must manage environments that are not set up to meet one’s developmental needs and are designed to reinforce marginalization by not meeting developmental needs (Spencer et al., 2020). For example, scholars have noted the conundrum facing Black boys during adolescence; precisely when adolescents have developmental needs for competence and autonomy, care and community, and a sense of

identity and place in the world, they are too often treated in schools with suspicion, as the “other,” and are met with a profound lack of care (McKinney de Royston et al., 2020; Nasir et al., 2019).

Such interactions center the importance of identity formation processes for learning, and how learning settings provide feedback to young people about whether or not they belong. Identity and learning are deeply intertwined, such that when identities are accepted and aligned in learning settings, opportunities to learn open up, and when key identities are rejected, opportunities for learning are shut down (Nasir, 2012; Nasir et al., 2020; Spencer et al., 2020; Vakil, 2020). Young people develop multiple kinds of identities (gender, race/ethnicity, civic/political, and learner identities to name a few) while they engage in learning settings both in and out of schools. Healthy identity development involves both positive embrace of the identities attached to group membership, such as racial/ethnic identity, and resistance to processes that negatively influence one’s healthy emotional development, such as being stereotyped (Rogers et al., 2020; Rogers & Way, 2011).

Emotional needs for safety and belonging are also key components of the learning process (Darling-Hammond et al., 2020; Osher et al., 2018; Spencer et al., 2020). When a sense of belonging and emotional safety is present, learners are better able to engage, learn, and develop identities as learners (Cantor et al., 2018; Lee, 2017).

Taking this principle seriously would involve centering belonging and identity and focusing on creating identity-affirming spaces (Spencer et al., 2020). It would also require valuing all students as learners and attending to and eschewing the presence and power of racial and gender stereotypes in school spaces, while providing access to rigorous learning experiences.

### *Learning Is Shaped in Culturally Organized Practice Across People’s Lives*

Learning happens in many settings in and beyond schools. Community spaces can be important sites for learning (Baldrige, 2020; Heath et al., 2020; Peele-Eady & Moje, 2020), and understanding the nature of learning in such spaces affords us a fuller understanding of how learning itself occurs within social and institutional settings, and across the life span, and is guided both by need and interests (Barron, 2006; Stevens, 2020). For instance, Heath et al. (2020) document the learning that occurs in refugee camps in Kenya, in youth prison environments, and in a drama program for the homeless. They use the term *adaptive learning*, making the point that learning is what people do in all manner of contexts and circumstances to better their futures, to engage with social others, and to experience freedom. Rose (2004) has similarly written about the learning that occurs in blue-collar work—waitressing, hairdressing, welding—highlighting that sophisticated learning is fundamentally a part of human experience and activity.

Thus, sophisticated and multidimensional learning occurs everywhere, including and beyond formal schooling environments. This requires rethinking learning beyond the highly controlled, constrained designs one finds in most classrooms, most of the time (e.g., see Pianta et al., 2007, for elementary schools).

Teaching should build on natural interests and capacities rather than simply engaging in the forced march of learning observable in many classrooms. This perspective also acknowledges that learning unfolds on multiple pathways across lives at once (Nasir, McKinney de Royston, Pea, Stevens, Barron, & Goldman, 2020), and that learning at its best is a tapestry where what is learned in one setting is expanded and built on in another setting, in ways that honor and enrich the experiences of every learner.

And yet, learning is not neutral. We are more willing to “see” learning in practices associated with formal learning spaces, and less inclined to see the complexity of the learning that occurs elsewhere. Learning settings are power-laden, historically located, and weighted with histories of oppression and/or freedom (Alim et al., 2020; Alim & Paris, 2017; Annamma & Booker, 2020; Warren et al., 2020). Schools have complicated histories and can at once be institutions that perpetuate and deepen inequalities as well as spaces that disrupt inequalities and create opportunities for social change and justice (Anderson, 1986).

And it is not simply that schools have provided inequitable access to high-quality teaching (which they have: Darling-Hammond, 2010), or that learning happens in settings outside of school (which it does: Nasir et al., 2006). We must also understand that what we learn—the curriculum, the core ideas embedded within it—and how we learn are also not neutral. Indeed, the canon, across multiple disciplines, acts as a process of “exclusion, erasure, and onto-epistemic violence” (Warren et al., 2020, p. 277) for Native, Black, Latinx, and other nondominant groups. Decisions around what to include (and exclude) in the canon become forms of sanctioned epistemic stances and are thus instruments of racial, colonial, and patriarchal motives to oppress and erase. White supremacist ideology is ensconced in curricular as well as pedagogical choices, whereby what are presumed to be “White” ways of being and doing are normed and centered. Such ideologies presume homogeneity within cultural communities, not recognizing both homogeneity and heterogeneity as well as the laminations that cross cultural communities (Gutiérrez & Rogoff, 2003). We need more nuanced considerations of what constitutes cultural membership, and especially those interrogating the construct of “race” as political and ideological, rather than biological (Nasir, 2002). Teaching in antiracist and justice-oriented ways requires a commitment to move beyond colonial terms for learning, embracing multiplicity, and seeing learning as intimately connected to processes of liberation and freedom.

An example of what it might look like to center multiplicity in ways of knowing and doing is a project that intentionally builds on Indigenous knowledge systems in Mexico (Rosado-May et al., 2020). These authors argue that learning by “observing and pitching in” is key to indigenous ways of learning, and write about the efforts of the Intercultural Maya University of Quintana Roo to use the knowledge system known as *iknal* as the basis for supporting Mayan students in obtaining a university degree.

More generally, classrooms and schools organized in alignment with this principle would build on and extend learners’ interests, would view learning as a taken-for-granted aspect of the human condition, and would provide multiple kinds of

opportunities for learners to engage learning settings by bringing in a range of skills and experiences to bear on their disciplinary learning. They would recognize learning and teaching as acts of power and would be clear that the desired outcome of education is freedom and justice at both the individual and collective levels. Finally, they would engage curricula that attend to complex truths: science and mathematics curricula that advances disciplinary knowledge from multiple perspectives and literature that helps us reflect on the human condition and the society within which we operate (Lee et al., 2021).

### *Learning Is Experienced as Embodied and Coordinated Through Social Interaction*

We have established that learning is an everyday human activity, that it is cultural and adaptive in nature, involving neurological, brain, and cognitive processes that interact in complex and consequential ways within the social and political contexts in which they are situated. Learning thus involves all aspects of what it means to be human. Indeed, uses of the body and of representational systems are key to how human and learning activity is organized and coordinated. Learning at its core is about engaging in coordinated cultural activity. Language is central in this mediation, but so is nonverbal communication, such as gestures, eye gaze, and bodily orientation, geared toward the establishment of joint attention and negotiation of meaning (McDermott & Pea, 2020). In addition to language as a direct mediator of learning, language and discourse also function to position learners into identities in learning spaces, thus operating as a tool by which power is instantiated and negotiated (Green et al., 2020). Furthermore, the acquisition (or not) of languages is another way that power is negotiated, with the stigmatization of community language practices oppressing and denying young people their opportunities to learn. The notion of “academic language” has too often been utilized to justify such oppressive practices and policies (Flores & Garcia, 2020).

However, when the discourse and argumentation practices from the diverse contexts of young people’s lives are respected and engaged, opportunities occur for justice-oriented and robust disciplinary learning to arise (Brown, 2019; Levine et al., 2020). Levine et al. (2020) describe these as “hybrid argumentation characteristics” and argue that this approach includes attending to relationships, encouraging curiosity and playfulness, and taking multiple perspectives on how the world works. They argue that interrogating race, class, gender can be a key part of designing critical, expansive, and transformative learning environments for argumentation.

This principle suggests designing classrooms to be multilingual and to maintain home languages while also teaching additional languages, to provide opportunities for multiple forms of learning, including integrated kinesthetic learning experiences, and focus on the development of argumentation as a foundational practice of critical thinking.

### **A Research Agenda for the Future of Learning**

As we have established in this essay, learning involves all aspects of what it means to be human and a new science of learning

must be informed by an asset-based orientation to the dynamism, complexity and expansiveness of human lives, activities, and societies. Here, we consider what this means for future research. Without question, it requires an array of methodological and theoretical tools spanning disciplinary (e.g., anthropology, economics, psychology, learning sciences, neuroscience, education, ethnic studies, gender and women’s studies, linguistics, philosophy, and political science) boundaries and offering novel and innovative insights into the multidimensionality of learning that consider who is involved in learning, what is being learned, and when, where, how, and toward what ends learning unfolds.

Cutting-edge research methods have begun to desettle long-held conceptualizations of learning and think anew the relations between these conceptualizations and the work of researchers. This enterprise includes both qualitative approaches, such as critical qualitative and mixed methods, and quantitative approaches, such as critical quantitative and computational methods. For example, social design-based experiments (SDBEs) are one example of a qualitative approach that analyzes how learning settings “get built materially, symbolically, and culturally to advance some forms of knowledge and not others” (Gutiérrez et al., 2020, p. 332). SDBEs seek to work from a space of holding the “possible futures” for systems that have not yet been realized, but which recognizes “learning and development are drivers of systemic change and movement toward utopian ideals” (p. 331). At their core, SDBEs work to design interventions to “re-mediate” inequitable systems to reorganize activities, practices, and actors in order to bring about equitable experiences and outcomes.

To do future-oriented work that reimagines new possibilities for equitable learning, it is critical that scholars interrogate long-standing methodological debates, for instance, the debate about nature versus nurture and quantitative versus qualitative research and consider these debates anew in the context of racialized, gendered, and otherwise “othered” bodies and realities (Dixon-Roman et al., 2020). Examinations of the political and ethical tensions in our conceptualizations of learning matter because power and normativity get reinscribed into discussions of learning and in learning contexts, including through the language we use. For instance, the concept of diversity gets wielded as a “weapon of normativity” to essentialize difference and discursively reinscribe power (Annamma & Booker, 2020). New theoretical tools—such as intersectional analyses (Hancock, 2016)—are necessary to explicitly articulate and disrupt power dynamics.

Another key area of new research is understanding the consequences for learning of new kinds of institutional configurations and partnerships designed to improve learning. Systemic and institutional change always requires developing and sustaining long-term relations among and across people, tools, and settings (Penuel, 2020). Research-practice partnerships provide one mechanism for educational leaders to negotiate meanings and collectively make headway on vexing educational issues (Gomez et al., 2020), and in doing so can renegotiate relations of power between scholars and education systems. But little research exists on the effectiveness of these partnerships, nor on how such partnerships support institutional change toward deeper learning. Other areas of future research include more sophisticated

measures of deep learning that explore the multidimensionality of learning in disciplinary learning settings, across developmental domains and disciplines, and within and across institutions. Additionally, deeper inclusion of families, communities, and young people themselves in these partnerships would be innovative forward learning.

It is imperative that as our understanding of learning as an interdisciplinary process grows, our scholarship will also increasingly draw on the insights and research methods from across disciplines, and will require new conceptual and methodological approaches to studying learning. It is also critical that this future research takes seriously the goal of creating experiences of learning that are liberatory, and which traverse current boundaries and limitations imposed by deficit assumptions and attendant research frames and methods.

### **Implications for Equitable Teaching and Learning**

While the task of taking up a rigorous and detailed treatment of how these learning principles might be utilized to create richer and more equitable learning spaces is beyond the scope of this essay, we'd like to offer a few thoughts here about key insights from the RISE principles that have implications for the types of learning environments we should seek to create. This is an unprecedented moment for schools, given the rising recognition of the severity and extent of racial inequality in the wake of the COVID-19 (coronavirus disease 2019) pandemic and the social unrest around systemic racism. Given this context and these properties of learning, what does this multidimensional theory of learning offer for thinking about how we teach, how we organize learning environments, develop capacity with teachers, and make policy to support schools and informal learning spaces?

One insight relevant to teaching is that instruction should be organized to invite diversity in pathways of participation in learning activities and bring multiple knowledges to bear on learning academic content. If we know that learning, at best, engages a multiplicity of cultural repertoires of practice (Gutiérrez & Rogoff, 2003) and involves multiple representations and ways of knowing, then it is imperative that teaching start from a place of respecting the range of knowledges and epistemologies learners bring to the learning setting and have the capacity to connect learning and provide a range of entryways into core academic content. Relatedly, assessment practices must also be expanded to better account for the richness of the multiple pathways of learning and knowing, and to assess not just what is easy to measure, but what we care most about knowing, including the emotional and identity-relevant aspects of learning. This advance could involve intentionally drawing on interactional and discourse practices that invite multiple linguistic repertoires and socializing epistemological and ontological diversity as resources for wrestling with intellectually complex problems (Bang et al., 2012). Concretely, this would require an expanded set of curricular resources so that a range of contributions to a discipline, or way of engaging disciplinary thinking, is supported. It would also require teachers to have deeper knowledge of their disciplines in many cases, in order to be able to recognize and support disciplinary thinking in these expanded ways.

The RISE learning principles also make salient that learning cannot happen without a deep consideration of the developmental, emotional, and psychosocial needs of learners. Processes of racism and other forms of oppression are antithetical to meeting the developmental needs of learners, because oppressive processes are premised on the notion of denying full humanity, and ensuring that only some have their full human and developmental needs honored. What is important about this problem is that it highlights that we cannot profess to be providing adequate learning opportunities if the full complexity and range of developmental domains are not on the table for careful consideration and support. Thus, eradicating systemic racism and other forms of bias are not merely the moral right thing to do; it is imperative that we do so to provide deep and rich learning opportunities to all learners. This emphasis highlights a key insight—that systems of oppression are not separate from processes of learning that occur within these systems. Cognizant of this fusion, we argue that we must raise the bar on our goals and expectations for learning settings and systems, if we want to argue that our approach is driven by the most current science of learning. Such leveling up would require elucidating and rooting out practices and processes at the district, school, and classroom levels that perpetuate inequity—systems such as school segregation, tracking and homogenous grouping, assigning newer teachers less advanced courses, and the widespread use of teacher-centered pedagogies (Ball & Ladson-Billings, 2020; Darling-Hammond, 2020).

There are also particular insights here relevant to teacher preparation and professional development. While there are more options for teacher preparation pathways than ever before, attention to the cultural foundations of learning and development remain an underexamined focus (Ball & Ladson-Billings, 2020). Teachers need a complex set of skills and habits of mind to teach in ways that promote deep knowledge and wide access (Darling-Hammond et al., 2020; Darling-Hammond & Oakes, 2019), and which take seriously the cultural repertoires of practice students bring into classrooms. Teacher preparation programs should ground teacher candidates in a deep understanding of child and adolescent development, as well as “addressing implicit bias, creating culturally responsive classroom communities, and advancing equity, as well as crafting engaging instructional units that connect to students’ experiences and move them toward deeper learning outcomes” (Darling-Hammond, 2020, p. 406).

Policies, pedagogies, and teacher education must all be rooted to this commitment to equity, to disrupting inequality, oppression, and marginalization (Ball & Ladson-Billings, 2020; Darling-Hammond, 2020). Such commitments include attending to structures that provide access to equitable funding and the opportunity for human-centered and developmentally nurturing relationships, and that set the stage for safe, culturally responsive classrooms, connection with families, and fluid boundaries between in-school and out-of-school learning (Darling-Hammond, 2020).

### **Conclusion**

We have articulated a multidimensional theorization of learning, one that takes seriously the cultural nature of learning and the multiple pathways of learning and knowing. Educational spaces must be better aligned with what we now know about the

complexity of how people learn and with the richness of the linguistic, cultural, and everyday experiences students bring to classrooms. When they are, we will have created spaces where deep learning happens for all students and where schools build on and contribute to the existing strengths in families and communities. However, if we continue to assert that cognition can be understood as separate from the social, cultural, and emotional aspects of learning and human experience, or that we can attend to the sociocultural nature of learning without considering the oppressive and systemically inequitable systems within which those processes take place, we will continue to reproduce inequitable outcomes and systems and to miss the mark on creating learning spaces rooted in the complexity of human learning.

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