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LEARNING PATHWAYS
How Learning Is Culturally Organized

Na'ilah Suad Nasir, Maxine McKinney de Royston, Brigid Barron, Phillip Bell, Roy Pea, Reed Stevens, and Shelley Goldman

Educational research over the past several decades has expanded our view of learning beyond the cognitive processes and psychological traits of the individual learner to consider the varied influences of local interactions with social others and with learning resources and environments. While this expanded view provides richer accounts of the social and interactional aspects of learning, the focus on *local* learning interactions has the potential to limit a deep understanding of the cultural, relational, affective, and contextual nature of learning that gets further complicated by race, gender, language, and other dynamics and systems of power (Annamma & Booker, this volume; Esmonde & Booker, 2016; Immordino-Yang, Darling-Hammond, & Krone, 2018). In part, this is because current approaches to learning often understand culture as related to learning rather than understanding learning as necessarily a cultural process (Nasir, Warren, Lee, & Rosebery, 2006; Warren, Vossoughi, Rosebery, Bang, & Taylor, this volume).

Relatedly, many accounts of learning do not attend to how it takes place as a part of an individual's longer-term trajectories of participation in a broad range of activities, across more and less formally structured learning spaces, and over longer stretches of the life span (Barron, 2006), phenomena usefully reflected in the metaphor of a "learning career" or the development of dispositions to learning for an individual over time (e.g. Bloomer & Hodkinson, 2000; Crossan, Field, Gallacher, & Merrill, 2003). Finally, few studies examine how these learning careers may be facilitated or constrained by social systems and institutions (as informed by racism, sexism, ableism, and many other isms) that differentially position individuals' access to particular resources and associated experiences that are important for future learning or engagement in learning in formal spaces.

By contrast, our approach is to examine learning across time and space—namely, how access to learning resources and experiences over time is disrupted by processes of structural inequality that get reproduced through institutions (Oakes, 2005; Warren et al., this volume). We conceptualize learning as occurring along culturally organized learning pathways—sequences of consequential participations and transitions (Beach, 1999) in learning activities that move (or do not move) one towards greater social recognition as competent in particular learning domains and situations. This framework draws attention to the resources to which learners have access over time, how learners are positioned within the broad range of learning settings in which they participate, and the roles that issues of *identity*—who one is in the process of becoming—play in learning (Nasir, 2012; Offidani-Bertand, Harris, Velez, & Spencer, this volume; Rogers, Rosario, & Cielto, this volume). It also attends to how institutions and systems structure access to and position (Green, Brock, Harris, & Baker, this volume) various types of learning and learners.

We draw on data from multiple studies of STEM learning that illustrate three key aspects of culturally organized learning pathways, namely that: (1) they are taken up in relation to identities, and have relational, affective, and motivational components; (2) they are made up of sets of cultural practices and routines, socially constructed by self and others, and they build up over multiple instances and protracted time periods; and (3) they include enactments of privilege and marginalization that occur in relation to structural constraints and supports which are experienced by learners in their families, peer relations, and institutions such as schools. A learning pathways framework is a synthetic and pluralistic approach that attends to the multi-level, longitudinal nature of how cultural processes are inherent in and intrinsic to learning.

We argue that a learning pathways framework deepens our analyses of learning by attending to how learning is fundamentally cultural (Lee, Meltzoff, & Kuhl, this volume; Rogoff, Rosado-May, Urrieta, & Dayton, this volume), and how it is shaped by structures that can empower or marginalize (Alim, Paris, & Wong, this volume; Cole & Packer, this volume). The implications of this framework extend to how we conduct research as well as how we translate research into practice. In terms of conducting research, this framework invites new empirical methods to deepen our understanding of learning as a dynamic life-long cultural process, and as an accumulation of an individual's local and longer-term interactions with differing levels of access to learning resources and opportunities. Similarly, this framework invites conversation among educational psychologists, learning scientists, and other educational researchers about how our research can translate into relevant educational interventions or designs (Greene, 2014), including how we can design learning settings that create multiple entry points and sustained opportunities for learning.

The chapter is organized into four sections. First, we review scholarship that moves towards a culturally informed learning pathways framework. In the second section we introduce three contrasting cases of student learning pathways, cases that ground the notion of pathways in the real life experiences of students and families. The third section outlines three aspects of the learning pathways framework, synthesizing the literature that elaborates each aspect of the framework and which links back to the student cases. In the fourth and final section we outline directions for future research and implications for educational practice.

Towards Culturally Informed Learning Pathways

The dictionary defines a pathway as "a route to or way of access to; way of reaching or achieving something; a trodden track or way." This metaphor implies both movement over time, and the notion that a pathway already exists from a "trodden" track—that is, pathways tend to be culturally defined and situated. Scholars concerned with the cultural contexts or ecologies relative to learning have used the metaphor of pathways to consider how developmental or learning trajectories are shaped (Greenfield, 2009; Stevens, O'Connor, Garrison, Jocuns, & Amos, 2008). For example, Greenfield (2009) provides a model to predict how changing socioeconomic demographics likewise trigger shifts in the life-long developmental pathways and outcomes of individuals and communities through changing learning environments and, at times, cultural values. Stevens et al. (2008) used pathway as a metaphor to characterize how young people "become" (or don't become) engineers over time and through experiences during their college years, with pathways rendered further into three, interrelated dimensions of change: accountable disciplinary knowledge, identity, and navigation. Each author uses the pathways metaphor differently, yet all caution that pathways are constrained and enabled by the cultural, ecological niche in which they reside.

As in the work by Greenfield and Stevens et al., our notion of a pathway reaches beyond local moments or single interactions to more fully consider how an individual's participation occurs over longer stretches within the life span and how those trajectories of participation vary with situated conditions that change at multiple time scales. Similar to Greenfield (2009), Stevens et al. (2008),

and Gallimore and Goldenberg (2001), we view individuals' pathways as being fundamentally influenced by their interaction with cultural practices and values across a range of learning environments, informal and institutional. We recognize the importance of understanding how these interactions across the institutional and the informal can be consequential for success, especially academic success within schools.

David Plath's (1985) metaphor of pathways, generated through studying a cohort of middle-aged Japanese citizens, is also useful for thinking about learning across the life span. Plath articulates life pathways as being constructed at the intersection of culture and individual choice and meaning. Pathways include routes and timetables that are associated with types of trajectories and variations in images of oneself in relation to both past and future. While culture has a heavy hand in determining the potential pathways that are made available (and to whom they are made available), constructing a pathway is more than simply choosing or following a culturally determined road. Instead, "Pathways can vary in their appeal for different persons or for the same person at different phases of life" (p. 50), which is to say that choosing a pathway involves both drawing on a frame which one uses to construct meaning and understanding that this chosen frame often implies a pathway that may be more or less desirable depending on where a person is in their life course. Moreover, although individuals have a choice of possible frames and pathways, the notion of the "trodden" track suggests that despite some agency to choose among possible frames and pathways, these pathways are not infinite and access to them is located historically, geographically and politically.

The importance of time and cohort is also expressed by Elder (1994) in his description of life course research as part of a general conceptual trend that has made time, context, and process more salient dimensions of theory and analysis. For Elder there are several guiding assumptions, including the critical role of historical times in life experience and outcomes, the way that life stage and timing matter for opportunities and ultimate outcomes, how our lives are linked in important ways to opportunities or constraints contributed by social others, and the critical role of human agency and choice in the construction of life pathways (Giele & Elder, 1998). These assumptions by Elder harken to Bronfenbrenner's (1994) notions of chronosystems, mesosystems, and microsystems where one's learning and development is influenced by and changes across time, and across the social worlds one navigates.

Two specific constructs most closely relate to our notion of learning pathways. The first one is Bloomer and Hodkinson's (2000) definition of "learning careers" which emphasizes understanding people's ways of orienting themselves to learning settings, and how these orientations or dispositions change over time. They point out that accounts of learning rarely take note of the broader social, cultural, and economic contexts within which people construct these learning careers, rendering these accounts unable to explain the complexities of how learning careers unfold. While "learning careers" broadens the conversation about learning to include external structural factors and discourses that shape young people's perceptions of learning and schooling and its role in their lives, it does not include a unit of analysis for the activities or resources we see as a crucial component for understanding learning and learning pathways. Moreover, the notion of "career" may signal attention to formal learning spaces rather than informal and life-wide experiences.

The second construct is that of "trajectories of identification" (Polman & Miller, 2010). Central to understanding these trajectories of identification is that interactions with social and cultural contexts occur in relation to perceptions of the past, present, and future—a process called *prolepsis* (Cole, 1996). Thus, trajectories of identification are shaped as people project into the future, based on the past, which structures interactions in the present. Much like the notion of pathways, Polman and Miller's (2010) trajectories of identification captures the idea that learning occurs as a part of a process that unfolds over time and consists of multiple instances of participation and positioning in multiple practices across various life spaces. Clearly, *identity* (or one's sense of one's place in the world and connection to others) has profound implications for how one engages in learning

settings; conversely, the ways in which learning settings engage individuals has important implications for how they view themselves. Expanding upon Polman and Miller's notion of "trajectories of identification," our framing of learning pathways also considers how some acts or practices that position an individual may be more or less consequential for their future participation and access to learning resources and learning.

Our framing of learning pathways, like some of the constructs discussed above, relies upon some fundamental assumptions of sociocultural theories such as using the social and cultural activities that people engage in with one another towards particular shared goals as a core unit of analysis for understanding learning (Nasir, 2002; Vygotsky, 1978; Wertsch, 1991). Centering cultural activities as a unit of analysis supports an examination of individuals and their cultural and social context, especially as it is carried through social interaction and involves cultural artifacts in activity systems. Activity systems can take many forms, including that of "academic lessons" which prepare children for subsequent school-based interactions by focusing on certain content or socializing forms of discourse that are later encountered in formal education settings. Or, they may take the form of games played with parents or other caregivers that allow a child to develop familiarity with representational tools that have been developed over long periods of time, such as writing systems, maps, language, or numerical systems (Griffin, Case, & Sieger, 1994; Vygotsky, 1978).

These culturally specific patterns of interactions are driven by implicit or explicit values, and the expertise developed through them plays a role in the early learning pathways of young children, long before they enter formal schooling (Rogoff, 1990; 2003). For example, parents may evaluate their children's knowledge using question/answer/evaluation sequences that are similar to those often observed in classrooms (Mehan, 1996), or they may orchestrate dinner conversations that invite children to participate in argumentation (Ochs & Taylor, 1992). In these shared contexts, parents can express their enthusiasm, explanations can be provided spontaneously or in response to questions, and children have an opportunity to demonstrate their interest or lack of it in particular activities and content. Consider how in an ethnographic study of musical parenting, intergenerational practices of singing and music making were documented as well as reciprocal child-parent interest in listening and producing traditional, popular, and spiritual songs (Gibson, 2009). Relatedly, Goodwin (2007) described one family's "occasioned knowledge exploration" (p. 97) that routinely emerged during daily walks, dinners, car rides, or bedtime stories. Within these interactions, playful imaginative conversations were connected to prior knowledge when a child asked questions and parents provided detailed explanations. These forms of guided participation (e.g. Rogoff, 2003) take the form of co-activity and rely on joint attention as an important means of building a basis for inter-subjectivity—the shared understanding of what is happening and what will happen next.

The aforementioned scholarship suggests that the notion of a context-dependent learning trajectory may be a rich way to understand learning and variation in learning over time. Yet, we still do not have a coherent framework for studying learning that attends to the interplay between the individual, local, cultural, and institutional contexts and practices in and across time and space. Our notion of learning pathways offers such a framework and adds two important dimensions. First, our framework shifts the unit of analysis from learning outcomes to the specific and consequential learning resources or experiences that learners are able to access. These include cultural practices, activities, and events, as well as identity resources or ways in which learners are socially recognized or supported in developing positive dispositions to engage and persist in thriveful learning.

Second, although such learning resources often play out in the context of institutions, scholars who attend to the nature of these in their analyses (e.g., Mehan, 1996; Rogoff, Topping, Baker-Sennett, & Lacasa, 2002) do not systematically attend to how an individual's access to such resources (by virtue of race, class, disability status, gender, etc.) subsequently shape the learning dispositions and pathways that they form (Esmonde & Booker, 2016). By contrast, our conceptualization of pathways considers how learning pathways develop over time and across spaces, namely (1) how

they are taken up in relation to identities; (2) how they are made up of cultural practices and forms of participation that are socially constructed by self and others; and (3) how they include enactments of privilege and marginalization that structure access to and position various types of learning and learners relative to dynamics of power (e.g. racialized, gendered, etc.). Below we present contrasting cases of learning pathways from three different studies. These cases illustrate the multiplicities of learning pathways individuals engage in over time, and how these unfold across formal and informal learning environments.

Contrasting Learning Pathways: The Cases of Layla, Renee, and Jill

In this section, we present the learning pathways of three students, operating within different learning contexts. These cases are all drawn from studies funded under the auspices of the Learning in Formal and Informal Environments (LIFE) Center between 2004 and 2014, involving a range of methods, including case studies, observations, and interviews. Taken together, these contrasting cases point to the limitations of notions of learning that understand learning within only one context at only one particular point in time, as well as the limitations of using constructs like identity or motivation to explain different experiences of learning and of learners devoid of a treatment of the social, cultural, institutional, and political context within which learning takes place. These cases highlight how access to learning pathways is negotiated and contested, and highlight the processes of identity and positioning that determine how one engages a particular learning context—in relation to other learning contexts, social and information networks, family life, and past interactions and access—and the kinds of dispositions towards learning they develop across time and space.

Layla's Learning Pathway in Computer Programing

Layla considers herself, and is considered by others, as a strong math learner. Layla attributes her early interest in math to her grandmother, a former math teacher, who played math games with her as a child and encouraged her. Both of her parents pursued math in their own careers, noting the strong emphasis on math and science in their country of origin, China. At age 12, Layla's initial involvement in computing activities revolved around her interest in mathematics, becoming more serious upon joining the mathematics team at her school (Barron et al., 2009), then later an online math community her mother found. After Layla began to engage in the computing community and experience success and belonging there, she became involved in other areas like programing, blogging, and discussion boards that were related to math as well as to broader social and political issues. Based on conversations with her online peers, she decided to teach herself C++ and used Google to find an online tutorial. Based on the tutorial, Layla decided to enroll in the school's programing class as a seventh grader. That course prepared Layla to teach herself a code-based 3D graphics application called POV-Ray, which she picked up as a home-based hobby.

In the online community Layla engaged with same age and older peers, as well as with adults who had expertise in mathematics. Her online peers motivated her pursuit of programing languages, and again she used her resources, in this case a course at her school, to find new ways to learn in and out of school. Since none of her local friends were interested in math, the online community was an important resource for her at that time. Later, Layla's commitment to mathematics was deepened through more local connections as she matriculated into high school and became the founder and three-year president of her school's math club.

Traditional approaches to analyzing Layla's engagement and success might highlight her individual motivation, her strong sense of identity as a computer scientist, or her diligence in seeking out opportunities in and outside of school. In noting her disposition towards engaging in and seeking out additional opportunities to learn, they might consider the important role of her family in nurturing her interest and exposing her to computer science at an early age. However, Layla's case

also illustrates how learning pathways are iterative, build up over multiple instances and positionings, are often dependent upon resources one has access to and the recognition mechanisms they afford (e.g. tests, prizes, and scholarships), and are critically shaped and maintained by key social others as well as their social positions and privileges. The supports Layla had access to and experienced, repeatedly positioned her, to herself and others, as capable, and cumulatively facilitated her in assuming the role of the president of the math club, enrolling in regional and national contests, and becoming a math tutor. Taking up these roles, in turn, continued the cycle of her being recognized and positively positioned for her expertise. A learning pathways perspective thus captures Layla's agency, motivation, and identity development over time relative to computing *and* captures the repeated influence of dynamics of power, such as class, that lent access to her learning and supported her learning pathway.

Renee's Math Learning Pathway

The case of Renee similarly illustrates the role of family and the iterative layering of experiences that shapes learning pathways, but contrasts with Layla's in showing how institutions and processes of exclusion and marginalization also play into how learning experiences, and subsequently learning pathways, are constructed. Renee's family is from Mexico, and she lives with her older sister, Vivian, and her mother, Yali. The research team met the family when Renee was 14 and in the eighth grade. The team conducted a case study of the mom, Yali, and the daughters Vivian (25) and Renee (14). Yali came to the U.S. undocumented and subsequently earned an Associate of Arts degree, a Bachelor's degree, a certificate in arc welding, a California teaching credential, and is a homeowner. Daughter Vivian was a law student at Stanford University. In interviews, the three women all repeatedly said they loved math.

Renee thought of school math as the math context she dealt with most often. She was extremely proud of her achievement, yet attributed some of her success to her sister, Vivian, who helped her when she needed help. Both Yali and Vivian spent considerable time and energy clearing a learning pathway for Renee in school math, establishing regular goal-oriented routines for math study and problem-solving at home. She was two years ahead of her grade in math, taking Algebra 1 in seventh grade and Geometry in eighth grade. As she was finishing middle school, Renee asked her mom if she would pay for her to take college math classes at a local college before she finished high school, later engaging with her mom and sister in thinking about which classes to take and how to pay for them. Renee's mom, sister, and school counselors all eventually decided that she might be able to go to an early college program on the east coast, which she was later accepted into with a full scholarship. Renee struggled with her decision to skip the last year of high school to attend the program because she felt like she "was being exiled," but eventually decided to attend. Once there, she excelled and proudly posted her grade point average, her pre-med major, and her graduation picture on Facebook.

A traditional approach to understanding Renee's engagement and learning in mathematics would highlight how schools were Renee's main math context—first her high school and later the early college program—and how they supported Renee's identity and success in mathematics. It would demonstrate how Renee's teachers and other school staff, such as school counselors, supported Renee's identity formation relative to math and pushed her to engage in and benefit from additional learning opportunities such as the early college program. It might also point out how Renee's sister and mother were there to help her and how Renee herself demonstrated resilience and motivation in pursuing mathematics. Aside from the out-of-school supports that Layla had access to, a traditional analysis for Layla and Renee might present them as somewhat similar cases of highly motivated students who had very supportive families. This type of analysis may even note the differences in their profiles—e.g. the racial or class designations of their families, their documentation status, and the kinds of schools they attended. Traditional analyses, however, rarely

interrogate the implications that these demographic differences and institutional configurations might have for students' access to in- or out-of-school learning opportunities and resources, the quality of these learning environments, nor the ways in which these students might differentially experience or be positioned relative to learning opportunities, resources, and environments based on societal perceptions about what these students' social demographics signify.

By contrast, a learning pathway analysis attends to Layla and Renee as contrasting cases that bring to the fore the limitations of understanding only one or two contexts—such as home and/or school—at a time and at a particular point in time. It would examine how these various layers of experience multiplex over time in ways that can either further legitimize, marginalize, or disrupt students' engagement and identity formation. In essence, a learning pathways analysis makes visible how power operated for each of these students and points out the influential nuances that have strong implications for their participation, identification, and learning. Such an analysis might point out that Renee's family and school counselors sought out alternative learning opportunities for her beyond traditional schools. The dynamics of power and race are ever-present here as Renee may have been perceived by her teachers and peers in relation to being a Spanish-speaking, first generation Latina interested in mathematics. Thankfully, for Renee, these potential challenges were not deterministic. Renee's family supported her, making sure she had gatekeepers on her side within her school. Over time, Renee incorporated these routines and practices into her own repertoire—she internalized the social, interactional support of her math identity and competency advancement such that she was able to attend college early and become an independent math learner and user.

Jill's Learning Pathway in Engineering

The cases of Layla and Renee were illustrations of learning pathways where learners remained on the pathway. The next case, that of Jill, illustrates how a range of institutional forces can come together over time to remove a potential learner from a pathway. Pathways into the engineering profession, like in other careers, are fundamentally related to taking on a domain-specific identity, e.g. as an engineer or future engineer. Jill's story of *not* becoming an engineer illustrates the relevance of dimensions that span beyond knowledge acquisition to how identity and motivation are a core part of taking up or resisting learning pathways. It also demonstrates how institutional structures and agency work to co-construct one's pathways.

At the university that Jill attended, students needed to be admitted as engineering students after one or two years of pre-requisite coursework in cognate disciplines such as mathematics, physics, and chemistry (Stevens et al., 2008). Jill was a first-generation white college student who got very good grades in high school and initially identified herself as a future engineer. Not having clear guidance from mentors or peers, early on Jill took all the hardest classes—chemistry, physics, and higher mathematics—during the same quarter. Consequently, Jill received poor grades in each and ended her freshman year with a low GPA. Moving into her second year, when she was to apply as an engineering major, Jill became dis-identified as an engineer and lost faith in herself as a "good student" (Stevens et al., 2008). By the end of her sophomore year, Jill had left engineering but went on to successfully complete a degree in business.

A traditional approach to understanding Jill's case would highlight the role of social others at Jill's university, such as her peers and the support staff and faculty, who failed to advise Jill about appropriate course-taking patterns or to provide support to her despite her poor academic performance. They might also focus on the local learning interactions within the college classrooms she participated in and examine these learning settings and resources to understand whether they were productive for her engagement and identity development relative to engineering. This view would provide a useful account of the social and interactional aspects of learning processes that certainly influenced Jill's learning and her decision not to pursue engineering.

At the same time, analyzing Jill's case around local or specific learning interactions can limit—temporally and contextually—how we understand her shifting identification with engineering. Jill was a high achiever in high school who identified as a future engineer. Her lack of success in college—like that of many women in STEM fields—is not related to her capacity or intelligence nor her motivation or interest in identifying with engineering. Rather, like Layla and Renee, Jill's case requires examining how her learning and identification as an engineer was culturally organized along a particular pathway. For Jill, however, that pathway in high school did not evolve into a pathway in college, instead it was shut down and supplanted with another pathway. The official, non-contextual pathway into an engineering major—a high GPA—was the only one to which Jill had access and became her *only* image of a pathway into engineering. She had no exposure to other pathways into engineering or to practices that would aid her in achieving the official pathway. Perhaps not surprisingly, once Jill became a business major and a recognized member of a community of future business people, she excelled.

Jill's case shows that constructing or maintaining a positive trajectory on a learning pathway is as much about one's ability to acquire knowledge or engage in learning activities as it is about *continuing to have access to and iteratively crafting a sense of oneself as belonging on that pathway.* This sense of identity can be privileged, marginalized, disrupted, or foreclosed by prevailing ideologies about race, gender, and other dynamics of power, and the accompanying institutional norms and practices that can critically influence one's motivation to remain on a learning pathway. Jill's case demonstrates that a student's persistence and success is often a function of their access and exposure to social, cultural, and navigational capital (Yosso, 2005) that make official and alternative pathways available and that, in turn, open up opportunities for participation, recognition, and ongoing acquisition of domain-specific knowledge and identities.

These three cases, taken together, illustrate the range of forces that impact the cultural nature of learning in local learning settings, *and* how these moments and instances of learning become consequential for future participation on a pathway. They make salient the multiple layers of access, institutional positioning, and identity processes that play into sustaining one's position within, and movement along, a learning pathway. Drawing on these cases, below we highlight three key aspects of learning pathways.

Three Characteristics of Learning Pathways

The Learning Pathways framework identifies three key characteristics of learning pathways: (1) They are taken up in relation to identities, and have relational, affective, and motivational components; (2) They are made up of sets of cultural practices and routines, socially constructed by self and others, and build up over multiple instances and protracted time periods; and (3) They include enactments of privilege and marginalization that occur in relation to structural constraints and supports which are experienced by learners in their families, peer relations, and institutions such as schools.

Characteristic 1: Learning Pathways Are Taken Up in Relation to Identities, and Have a Relational, Affective, and Motivational Component

Research studies over the last decade or so highlight how identity formation processes are fundamentally related to learning (e.g. Anderson, 2009; Boaler & Greeno, 2000; Esmonde & Langer-Osuna, 2013; Lave & Wenger, 1991; Nasir, 2002, 2011; Stevens, O'Connor, & Garrison, 2005; Stevens, O'Connor, Garrison, Jocuns, & Amos, 2008; Wenger, 1998; Wortham, 2008). In her studies of learning in the practices of basketball and dominoes, Nasir (2002) demonstrates how learning and identity processes support one another, such that as one learns the skills and content in a given domain, one's identity as a learner in that domain is reinforced. Hence, the taking up of an iden-

tity as a learner in a domain supports the learning underway, and further motivates the learner for future domain-specific learning.

Likewise, Wortham (2008) makes deep connections between processes of learning and processes of identity (or identification) in his study of learning in a social studies classroom. His findings show how students drew on the material they were learning to create identity categories (e.g. the category of a social outcast, or "beast") and to position members of the class into those categories. Students who were positioned in these ways took them up as a part of their identities or resisted them with varying degrees of success.

In each line of research, the relational and affective nature of learning and identity processes is apparent. In Nasir's work on basketball and dominoes, identities as participants in these practices are supported as players are engaged in relationships with other players—as teammates, or as adversaries—and as they develop a *sense of belonging* in and to the practice. This sense of belonging (powell & Roediger, 2012) is motivational in that it increases a player's identification with the practice and is related to affective feelings of connection and responsibility to other players that enhance the players' practice-based engagement and learning. In Wortham's study, students positioned one another relationally, ultimately creating new (and marginal) identities for some students. The identity and learning processes were also affectively laden in that peer positionings eventually shaped students' modes and patterns of participation in a classroom, and their respective domain-specific learning trajectories over the course of an academic year. Hence, learning pathways get shaped, taken up, and resisted in relation to identities—the identities others perceive one to have, and the identities ascribed to oneself. As identity and identification are related to a sense of belonging, affective and relational processes are central to both identity and learning (e.g. Nasir, 2012; Spencer, 2008).

This cycle of identity as supported by access to a set of practices where one feels connected to others and has a positive affective experience that provides the intrinsic motivation for continued learning is prevalent in the research literature (e.g. Bricker & Bell, 2014; Stevens et al., 2008). These findings resonate with other in- and out-of-school studies that discuss how to support intrinsic motivation for creative contributions in corporations (e.g., Collins & Amabile, 1999) or for inducting youth into an interest in technology (e.g. Barron, Martin, Takeuchi, & Fithian, 2009). Barron et al. show how in developing technology fluency while making computational artifacts, it was common for young people to begin participating in a technology learning space (usually a class or community program) because of their relationships with other youth or with their families, and to then develop an identity as someone who "belonged" in the setting, which supported learning and continued participation.

However, these cycles can also be negative ones, in which an identity as a participant was not encouraged by others and thus learning and engagement with the learning pathway ends. Pathways are also "validated" and confirmed in relations with a person's intimates at various phases of the life course. Building on Schutz (1932/1967), Plath theorized that a person's intimate and enduring social group is deeply implicated in the pathways that are made available or abandoned. Different pathways, therefore, can circumscribe different "possible selves" (Markus & Nurius, 1986) that facilitate cultural goals and regulatory strategies (Oyserman, Bybee, Terry, & Hart-Johnson, 2004; Saxe, 1999) that people construct and that then make available particular pathways that can facilitate goal achievement. Indeed, there is a robust literature on the relationship between parental racial socialization practices (quite related to identity) and various motivational and academic outcomes, which shows that when parents support young people in developing strong racial/ethnic identities, academic and social outcomes are improved (Wang, Smith, Miller-Cotto, & Huguley, 2019).

Layla, Renee, and especially Jill's cases demonstrate how learning pathways are deeply related to identities—as to how one sees oneself and how one is viewed by others. They also demonstrate how the initiation and maintenance of these identities, and with a learning pathway more broadly, are influenced by relational, affective, and motivational factors. Learning pathways are reciprocally linked to one's access to resources of identification and to the life choices that one has and that one makes.

Characteristic 2: Learning Pathways Are Made Up of Sets of Cultural Practices and Routines, Socially Constructed by Self and Others, and Build Up over Multiple Instances and Protracted Time Periods

Characteristic 2 demonstrates how the cultivation and sustaining of learning pathways occur via culturally organized and goal-oriented practices and routines. This characteristic draws from sociocultural theorists that have focused on cultural practices and activities as important units of analysis in studying learning (Saxe, 2002; Scribner & Cole, 1981; Wertsch, 1991). These units of analysis capture the ways that learning takes place within communities, as people take part in and help reproduce culturally valued activities and practices (e.g. Greenfield, 2009; Gutierrez & Rogoff, 2003; Lee, 2007; McInerney, 2008; Saxe, 1999, 2002), and illustrate how mathematical and cultural processes interact in the context of personal and community goals (Martin, Goldman, & Jimenez, (2009). For instance, Martin et al. show how people start learning about, and over time participating in, the practice of Tanda—a rotating, community-based credit and savings practice. Mathematical work in the context of the Tanda is in service of, and intimately tied up with, familial community and cultural goals and values—for instance the goal to buy a house or pay off debt. Learning pathways thus provide a way to characterize the learning that occurs as goal driven practices and routines that do not simply occur within one activity, but accumulate over time as individuals participate in multiple activities, or multiple instances of the same activity, over time, place, context.

Such a perspective requires moving beyond an individual level of analysis to a focus on understanding individual development in the complex social and cultural ecologies where learning and development occur (e.g. Rogoff, 2003; Lee, 2010; McDermott & Pea, this volume; Moje & Peele-Eady, this volume). From this perspective, learning is understood as an ongoing, iterative project that involves complex interactions between multiple contexts (e.g. Cantor, Osher, Berg, Steyer, & Rose, 2018). Further, given that humans are naturally adaptive, it follows that learning pathways too have multiple beginning and end points (Lee, 2010; Cantor et. al., 2018). This perspective views variability as a norm, and as a strength. Further, as pathways are socially constructed and take shape over multiple instances, we must recognize that instances of learning are not isolated but occur across formal and informal settings. Developing expertise in any domain requires access to a continual cache of diverse opportunities to learn, to identify with others engaged in domain-relevant practices, to engage in deliberate practice, and to be challenged above one's current threshold of expertise (Ericsson, 2006). The metaphor of pathways honors the multiplicity of routes to become disciplinarily engaged and the multiplicity of destinations that are possible.

The metaphor of pathways also evokes longer timescales, one where parents and educators play an active role in coordinating learning opportunities *across* settings. These brokering moves involve connecting young people to experiences, people, institutions, or information sources. Brokering relies on access to the right social networks and benefits and often requires financial resources such as access to transportation. The impact of brokering roles has been made clear in studies of interest-driven learning in families with parents taking on this role (Barron, Martin, Takeuchi, & Fithian, 2009) and in community-based learning centers where adult mentors or advanced peers engage in brokering (e.g. Barron, Gomez, Pinkard, & Martin, 2014; Ching, Hoadley, Santo, & Peppler, 2015; Erstad & Sefton-Green, 2013). The moves to coordinate learning experiences help forge pathways by increasing opportunities for identity building, expertise, interests, and learning partnerships with peers (Barron & Bell, 2015).

It is equally important to understand educators and institutions as intentional or unintentional gatekeepers. In a retrospective study of the learning pathways of adults who became "naturalists," the opportunity to explore nature during childhood was critical for the interest development of all participants (Hecht, Knudson, & Crowley, 2019). However, school opportunities varied in valence and generativity—some participants were discouraged by school counselors from taking science courses and did so anyway, whereas others did not have the financial backing to complete

college and their interest in taking care of the natural world was not expressed in a formal career. For others, parents and teachers played important roles as models and brokers, connecting young naturalists with formal educational opportunities or additional informal experiences that kept them engaged. This study and others foreground the distributed nature of learning (Barron, 2006) and show fluctuations in "interest episodes" as varying with the amount of support for learning and resource constraints (Azevedo, 2013). In contrast to linear perspectives on interest development, the learning biographies of naturalists suggest cycles of more and less stable interest (Hidi & Renninger, 2006) that often depend upon the opportunities available and the social or material constraints faced. In other accounts of educational journeys, we learn about the role of discipline and punitive responses to traumatized young people, in consequence removing formal schooling as an option (Annamma, 2016).

When and where a pathway is entered, and how easy it is to stay on, is highly dependent on the cultural practices and supports one grows up in, has access to, and how well others have cleared the way, left signposts, and eliminated obstructions to opportunities to learn. The cases of Layla and Renee highlight that while most parents seek out ways to develop their child's talents and interests, families vary in their access to the resources to realize such goals. Camps, lessons, and materials that sustain disciplinary engagement are expensive and beyond the reach of many families like Renee's. Social networks, like those Layla had access to online and through extracurricular activities at her school, can offer more informal learning partnerships and the distribution of adult hobbies, occupations, and interests can shape youth's learning opportunities. It is often too easy to undervalue the *readiness* of learning pathways when others have done much of the work that has ensconced future generations in privileged positions.

Learning pathways are often constructed by others—parents, teachers, peers—who offer resources for learning and make available learning opportunities for a particular practice that can get reinforced once one strongly identifies with a practice or a domain. As DiSessa (2002) notes, when learners become "committed," they seek out opportunities that increase their expertise. Indeed, as individuals move along learning pathways, they make critical choices (such as to take or not take on a course or the challenge of a team design project), and develop motivation to continue (or discontinue) participation in a practice or domain. Yet, as Jill's case demonstrates, learning pathways are not de-contextualized "tracks" to which everyone has equal access. A lack of access and support by social and institutional others can become difficult for one individual to maintain. Indeed, certain practices and routines like not seeking out an alternate advisor or not utilizing academic supports at a university, can *constrain* access to learning pathways irrespective of an individual's goal orientations. These constraints are less about an individual's disposition and goals towards learning than they are about how one has been socialized into navigating and understanding a pathway. Renee's interest in STEM, by contrast, began in relation to her sister and mother creating particular routines and practices around mathematics to support her learning. Renee took up this repertoire of practices that they developed in their household, and then used it towards her goal of learning mathematics and her and her family's goal of preparing her for college.

Characteristic 3: Learning Pathways Include Enactments of Privilege and Marginalization That Occur in Relation to Structural Constraints and Supports in Families and Institutions

So far, we've discussed the learning pathways of Layla, Renee, and Jill in relation to cultural practices and routines and to the types of disciplinary identities that have been socially constructed by themselves and others, each having been built up over multiple instances, protracted time periods, and across multiple formal and informal learning settings. These renderings of their pathways effectively shift the unit of analysis around learning from static outcomes measures or local interactional accounts to centering cultural and social activities and resources as a unit of analysis. This re-centering allows us

to examine individual learners as embedded within cultural and social contexts across time and space, and leads us to understand how learning and identifications are influenced by an individual's access to, and choices around how to utilize, cultural, social, relational, affective, motivational, and identity resources and supports. This rendering of the notion of a "pathway," however, offers an incomplete analysis of the broader social systems and institutional structures within which pathways get constructed, privileged, disrupted, or foreclosed.

Consequently, the third characteristic of our learning pathways framework posits that pathways are not always infinite for every person—viz. choosing a pathway is not a matter of individual choice; instead, accessing learning pathways is located historically, geographically, and politically by virtue of race, class, disability status, documentation status, gender, etc. It is no secret that the United States is a society highly stratified by race and class with increasing wealth and opportunity gaps (Carter, 2018; Nasir, Scott, Trujillo, & Hernandez, 2016; Reardon, 2011). Black and Latinx communities have significantly less access to resources and have been systematically disenfranchised in every dimension of social life, from health, wealth, education, and exposure to the criminal justice system, to housing (Carter, 2018; Ladson-Billings, 2006; Massey & Brodman, 2014). As with other realms of society riddled with patterns of inequality (Carter, 2018; Reardon, 2011), systems and institutions often have the power to facilitate or constrain individuals' access and opportunities. In the case of education, this power frequently operates relative to particular learning pathways.

Taking up this third characteristic allows us to see how Layla benefited from enactments of privilege via her family supports and institutional supports—like her seventh grade programing class and her high school math club—that spanned across time and context to facilitate her pathway into computing. Layla, also benefitted, however perversely, from the ideological supports as a Chinese American whose interests and success profile fit within the "model minority" discourse about East Asian students. That is to say, her success in mathematics and later her learning pathway in computing, did not run up against ideological or structural roadblocks that might constrain her pathway. Renee, on the other hand, ran the risk of being stereotyped as "not being good at math" by virtue of her being a bilingual girl whose mother immigrated and at one time was undocumented. However, because of her familial supports from her mother and sister, Renee was able to navigate around stereotypes and structural constraints to, like Layla, enact institutional privilege in the form of her encouraging high school counselors. It is important to note that Renee's institutional supports actually emerge out of her mother and sister's ability to access, navigate, and exploit institutional supports on her behalf—such as when Renee's mom, sister, and school counselors decided that she might be able to go to, and find funding for, an early college program. Having been undocumented and navigated the system—likely through a variety of supports unknown to us—Renee's mom (and later Renee's sister at Stanford) had the navigational and aspirational capital to activate institutional resources for Renee in ways that many other students with Renee's background may not be able to do. We see this with Jill who, as a first-generation college student, did not have the family supports or know how to leverage institutional supports to maintain her learning pathway as an engineer in college. Despite coming from a racially more privileged background with fewer ideological and structural constraints around the possibilities for her learning pathway, Jill's case demonstrates how structural and institutional constraints are nonetheless real and may have even more tenuous implications for learning pathways in high-stakes, high-status domains like mathematics, engineering, and other STEM fields and majors.

Reflecting on the cases of Layla, Renee, and Jill makes clear that processes of learning and identification are often set within institutional contexts, such as schools, science centers, families, or community organizations, which can both constrain and support access to learning pathways. Thus, learning pathways can reinforce systems of social advantage in society, or, as the case of Renee demonstrates, they can be purposefully deconstructed or constructed to disrupt social systems of advantage.

Conclusion and Implications

We have argued in this paper that learning might be productively characterized as occurring along learning pathways (Stevens et. al., 2008) to better capture the situated, social, relational, affective, cultural, and political (in terms of power dynamics) nature of learning. Indeed, we often already think about how learning and the learning pathways within schools are socially constructed wherein learners on different tracks have very different experiences than students on other tracks in ways that often correlate with race and social class (e.g. Oakes, Lipton, Anderson, & Stillman, 2018; Wells, 2015). However, these historicized and situated conceptualizations of learning and of learning pathways can be limited to specific learning settings, types of learners (e.g. racially, linguistically, and/or gender minoritized), or points in time within a learner's broader trajectory. Instead, the framework and cases presented here have the potential to offer guidance about how positive learning pathways can be supported across time, space, and context (formal or informal) for young people while paying deep attention to the structural and ideological constraints and affordances of institutions and systems that often feed into students' experiences of privilege and marginalization. Our case descriptions and understandings of the characteristics of learning pathways, and their intersections with culture, identity, and power, gives deeper insight into how we can nurture and understand the development of interests, positive learning identities and settings, and domain expertise of learners whose stories do not mirror our own but which reflect the diversity of today's youth.

We presented several cases to illustrate the three key characteristics of learning pathways, including cases where positive learning trajectories were maintained for students and cases where accessing such learning pathways was unavailable, constrained, or where learners chose not to pursue them. Renee and Layla's cases illustrate how families make concerted efforts to support learning pathways, by supporting the creation of opportunities to engage with, in these cases, STEM learning over multiple instances and in a range of activities. These pathways are sustained and deepened over time, and further validated when they intersect with school mathematics learning pathways. In these cases, the alignment between school learning and out-of-school learning prevented marginalization in school learning, and worked to privilege the students. These pathways, too, were shaped in vital ways by families, educators, and the young people themselves and how they reified their identities as mathematics learners and doers.

While Layla and Renee's pathways demonstrate how learning trajectories can be strengthened over time through familial and institutional supports, Jill's experiences illustrate that learning pathways and the sets of practices and routines that make them up are not always accessible to every student. Renee's case suggests that not all learning settings are created equally and that despite the odds some families can and will develop their own practice-level supports and seek out additional learning environments and supports. These cases make clear that learning settings are value-laden, that processes and instances of marginalization and privilege are enacted within them, and that different forms of capital (social, cultural, navigational, etc.) often get leveraged to negotiate those processes and instances. In other words, some participants are positioned with certain kinds of privileges within learning settings, and along learning pathways, while others are positioned more marginally, with less access to particular resources and pathways (Nasir & Shah, 2011; Wenger, 1998).

There is a need for studies to utilize and further this conceptualization, such as those that take into consideration characteristics of learning pathways and intentionally design learning environments that develop and enact design principles for hubs of learning that can cross formal and informal spaces, or that take analyses of power seriously and figure out and design around what students have access to and how they have been positioned as learners over time, for instance the Culturally Sustaining Pedagogy approach described by Alim, Paris, and Wong (this volume). Beyond implications for the design of learning environments and classroom instruction, the conceptual approach presented here has implications for how we study learning, and how we think about the various

intersecting effects on learning outcomes for students in and across settings. Specifically, taking the concept of learning pathways seriously would encourage learning scientists to broaden the types of data collected to reflect on learning and affective, relational, political, and motivational aspects of education. This would include collecting data that would lend itself to a deeper understanding of:

- broader notions of context and of learning settings
- the ideologies or societal discourses present in the contexts
- learning and shifts in learning participations and pathways over longer stretches of time, and over more than one environment
- the contextual and shifting nature of motivational processes, especially in relation to power, access, and marginalization
- deeper analysis of barriers and disruptions to a sustained learning pathway, including social, affective, financial, geographic and institutional factors among others

For example, combining a learning pathways approach with a geographical unit of analysis may be productive for continuing to theorize important dimensions of context and place-based learning by expanding our understanding of local settings to neighborhoods, cities, and states (Chetty, Hendren, Kline, & Saez, 2014). Likewise, from an empirical perspective, we would want methods that could capture these varied dimensions as well as capture everyday interactions and transformational moments that help us as researchers and educators to really unpack the role of resources and structural dimensions in a life history vis-a-vis a future-oriented learning pathway.

In summary, the concept of learning pathways supports a more nuanced account of learning—the settings in which it occurs, the timescales across which it occurs, and the dynamics of power by which it is shaped, taking up how recent analyses and theoretical innovations highlight power as a key focus for analyzing how race, gender, language, disability, and other dynamics become consequential in learning settings and for learners (Esmonde & Booker, 2016; Gholson & Martin, 2014; Langer-Osuna & Nasir, 2016). It also provides us with more sophisticated tools to appreciate the multiple ways that learning is socially and culturally situated, as people navigate the complex social and institutional settings, where they can be positioned—by others and themselves—in a range of more or less empowering ways. We need to better understand, research, and then design for diverse learning settings in and out of school wherein pathways of learning can be expanded out to each and every learner irrespective of their sociocultural origins, geographical location, or types of capital to which they personally have access. These processes have profound implications for *what* people come to learn and *who* is able to learn, not to mention what we understand to be consequential towards learning and towards the development of positive learning dispositions and pathways.

References

Alim, S., Paris, D., & Wong, C. (this volume). *Culturally Sustaining Pedagogy: A Critical Framework for Centering Communities*. New York, NY: Routledge.

Anderson, K. T. (2009). Applying positioning theory to the analysis of classroom interactions: Mediating micro-identities, macro-kinds, and ideologies of knowing. *Linguistics and Education*, 20(4), 291–310.

Annamma, S. (2016). Disrupting the carceral state through education journey mapping. *International Journal of Qualitative Studies in Education*, 29(9), 1210–1230. doi:10.1080/09518398.2016.1214297.

Azevedo, F. S. (2013). The tailored practice of hobbies and its implication for the design of interest-driven learning environments. *The Journal of the Learning Sciences*, 22(3), 462–510.

Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecologies perspective. *Human Development*, 49(4), 193–224.

Barron, B., & Bell, P. (2015). Learning in informal and formal environments. In: L. Corno & E. Anderman (Eds.), *Handbook of Educational Psychology: 3rd Edition*, pp. 323–336. Mahwah, NJ: Erlbaum.

Barron, B., Gomez, K., Pinkard, N., & Martin, C. K. (2014). *The Digital Youth Network: Cultivating Digital Media Citizenship in Urban Communities*. Cambridge, MA: MIT Press.

Barron, B., Martin, C. K., Takeuchi, L., & Fithian, R. (2009). Parents as learning partners in the development of technological fluency. *The International Journal of Learning and Media*, 1(2), 55–77.

Beach, K. (1999). Consequential transitions: A sociocultural expedition beyond transfer in education. *Review of Research in Education*, 24(1), 101–139.

Bell, P., Bricker, L. A., Lee, T. R., Reeve, S., & Zimmerman, H. T. (2006). Understanding the cultural foundations of children's biological knowledge: Insights from everyday cognition research. In: S. A. Barab, K. E. Hay & D. Hickey (Eds.), *Proceedings of the Seventh International Conference of the Learning Sciences (ICLS)*, pp. 1029–1035. Mahwah, NJ: LEA.

Bloomer, M., & Hodkinson, P. (2000). Learning careers: Continuity and change in young people's dispositions to learning. *British Educational Research Journal*, 26(5), 583–597.

Boaler, J., & Greeno, J. (2000). Identity, agency, and knowing in mathematics world. *Multiple Perspectives on Mathematics Teaching and Learning*, 1, 171–200.

Bricker, L. A., & Bell, P. (2014). "What comes to mind when you think of science? The perfumery!": Documenting science-related cultural learning pathways across contexts and timescales. *Journal of Research in Science Teaching*, 51(3), 260–285.

Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and by Design*. Cambridge, MA: Harvard University Press.

Cantor, P., Osher, D., Berg, J., Steyer, L., & Rose, T. (2018). Malleability, plasticity, and individuality: How children learn and develop in context 1. *Applied Developmental Science*. doi:10.1080/10888691.2017.1398649.

Carter, P. (2018). The multidimensional problems of educational inequality require multidimensional solutions. *Educational Studies*, 54(1), 1–16.

Chetty, R., Hendren, N., Kline, P., & Saez, E. (2014). Where is the land of opportunity? The geography of intergenerational mobility in the United States. *The Quarterly Journal of Economics*, 129(4), 1553–1623.

Ching, D., Santo, R., Hoadley, C., & Peppler, K. (2015). On-ramps, lane changes, detours and destinations: Building connected learning pathways in Hive NYC through brokering future learning opportunities. Document Retrieved from: http://hivenyc. org.

Cole, M. (1996). *Cultural Psychology: A Once and Future Discipline*. Cambridge, MA: Harvard University Press.

Collins, M. A., & Amabile, T. M. (1999). Motivation and creativity. In: R. J. Sternberg (Ed.), *Handbook of Creativity*, pp. 297–312. New York: Cambridge University Press.

Crossan, B., Field, J., Gallacher, J., & Merrill, B. (2003). Understanding participation in learning for non-traditional adult learners: Learning careers and the construction of learning identities. *British Journal of Sociology of Education*, 24(1), 55–67.

DiSessa, A. (2002). Why "conceptual ecology" is a good idea. In: M. Limon and L. Mason (Eds.), *Reconsidering Conceptual Change: Issues in Theory and Practice. Part 1*, pp. 28–60. Dordrecht: Springer.

Elder, G. (1994). Time, human agency, and social change: Perspectives on the life course. *Social Psychology Quarterly*, 57(1), 4–15.

Ericsson, K. A. (2006). The influence of experience and deliberate practice on the development of superior expert performance. In: K. A. Ericcson, N. Charness, P. J. Feltovich & R. R. Hoffman (Eds.), *The Cambridge Handbook of Expertise and Expert Performance*, pp. 683–703. New York: Cambridge University Press.

Erstad, O., & Sefton-Green, J. (Eds.) (2013). *Identity, Community, and Learning Lives in the Digital Age*. Cambridge: Cambridge University Press.

Esmonde, I., & Booker, A. N. (2017). *Power and Privilege in the Learning Sciences*. New York, NY: Routledge.

Esmonde, I., & Langer-Osuna, J. M. (2013). Power in numbers: Student participation in mathematical discussions in heterogeneous spaces. *Journal for Research in Mathematics Education*, 44(1), 288–315.

Gallimore, R., & Goldenberg, C. (2001). Analyzing cultural models and settings to connect minority achievement and school improvement research. *Educational Psychologist*, 36(1), 45–56.

Gholson, M., & Martin, D. B. (2014). Smart girls, Black girls, mean girls, and bullies: At the intersection of identities and the mediating role of young girls' social network in mathematical communities of practice. *Journal of Education*, 194(1), 19–33.

Gibson, R. E. (2009). *Musical Parenting: An Ethnographic Account of Musical Interactions of Parents and Young Children*. (Unpublished doctoral disseration). Seattle, WA: University of Washington.

Goodwin, M. H. (2007). Occasioned knowledge exploration in family interaction. *Discourse & Society*, 18(1), 93–110.

Greene, J. A. (2014). Serious challenges require serious scholarship: Integrating implementation science into the scholarly discourse. *Contemporary Educational Psychology*, (40), 112–120.

Greenfield, P. (2009). Linking social change and developmental change: Shifting pathways of human development. *Developmental Psychology*, 45(2), 401.

Griffin, S. A., Case, R., & Siegler, R. S. (1994). *Rightstart: Providing the Central Conceptual Prerequisites for First Formal Learning of Arithmetic to Students at Risk for School Failure*. Cambridge, MA: MIT Press.

Gutiérrez, K., & Rogoff, B. (2003). Cultural ways of learning: Individual traits of cultural repertoires of practice. *Educational Researcher*, 32(5), 19–25.

Hecht, M., Knutson, K., & Crowley, K. (2019). Becoming a naturalist: Interest development across the learning ecology. *Science Education*, 103(3), 691–713.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist*, 41(2), 111–127.

Immordino-Yang, M. H., Darling-Hammond, L., & Krone, C. (2019). Nurturing nature: How brain development is inherently social and emotional, and what this means for education. *Educational Psychologist*, 54(3), 185–204.

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

Langer-Osuna, J. M., & Nasir, N. S. (2016). Rehumanizing the "Other" race, culture, and identity in education research. *Review of Research in Education*, 40(1), 723–743.

Lave, J., & Wenger, E. (1991). *Situated Learning and Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Lee, C. (2007). *Culture, Literacy, and Learning: Blooming in the Midst of a Whirlwind*. New York: Teachers College.

Lee, C. D. (2010). Soaring above the clouds, delving the ocean's depths: Understanding the ecologies of human learning and the challenge for education science. *Educational Researcher*, 39(9), 643–655.

Lee, C. D. (2017). Integrating research on how people learn and learning across settings as a window of opportunity to address inequality in educational processes and outcomes. *Review of Educational Research*, 41(1), 88–111.

Leonardo, Z. (2009). *Race, Whiteness, and Education*. New York, NY: Routledge.

Martin, L., Goldman, S., & Jimenez, O. (2009). The Tanda: A practice at the intersection of mathematics, culture, and financial goals. *Mind, Culture, and Activity*, 16(4), 338–352.

Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist*, 41(9), 954.

Massey, D. S., & Brodmann, S. (2014). *Spheres of Influence: The Social Ecology of Racial and Class Inequality*. New York, NY: Russell Sage Foundation.

McDermott, R., & Pea, R. (this volume). *Learning How to Mean: Embodiment in Cultural Practices*. New York, NY: Routledge.

McInerney, D. M. (2008). The motivational roles of cultural differences and cultural identity in self-regulated learning. In: D. H. Schunk & B. J. Zimmerman (Eds.), *Motivation and Self-Regulated Learning: Theory, Research, and Applications*, pp. 369–400. New York, NY: Erlbaum.

Mehan, H. (1996). *Constructing School Success: The Consequences of Untracking Low-Achieving Students*. New York: Cambridge University Press.

Nasir, N. (2002). Identity, goals, and learning: Mathematics in cultural practice. *Mathematical Thinking and Learning*, 4(2&3), 211–245.

Nasir, N. (2011). *Racialized Identities: Race and Achievement among African American Youth*. Palo Alto, CA: Stanford University Press.

Nasir, N. S., & Shah, N. (2011). On defense: African American males making sense of racialized narratives in mathematics education. *Journal of African American Males in Education*, 2(1), 24–45.

Nasir, N.S, Rosebery, A. S., Warren, B. W., & Lee, C D. (2006). Learning as a cultural process: Achieving equity through diversity. In: R. K. Sawyer (Ed.), *The Cambridge Handbook of The Learning Sciences*. New York, NY: Cambridge University Press.

Oakes, J., Lipton, M., Anderson, L., & Stillman, J. (2018). *Teaching to Change the World*. New York, NY; Routledge.

Ochs, E., & Taylor, C. (1992). Science at Dinner. In: C. Kramsch & S. McConnell-Ginet (Eds.), *Text and Context: Cross-disciplinary Perspectives on Language Study*, pp. 29–45. Lexington, MA: D.C. Heath.

Oyserman, D., Bybee, D., Terry, K., & Hart-Johnson, T. (2004). Possible selves as roadmaps. *Journal of Research in Personality*, 38(2), 130–149.

Packer, M. (2000). *Changing Classes: School Reform and the New Economy*. New York, NY: Cambridge University Press.

Plath, D. (1985). *Long Engagements: Maturity in Modern Japan*. Stanford, CA: Stanford University.

Polman, J. L., & Miller, D. (2010). Changing stories: Trajectories of identification among African American youth in a science outreach apprenticeship. *American Educational Research Journal: Teaching, Learning, and Human Development*, 583–597. doi:10.3102/0002831210367513.

Powell, J., & Roediger, D. (2012). *Racing to Justice: Transforming Our Conceptions of Self and Other to Build an Inclusive Society*. Bloomington; Indianapolis: Indiana University Press. Retrieved March 27, 2020, from www.jstor.org/stable/j.ctt16gzcpj

Reardon, S. F. (2011). The widening academic achievement gap between the rich and the poor: New evidence and possible explanations. In: G. Duncan and R. Murnane (Eds.), *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances*, pp. 91–116. New York, NY: Russell Sage Foundation.

Rogoff, B. (1990). *Apprenticeship in Thinking: Cognitive Development in Social Context*. Oxford: Oxford University Press.

Rogoff, B. (2003). *The Cultural Nature of Human Development*. New York, NY: Oxford.

Rogoff, B., Topping, J., Baker-Sennett, J., & Lacasa, P. (2002). Mutual contributions of individuals, partners, and institutions: Planning to remember in Girl Scout Cookie sales. *Social Development*, 11(2), 266–289.

Saxe, G. (1999). Cognition, development, and cultural practices. In: E. Turiel (Ed.), *Culture and Development: New Directions in Child Psychology*, pp. 19–35. San Francisco, CA: Jossey-Bass.

Saxe, G. (2002). Children's developing mathematics in collective practices: A framework for analysis. *The Journal of the Learning Sciences*, 11(2), 275–300.

Schutz, A. (1932/1967). *The Phenomenology of the Social World*. London: Heinemann.

Scribner, S., & Cole, M. (1981). *The Psychology of Literacy*. Cambridge, MA: Harvard University Press.

Spencer, M. B. (2008). Fourth annual Brown lecture in education research--Lessons learned and opportunities ignored since Brown v. Board of Education: Youth development and the myth of a color-blind society. *Educational Researcher*, 37(5), 253–266.

Stevens, R., O'Connor, K., Garrison, L., Jocuns, A., & Amos, D. (2008). Becoming an engineer: Toward a three-dimensional view of engineering learning. *Journal of Engineering Education*, 97(3), 355–368.

Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University.

Wang, M. T., Smith, L. V., Miller-Cotto, D., & Huguley, J. P. (2019). Parental ethnic-racial socialization and children of color's academic success: A meta-analytic review. *Child Development*.

Wells, A. S. (2015). *Diverse Housing, Diverse Schooling: How Policy Can Stabilize Racial Demographic Change in Cities and Suburbs*. Boulder, CO: National Education Policy Center.

Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.

Wertsch, J. V. (1991). *Voices of the Mind: A Sociocultural Approach to Mediated Action*. Cambridge, MA: Harvard University Press.

Wortham, S. (2008). The objectification of identity across events. *Linguistics and Education*, 19(3), 294–311.

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