Toward Conceptualizing Resources for Learning Across Settings

Jasmine Y. Ma, New York University, j.ma@nyu.edu
Molly L. Kelton, Washington State University, molly.kelton@wsu.edu
Sarah C. Radke, New York University, scr274@nyu.edu
Daniela Della Volpe, New York University, ddv234@nyu.edu

Abstract: We build on the approach of treating learning as a cross-setting phenomenon, exploring how the learning sciences might critically and expansively re-conceptualize resources for nondominant youths' learning. First, we explore the range of ways the learning sciences has positioned settings theoretically and analytically, and some conceptual consequences of these choices. We then describe a cross-setting approach that de-centers schools as a primary analytical site for learning disciplinary content, and instead treats them as part of a larger ecology in youths' lives. We share analyses of two episodes from one youth's learning pathway to illustrate how a cross-setting analysis can expand a single-sited conceptualization of his resources for learning, in this case to include relational practices. This paper advances current scholarship on learning across settings by examining closely and empirically how cross-setting approaches might productively trouble and re-configure how we conceptualize nondominant youths' lives in the learning sciences.

Research in the learning sciences has long been identifying and categorizing resources that support learning, including discursive (e.g., Moschkovich, 1996) and sense-making practices (e.g., Cobb, 2002) both in and out of school, and identities (e.g., Nasir, 2002) that youth appropriate, contest, or negotiate. Additionally, the learning sciences has long held a commitment to studying and designing for learning as a situated enterprise (Hoadley, 2018). To better understand processes of learning, we must consider them as embedded in social, historical, cultural, political, and material contexts (e.g., Lave, 1988). Of course, what is meant by "situated" has been treated quite disparately, and is often under contestation. For example, some may see clinical interview methodology as removed from naturally occurring learning activity; it has also been argued that these experimental events may be analyzed as intact activity systems, thereby preserving important social interrelations (diSessa, 2007). "Situated" framings vary widely, and may focus, among other things, on sociocultural practices (e.g., Lave, 1988), material and representational ecologies (e.g., Hutchins, 2010), or sociohistorical and sociopolitical development (e.g., Jurow & Shea, 2015). However, the field has only recently begun to seriously consider the situated nature of learning as occurring across settings (e.g., Bell, Tzou, Bricker, & Baines, 2012; Vossoughi & Gutiérrez, 2014), and has not begun to identify resources for learning that emerge *across* youths' trajectories. Patterns of activity that become visible across settings may be usefully conceptualized as resources already investigated in the field, such as discourse practices. More likely, however, a cross-setting approach will bring refinements, revisions, remixes, or altogether new categories previously obscured in studies of discrete contexts bound by space or activity (Leander, Phillips, & Taylor, 2010).

In this paper we describe a theoretical approach to conceptualizing youths' resources for disciplinary learning, drawing on contemporary work in the learning sciences that looks across settings, viewing school classrooms as only one among many different settings that can support learning (Bell et al., 2012). Here, we situate the approach by providing a brief (and caricatured) historical glimpse through theoretical treatments of setting, or context, in learning sciences research (see Figure 1 for a summary). We use the term "setting" deliberately as a way to simultaneously take into account physical spaces and their sociohistorical development and sociopolitical positioning, the activity that occurs within them, and their interrelated nature (Lave, 1988).

Conceptualizing setting in the learning sciences

We begin with a brief characterization—or caricature—of various approaches to the notion of setting in the learning sciences. The purpose of this is not to provide a comprehensive review; nor do we mean to imply any sort of developmental trajectory for the field. The approaches referenced here are alive and well, and make diverse contributions. Instead, we mean to illustrate how repositioning setting within an analytic framework can shape the kinds of research questions we ask and the kinds of concepts we develop and make relevant (either for or through analysis). Just as major "turns" in theoretical frames have provided alternative—and at times more expansive—analytical focus to research in the past (see Lerman, 2000 on the social turn; Sfard, 2005 on the discursive turn; and Gutiérrez, 2013 on the sociopolitical turn), we argue that a turn toward cross-setting theories of learning may provide new opportunities for understanding the range of practices that occur in human activity

and the resources that support the learning of nondominant youth. At the same time, the discussion will help to situate our approach among other, similar approaches.

treatment of setting	example studies	guiding research question	driving or emerging theoretical concepts
"no" setting	• experimental studies, clinical interviews (Piaget; Abrahamson, 2009)	What mental representations support learning/doing this disciplinary content?	• assimilation, accommodation, disequilibrium
 within setting	• quantitative practices among "just plain folk" in grocery stores (Lave, 1988) • classroom studies (Langer-Osuna, 2015)	How do people learn/do here?	• legitimate peripheral participation • mathematical identity and engagement
 nested settings	• constructivist, emergent, and sociocultural perspectives (Cobb & Yackel, 1996) • micro-, onto-, sociogenetic shifts (Saxe & Esmonde, 2005)	How do broader contextual factors influence learning?	• ecological/multilevel frameworks • form-function shifts over time
 setting comparison	• street/school (Carraher, Carraher, & Schliemann, 1985) • basketball/classroom (Nasir & Hand, 2008)	What do people do there, versus here (school)?	• transfer vs. mismatch
 bridging settings	• culturally relevant (Ladson-Billings, 1997) • funds of knowledge (González, Andrade, Civil, & Mol, 2009)	How can we leverage disciplinary content (or other resources) from there for learning here (classroom)?	• critical consciousness • third space, hybridity
 cross-setting	we draw from: • multi-sited ethnography (Vossoughi & Gutiérrez, 2014) • cultural learning pathways (Bell et al., 2012) • learning as cross-setting (Jackson, 2011)	How do moments—experienced across settings and social groups—result in important learning?	• learning pathways • cross-setting resources

Figure 1. (Caricatured) summary of treatments of "setting" in learning sciences research.

From the early days of education research, studies adopted or took place within psychological traditions of experimentation (e.g., Piaget, 1954; Abrahamson, 2009). These studies attend to *"no" settings* in the sense that the locations and physical arrangements of experiments or clinical interviews, who was involved, and the framing activity of experimentation play little part in the analysis (see diSessa, 2007, mentioned above, for a counter-argument). At most, salient context variables included details around tasks given to subjects, such as instructions and content (Lave, 1988). These studies often aim to identify existing understandings or support learning of disciplinary concepts with predetermined definitions and associated behaviors.

As social theories of cognition and learning have been developed and taken up, a broad range of definitions and roles for settings have emerged. *Single setting* studies investigate learning and practices that occur within an individual setting, such as a classroom (Langer-Osuna, 2015) or a grocery store (Lave, 1988). These studies consider different aspects of these settings, from how disciplinary identity is socially co-constituted to how cognition and learning is supported by the organization of the activity. *Nested setting* studies (e.g., Cobb & Yackel, 1996; Saxe & Esmonde, 2005) are concerned with hierarchical relations between settings. For example, Cobb and Yackel described individual activity as a level within a classroom microculture, which occurs within a school, which is situated within a broader societal culture. These studies acknowledge the overlapping, sometimes competing influences of multiple levels of settings on learning.

Finally, two types of studies consider multiple settings. *Setting comparison* studies investigate activity within different settings (e.g., Carraher, Carraher, & Schliemann, 1985; Nasir & Hand, 2008), comparing, among other things, the organization of disciplinary activity, and resources for doing and learning it. These studies validate out-of-school settings as rich sites for learning and usually serve to inform school instruction. *Bridging setting* studies look to youths' experiences and knowledge in out-of-school settings to inform designs for learning academic content, usually in school classrooms. While these studies often focus on disciplinary learning as the primary goal (e.g., González, et al., 2009), many also strive to support young people in overcoming the very oppressive structures that are obstacles to their success (e.g., Ladson-Billings, 1997).

The cross-setting approach we investigate does not look to research in out-of-school settings to inform analysis or design in the classroom, as has typically been the case with comparison or bridging studies. Instead we suggest that there may be underexplored value in creating units of analysis comprised of multiple settings and the pathways through them. This allows us to interrogate holistically the relations among sites and youths'

movements across them for resources they assemble and deploy for learning. We acknowledge that a cross-setting lens does not inherently avoid deficit views of nondominant youth and their out-of-school lives. However, in our cross-setting approach to learning we deliberately displace school activity as the central locus of research and practical intervention by attending to—and valuing equally—the multiple heterogeneous school and non-school settings in which learners spend their time, while foregrounding the pathways they take across them. Like setting comparison studies, this approach is rooted in the principle that equitable education begins with investigating "the out-of-school spaces young people occupy and create with the guiding assumption that one will find complex intellectual activity, and then staying long enough to gain a deeper understanding of the developmental demands participation in such settings requires," (Vossoughi & Gutiérrez, 2014, p. 613). This understanding is then mobilized for expansive, more inclusive reinterpretations of disciplinary activity and learning. Looking across settings recognizes that learning is not bounded by particular places, activities, or events (Barron, 2006; Leander, Phillips, & Taylor, 2010), and that learners actively author the terms of their engagement, assembling resources that may originate from other settings (Bell et al., 2012; Jackson, 2011).

Toward a cross-setting approach: Learning pathways

The framework we envision assembles theoretical and methodological developments emerging from literacy and science education, learning sciences, and anthropological and cultural studies. These developments include (a) syncretic approaches to studying the development of nondominant youth across settings (Gutiérrez, 2014); (b) the cultural learning pathways framework (Bell et al., 2012); and (c) a multi-sited ethnographic sensibility (Marcus, 1995; Vossoughi & Gutiérrez, 2014) for following youth's pursuits.

First, emerging syncretic approaches in literacy education (Gutiérrez, 2014) present yet-underutilized theoretical tools for investigating how youths' movements across different contexts might support learning. A syncretic framing, "involves intentional moves that 1) bring together and reorganize different, contradictory and discrete cultural practices that are generally incompatible or in tension with one another; 2) preserve and foreground the tension between everyday and scientific practices; and 3) seek to maintain the value, history, and integrity of the everyday genre vis-à-vis the dominant form, especially in light of historical power relations" (p. 49). This differs from bridging setting approaches in its focus on an ecology of learners' multiple settings and social worlds and possible relations to disciplinary learning. Classrooms are no longer the focal site of disciplinary learning, instead one in an ecology of learning in which youth participate (Barron, 2006).

In situating classrooms within a broader learning ecology, the syncretic approach balances a concern for how out-of-school life can be cultivated toward academic success, on the one hand, with greater attention to how classrooms might be differently configured in ways that promote equitable learning settings for nondominant youth, on the other. Jackson's (2011) analysis, while not taking a syncretic framing, strikingly demonstrated mathematics learning as a phenomenon that stretched across a pathway involving both home and school. She described the mathematics activity of a 10-year-old, Timothy, as he moved between the two sites; homework practices supported Timothy's participation in the school, while his teacher's assumptions about what happened at home, and resulting instructional decisions, did not. A syncretic approach makes possible expansive conceptions of disciplinary learning that both are worthwhile of schools', educators', and learners' attention, and address disjunctures between historically sedimented structures of classroom disciplines and the lived realities of nondominant youth, by disrupting the former and honoring the latter.

We further investigate youth learning within syncretic learning ecologies through the concept of cultural learning pathways. Bell et al. (2012) define cultural learning pathways as "connected chains of personally consequential activity and sense-making" (p. 270) that unfold in time, across a variety of spaces, and involve multiple intersecting social practices and values. Within these pathways, learning is situated in evolving participation in cultural practices, is both an individual and collective process, and "is accomplished across settings (i.e., translocally) by persons acting within diversities of structures of social practice" (p. 272). Cultural learning pathways direct analytic attention to how "constellations of situated events" (p. 273) in youths' everyday and schooled lives produce and are produced by evolving participation in disciplinary sense-making. These events are situated in places whose sociohistorical and sociomaterial arrangements varyingly invite or discourage certain actions. This framework accounts for how these arrangements specific to a variety of contexts may differently configure the nature of students' possible engagements in disciplinary activity.

Finally, we suggest that a multi-sited ethnographic sensibility (Marcus, 1995; Vossoughi & Gutiérrez, 2014) allows us to craft appropriate methodologies for tracing actual and potential learning pathways across syncretic learning ecologies. Multi-sited ethnography originated in anthropology and has since been further developed in diverse fields (e.g. media studies) as an evolving body of approaches for investigating phenomena that transcend single locales (Marcus, 1995). This methodological sensibility "is designed around chains, paths, threads, conjunctions, or juxtapositions of locations in which the ethnographer establishes some form of literal,

physical presence, with an explicit, posited logic of association or connection among sites" (Marcus, 1995, p. 105). Practically, studying chains and conjunctions across multiple sites can entail following the movements of persons, material objects, signs, or storylines. It can also entail theorizing a "single" site as inextricably—if contingently—embedded in a systemic context or a multifarious entanglement of sites and practices.

Literacy and science education scholars have taken up multi-sited-ness as a strategy for challenging deficit views of nondominant youth, highlighting transits between official and unofficial spaces as sites of social and political tension and contradiction, and foregrounding youths' sensible navigations of these contradictions (Vossoughi & Gutiérrez, 2014). We are committed to understanding the meanings youth make in social action, honoring the complexity of youths' multiple engagements as they move across settings, treating youth and their practices as under development and continually unfolding. This can allow us to make *discoveries* rather than *assumptions* about how youths' experiences and sense-making are constituted by local and broader cultural practices (Vossoughi & Gutiérrez, 2014). A multi-sited approach allows us to investigate how some groups' "linguistic, cultural, and intellectual resources are free to move across settings or hybridize" while others' "are prohibited, devalued, and marginalized" (p. 620). Our enterprise is to better understand those resources, and develop strategies for valuing and leveraging them with respect to what we teach, and how we teach it.

Characterizing learning resources assembled across learning pathways

Analyses of youths' learning pathways consider and construct categories for the different practices they may draw dynamically from across settings. Taking a syncretic, pathways approach to disciplinary learning can uncover not only the wide array of resources for learning within the heterogeneous settings in which youth spend their time, but also those that emerge across those settings, at points of connection, inter-relation, and resonance—as well as disjunction, difference, and contradiction—across a learning ecology (Vossoughi & Gutiérrez, 2014). Investigating cross-setting continuities would illuminate instances of productive coordination in which "the interests, questions, ideas, practices, and tools sparked in one setting can find creative developmental pathways and resources in another" (Vossoughi & Gutiérrez, 2014; pp. 610-611). We explore one example of continuity in the following analysis. We share two episodes following Lucas, a focal participant in our pilot study investigating learning resources as cross-setting phenomena. We follow Nasir and McKinney de Royston (2013) in providing two possible analyses of Lucas's learning. We begin by briefly summarizing a possible single-sited analysis after the first episode. Then, after sharing a second, we offer a cross-setting analysis that demonstrates a different way of viewing Lucas's participation and resources for learning.

The study design began with an interest-driven, elective out-of-school time learning environment as an initial site of inquiry for our multi-sited ethnographic design. We then selected focal youth to follow into other settings as negotiated between researchers and focal participants. Our initial site, which we call Digital Studio (DS), was a non-profit youth afterschool documentary filmmaking program serving marginalized youth populations. The data shown here was collected by Radke (co-author of this paper) in the fall and winter of 2017, and jointly analyzed by the research team using methods of interaction analysis (Jordan & Henderson, 1995). Episodes were selected for this paper for the comparative leverage they provide for illuminating the different analyses.

Episode 1: Working with the numbers

It was early in the semester, and students were in small groups searching for statistics about their proposed documentary topics. Lucas's group was researching the experience of LGBT people in 2017. Lucas was searching online, and had asked Cai to write down his findings. Other members of the group included Xane and Zeena. Lucas's first search was for the total number of LGBT people in the US:

[1.1] Lucas: Approximately 3.5% of Americans (2s) Identify as lesbian, gay, or bisexual
[1.2] Xane: 3 point what?
[1.3] Lucas: 5
[1.4] Xane: Percent of Americans?
[1.5] Lucas: Yeah.
[1.6] Xane: Wow that's a lot.
[1.7] Cai: As what? Gay. Lesbian.
[1.8] Lucas: Or bisexual, while .3 percent are transgender - that's about...still 10 million.
[1.9] Xane: Yeah, that's a lot. That's what I'm saying (inaudible)
[1.10] Lucas: It's li- It's like=

[1.11] Cai: How much is transgender?
[1.12] Lucas: Point 3 (.) percent
[1.13] Zeena: [(inaudible)
[1.14] Xane: [Now I feel bad
[1.15] Lucas: Uh, it's also - you have to keep in mind that not everyone is comfortable to s- like -
[1.16] Xane: To say what th[ey are
[1.17] Cai: [there's probably more than that, [just like -
[1.18] Lucas: [yeah they just aren't comfortable with sharing the information
[1.19] Xane: (Yeah I understand)
[1.20] ((*19s; Lucas reports the Gates approximate number to Cai, who asks him to repeat it*))
[1.21] Lucas: 9 million members of the LGBT community in America today. (1s) ((*Scrolls down on the screen, looks at Zeena, back to screen, then to Zeena*)) Yeah and then, uh, during the break can I pick - actually either of you - can I pick either of you guys something up to make you guys feel better?

Lucas was actively working with and reasoning about statistics. It is notable that he was both seeing the power in them (there are a lot of LGBT folks in the US [1.8]), and how they were made or calculated (not all people reporting impacts accuracy [1.15-18]). As they continued researching, he engaged with Xane's ongoing grappling with his understandings of LGBT issues [1.14], and later, Cai's his own experience as gay and single (Cai would later complain that there are "9 million people and not one for me"). The statistics were used to convince Xane of the size of this population (and therefore the magnitude of the issue) and also to problem solve Cai's single-ness (finding a place for him to move where there is a larger proportion of queer people). Additionally, Lucas was doing some care-taking of Zeena and Xane [1.21], who were having a rough day.

Possible single-sited analysis

Taking up this episode for an analysis of statistical learning within DS as the single setting of focus, we would see that the group's and Lucas's negotiation of the general and the particular in statistical reasoning are salient in this exchange. The group's personal experiences with LGBT issues serve as resources for their statistical reasoning, and Lucas's negotiations around statistics and his peers' personal LGBT concerns support his developing understandings of how statistics might influence how those personal stories are understood.

Episode 2: Working with peers

Five months later, Radke spent time with Lucas in his History of Clothing class in school. The students were working in small groups to collectively recreate a model of Otzi the Iceman, a naturally well-preserved mummy of a man who lived between 3400 and 3100 BCE. Lucas's group was weaving the sleeping mat that Otzi might have worn as the outermost layer of his clothing. The project had been going for two weeks now, and the goal was to finish on this day. On this day Faye had joined him after being absent from the group almost the entire time. Lucas tried to explain his work of weaving the grass, while Faye expressed frustrations.

[2.1] Faye: I don't understand, it makes absolutely no sense to me.
[2.2] Lucas: Yeah, it's kinda weird. So when I was doing it, I would take ((*spreads out grass*)), so I would spread it out more right? And then, I [don't know
[2.3] Faye: [I feel like I should just tie it and then add them in.
[2.4] Lucas: Do whatever you, uh, [whatever way you think would -
[2.5] Faye: [Cuz - the tape thing is not helpful.
[2.6] Lucas: If you think it would be faster that way, do it that way. I only did the tape because it was easier for me. I'm not good with my hands though.
[2.7] ((*3:12 elapses as they talk about Faye's future plans for cosmetology*))
[2.8] Faye: ((*Turning her work toward Lucas*)) Look!
[2.9] Lucas: Yeah, it [looks good. ((*Leaning over*))
[2.10] Faye: [How's that?
[2.11] Lucas: Yeah and then you would [jus-
[2.12] Faye: [I'm more like doing knots cuz I don't understand.
[2.13] Lucas: And then, are you just gonna add more?

[2.14] Faye: Yeah, just add more.

[2.15] Lucas: Yeah, that works fine, an - uh, and then once you do that, I can help you weave the rest of it through. (1.5s) If it's too hard. (6s) I don't know what I want to do when I get out of school. I've been thinking about that a lot.

[2.16] Faye: I also got an offer for an animation college in Florida.

[2.17] Lucas: That's really cool. Yeah, I see you draw a lot so::

[2.18] Faye: I also animate my work.

[2.19] Lucas: Oh really? That's awesome. I do a little bit of animation, but I'm not that great.

[2.20] Faye: I do like anime style animation=

[2.21] Lucas: =Same ((*Smiles*))

This episode makes salient Lucas's social relationship with his peers, which we had begun to follow as a thread across settings. Here Lucas negotiates a leadership role as a member of small group work: he offers to help [2.2; 2.15] , he sympathizes (and identifies) with Faye's difficulties [2.2], gives her agency in deciding how to do it [2.6], and also weaves in social getting-to-know-you conversation where he both identifies with Faye but also positions himself as "not that great" [2.7; 2.15-21]. This episode is another instance of the relational work Lucas does with his peers in the context of directed/designed learning settings.

Cross-setting analysis

A cross-setting analysis would follow practices such as this relational work across different settings, and ask how they are distributed and transform. Bringing the two episodes together, we focus on Lucas's negotiations around statistics and LGBT concerns with his peers as a thread into other settings. We treat Lucas's exchanges with peers as cross-setting phenomena; in other words, we focus on what we call his relational practices. We looked to as many settings as possible—including home, DS, and classrooms—for these relational practices.

With a cross-setting lens, we return to Episode 1 with new eyes. This lens helps us see work in DS as constituting many interacting activity systems—or we say, how many intersecting settings are produced. Then, with this lens we don't see, for example, his exchanges with Xane about the surprise of the large population of the LGBT community, or his problem-solving with Cai about his dating prospects, as separate from his statistical reasoning, but instead *playing a part in constituting that reasoning*. Similarly, Lucas's wanting to take care of Zeena by getting her some food during the break is not an off-task exchange, but also gives shape to their statistical work. Next we share an extension of Episode 1, less relevant to the single-sited analysis, to demonstrate how Lucas deploys his relational practices to support the group's statistics learning activity.

[1.22] ((~30 seconds later…))

[1.23] Xane: ((*To Zeena, rubbing her back*)) You okay?

[1.24] Zeena: Yes, I'm just fucking tired. Stop asking if I'm okay.

[1.25] Xane: (I wanna help you out)

[1.26] Zeena: I'm sorry. Everyone's like are you okay? Yes I'm not fucking dying I just want to sleep. (5s) Sorry man, when I'm tired I snap at people.

[1.27] Xane: It's okay.

[1.28] Zeena: (inaudible)

[1.29] ((*18s of silence, during which:*))

a. looks at Zeena b. looks at screen c. rubs face d. looks at screen e. looks Cai's paper

[1.30] Zeena: ((*Just as Lucas turns back to the screen*)) Scroll down? ((*Lucas scrolls*)) Woah too far down.

[1.31] Lucas: This is the (stat we're working on.)

[1.32] Zeena: Nah I was looking at what are the other forms of discrimination. The line (with the)

We see Lucas here doing some embodied relational work that demonstrates his multiple alignments with concern over Zeena's tiredness, as he looks over at her [1.29a], the ongoing research that they've been asked to do [1.29b], his identification with Zeena's tiredness as he rubs his face then looks back at his screen [1.29c-d], then the work Cai was doing recording the statistics that they had found [1.29e]. We argue that he was not simply demonstrating these alignments, he was also directing the group's mutual attention, threading these participant frameworks together as he shifted his embodied stance.

Discussion

Conceptually, Lucas's peer negotiations as a resource for learning are remixed in this analysis. We see a broader category of relational practices as relevant to Lucas's statistical meaning-making (and learning in general). These relational practices must be followed within DS and in other places, to understand how, as a whole, they were deployed, transformed, and hybridized across settings. If relational practices, as they move across settings, are treated as a learning resource, then this also raises questions for how statistical sense-making, in turn, is a resource that is embedded in these practices, rather than an abstract skill that is simply transferred across settings. Attending to the potential supports these kinds of continuities might provide for engaging with disciplinary content would allow us to draw conclusions about the conditions that facilitate robust, connected (Ito et al., 2013) learning.

At the same time, learning pathways across settings will also be marked by numerous disjunctures, points at which interests and practices pursued in one set of settings do not take hold in—or present contradictions with—another. In some cases, disjunctures could reveal competing social practices that make it difficult for youth to pursue their interests. Cases like this can provide important insights into how the design and structure of learning environments can impede learning pathways, as well as the creative work of young people to resist those impediments. In other cases, discontinuities between settings might themselves become sites of productive disruption, in which felt disjunctures provoke the emergence of new strategies for solving problems or instigate critical conversations about disciplinary knowledge. Disjunctures experienced by nondominant youth might function as resources for expansive, critical sense-making with and about disciplinary content; a focus on learning pathways would uncover the conditions under which this might be the case.

Finally, these cross-setting resources can shape new design conjectures for instruction both in and beyond the classroom. For example, one major contribution of single-sited studies of out-of-school learning mentioned above (e.g., studies of grocery shoppers; Lave, 1988) was the identification of the disembedded and prescribed nature of typical school mathematics activities. This, in turn, informed the design of contextually meaningful tasks that flexibly support student-invented problem-solving strategies now promoted by most mathematics educators (e.g., the Middle School Mathematics Through Applications Project; Greeno & Hall, 1997). By analogy, characterization of resources assembled across youths' learning pathways can inform the (re)design of more expansive, equitable modes of instruction and point to new ways of conceiving the content of disciplinary learning. New design principles may target elements of activity structures that have potential to reach backward into previously experienced settings or forward into future, anticipated activity (Jackson, 2011). Alternatively multi-sited work may inform the design of expanded activity structures that themselves stretch across time and settings in new ways (Ito et al., 2013), toward networks of formal and informal learning environments, creating opportunities for practical changes that extend beyond the boundaries of single settings. For example, a cross-setting perspective on disciplinary learning might allow as to discover how formal and informal organizations might better coordinate with one another to provide more meaningfully connected learning experiences in ways that leverage multiple community sites and resources. Centering learning pathways might also enable us to better understand – and better leverage – ubiquitous mobile tools and technologies toward equitable and expansive forms of learning.

In summary, if we assume that all young people already engage in rich learning pathways that (a) may be cultivated toward academic, personal, or other forms of success and (b) may help inform equitable expansions of education in and beyond schools, we must discover these pathways and develop productive ways to characterize them. By investigating how different settings and events might contain meaningful connections for disciplinary learning among underprivileged youth, the kinds of resources that play a critical role in participating in learning activity across settings may be uncovered and formulated. Conceptualizing these resources can, in turn, inform the design of settings that can promote productive forms of syncretic disciplinary content within youths' learning pathways.

References

Abrahamson, D. (2009). Orchestrating semiotic leaps from tacit to cultural quantitative reasoning—The case of anticipating experimental outcomes of a quasi-binomial random generator. *Cognition and Instruction*, *27*, 175–224.

Barron, B. (2006). Interest and self-sustained learning as catalysts of development: A learning ecology perspective. *Human Development*, *49*, 193–224.
Bell, P., Tzou, C., Bricker, L., & Baines, A. D. (2012). Learning in diversities of structures of social practice: Accounting for how, why and where people learn science. *Human Development*, *55*, 269–284.
Carraher, T. N., Carraher, D. W., & Schliemann, A. D. (1985). Mathematics in the streets and in schools. *British Journal of Developmental Psychology*, *3*, 21–29.
Cobb, P. (2002). Reasoning with tools and inscriptions. *Journal of the Learning Sciences*, *11*, 187–215.
Cobb, P., & Yackel, E. (1996). Constructivist, emergent, and sociocultural perspectives in the context of developmental research. *Educational Psychologist*, *31*, 175–190.
diSessa, A. A. (2007). An interactional analysis of clinical interviewing. *Cognition and Instruction*, *25*, 523–565.
González, N., Andrade, R., Civil, M., & Moll, L. (2009). Bridging funds of distributed knowledge: Creating zones of practices in mathematics. *Journal of Education for Students Placed at Risk*, *6*, 115–132.
Greeno, J. G., & Hall, R. P. (1997). Practicing representation: Learning with and about representational forms. *Phi Delta Kappan*, *78*, 361–367.
Gutiérrez, K. D. (2014). Integrative research review: Syncretic approaches to literacy learning: Leveraging horizontal knowledge and expertise. In P. J. Dunston, L. B. Gambrell, K. Headley, S. K. Fullerton, & P. M. Stecker (Eds.), *63rd Literacy Research Association Yearbook* (pp. 48–60). Alamonte Springs, FL: Literacy Research Association.
Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education*, *44*, 37–68.
Hoadley, C. (2018). A short history of the learning sciences. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann (Eds.), *International handbook of the learning sciences* (pp. 11–23). New York: Routledge.
Hutchins, E. (2010). Cognitive ecology. *Topics in Cognitive Science*, *2*, 705–715.
Ito, M., Gutiérrez, K., Salen, K., Schor, J., Sefton-Green, J., & Watkins, S. C. (2013). *Connected learning: An agenda for research and design*. Irvine, CA: Digital Media and Learning Research Hub.
Jackson, K. (2011). Approaching participation in school-based mathematics as a cross-setting phenomenon. *Journal of the Learning Sciences*, *20*, 111–150.
Jurow, A. S., & Shea, M. (2015). Learning in equity-oriented scale-making projects. *Journal of the Learning Sciences*, *24*, 286–307.
Ladson-Billings, G. (1997). It doesn't add up: African American students' mathematics achievement. *Journal for Research in Mathematics Education*, *28*, 697–708.
Langer-Osuna, J. M. (2015). From getting "fired" to becoming a collaborator: A case of the coconstruction of identity and engagement in a project-based mathematics classroom. *Journal of the Learning Sciences*, *24*, 53–92.
Lave, J. (1988). *Cognition in practice: Mind, mathematics and culture in everyday life*. Cambridge, UK: Cambridge University Press.
Leander, K. M., Phillips, N. C., & Taylor, K. H. (2010). The changing social spaces of learning: Mapping new mobilities. *Review of Research in Education*, *34*, 329–394.
Lerman, S. (2000). The social turn in mathematics education research. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 19–44). Westport, CT: Ablex Publishing.
Marcus, G. E. (1995). Ethnography in/of the world system: The emergence of multi-sited ethnography. *Annual Review of Anthropology*, *24*, 95–117.
Moschkovich, J. N. (1996). Moving up and getting steeper: Negotiating shared descriptions of linear graphs. *Journal of the Learning Sciences*, *5*, 239–277.
Nasir, N. S. (2002). Identity, goals, and learning: Mathematics in cultural practice. *Mathematical Thinking and Learning*, *4*, 213–247.
Nasir, N. S., & Hand, V. M. (2008). From the court to the classroom: Opportunities for engagement, learning, and identity in basketball and classroom mathematics. *Journal of the Learning Sciences*, *17*, 143–179.
Nasir, N. S., & McKinney de Royston, M. (2013). Power, identity, and mathematical practices outside and inside school. *Journal for Research in Mathematics Education*, *44*, 264–287.
Piaget, J. (1954). *The construction of reality in the child*. New York, NY: Basic Books.
Saxe, G. B., & Esmonde, I. (2005). Studying cognition in flux: A historical treatment of Fu in the shifting structure of Oksapmin mathematics. *Mind, Culture, and Activity*, *12*, 171–225.
Sfard, A. (2005). COMMENTARY: Discourse in flux. *Mind, Culture, and Activity*, *12*, 233–250.
Vossoughi, S., & Gutiérrez, K. D. (2014). Studying movement, hybridity, and change: Toward a multi-sited sensibility for research on learning across contexts and borders. *National Society for the Study of Education*, *113*, 603–632.