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Rhizomatic Research Design in a Smooth Space of Learning *Rupturing, Connecting, and Generating*

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Abstract

Racial disproportionality in special education is a symptom of larger social justice problems in a racially stratified society. Despite the favorable expectation of the effects of culture-free, universal and objective “evidence-based” interventions in serving students from nondominant groups, overrepresentation of students of color in special education continues to hinder efforts at achieving equity in and through education. In this article, we draw on Deleuze and Guattari’s rhizome metaphor and Vygotskian cultural-historical activity theory to analyze the dominant paradigm for intervention research in special education. We illustrate how the naturalized a priori assumptions and practices have contributed to the reinforcement of the racialization of disability. We then offer a rhizomatic research design as an alternative in which teachers, parents, students, administrators, university researchers, and community members engage in collective knowledge production and decision-making activities to develop systemic solutions to racial disproportionality within their local contexts.



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Racialization of disability has been a central issue in the quest for equity in education. Since the 1960s, racial disparities in academic and social opportunities and outcomes in special education programs have been widely reported nationally and internationally (Artiles, 2011; Artiles & Bal, 2008; Donovan & Cross, 2002; Dunn, 1968; Harry & Klingner, 2014; Skiba et al., 2011). In the United States, students from historically marginalized communities are subjected to disproportionately higher representation in relatively less visible disability categories (e.g., emotional disturbance [ED], learning disabilities [LD], and speech/language impairments [SLI]), primarily relying on the judgment of school personnel and observational tools. According to the 40th Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (U.S. Department of Education, 2018), African American students are twice as likely to be labeled as emotionally disturbed and placed in special education. Native American students are more than four times as likely to be labeled as having developmental delay compared to all other racial/ethnic peers combined.

Racial disproportionality is a complex and spatially and temporally situated conundrum, which reveals varying patterns. For example, the disproportionate representation of Latinx students displays fluid patterns and predictors across a spatio-temporal context. Latinx students are underrepresented in LD and ED categories nationally (U.S. Department of Education, 2016). On the other hand, Latinx students are overrepresented in LD and ED categories in large districts in Arizona and California where the English-only policies have been implemented (Artiles, Rueda, Salazar, & Higareda, 2005; Sullivan, 2011).

To address racial disproportionality, the Individuals with Disabilities Education Act (IDEA) in 2004 laid the legislative foundations for the implementation of multi-tiered system of supports models (MTSS), Response to Intervention and Positive Behavioral Interventions and Supports, as prevention and early intervening services. MTSS models emphasize providing schoolwide academic and behavioral supports delivered through the so-called “evidence-based” interventions that are supposed to be context-neutral, objective, and universal instructions and additional academic and behavioral interventions based on students’ responses to the interventions in each tier of support (Fuchs & Fuchs, 2006; Sugai & Horner, 2009). Despite the favorable expectation of the effects of MTSS models designed to offer a continuum of empirically demonstrated interventions to address improper referrals into special education, overrepresentation of students from racially minoritized groups endures.

The purpose of this paper is to provide a cultural-historical lens for re-examining a modus operandi in the dominant paradigm in special education, which may perpetuate and even justify disproportionality. Based on a critical examination of the normative logics of intervention research, we seek to draw an alternative trajectory of intervention for building inclusive and culturally responsive knowledge production activities for systemic transformation. Through the rhizome metaphor presented by Gilles Deleuze and Félix Guattari (1987), we attempt to depict the stratified landscape of learning and research along the chromatic line while re-envisioning the possibility of rhizomatic research for designing ecologically valid and socially just interventions contributing to the wellbeing and joy of the whole school community, especially students and families from historically marginalized communities.

Tree-Like and Rhizomatic Images of Thought

The historical emergence of a reflexive turn against positivist determinism in social science and education during the 20th century has accelerated critical inquiry into the dominant assumptions and practices in knowledge production activities in science. The critics came from various fields and philosophical schools. As the leaders of a strand of critical intellectual movements, French philosophers Gilles Deleuze and Félix Guattari (1987) presented new metaphors that led to a creative mode of thought for dissolving the linear and vertical worldview of positive determinism in the West. Deleuze and Guattari (1987) proposed the metaphors of “tree-like” and “rhizome” as conceptual artifacts to examine two oppositional ways of thinking. Despite the oppressive nature of binary modes of thinking, they deliberately employ dualistic images of thought to problematize the Cartesian mode of logic that dominates our lives in social, institutional, and legal domains (e.g., mind|body, individual|social, theory|practice, normal|abnormal, and abled|disabled). The tree-shaped image relies on an autonomous, rational, self-reliant, and universal object (e.g., an individual or a social group) in a fixed space-time. Components of the tree are vertically arranged on the basis of the centralizing taproot. The tree-shaped system operationalizes to generate a symmetrical and stable architecture characterized by hierarchical divisions of entities revolving around norms, assumptions, tools, and practices that are taken for granted, and hence often invisible (e.g., ableism, individualism, and racial hierarchy).



Figure 1. Juniper (Ehret, 1745).

As seen in Figure 1, the tree-like image maintains the well-organized constellation of objects (like a stable pyramid or army formation) by organizing a hierarchical system among components based on similarity to and difference from a centralizing concept of normativity. The tree-shaped modes of thinking mobilize a number of dividing lines to sustain the regime of truth

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and serve as mediating tools to sort out and regulate diverging ways of being and knowing. Homogenizing lines create grids of binaries wherein fixed, predetermined, and recognizable identities are emphasized to legitimize present social orders (e.g., black|white, male|female, and abled|disabled; St. Pierre, 2018). Activity systems are formed around these objects that are constantly reproduced in the corresponding activity systems (Engeström, 2015). Segmenting lines constitute a “striated space” (Deleuze & Guattari, 1987), a closed territory wherein multiple and fluid forms of boundaries existing in our lives become territorialized along with strict guidelines and inflexible rubrics. The demarcating lines constitute stratifying systems of life in which transgressive movements against the rigid boundaries are squelched (hooks, 1994).

Dualistic thinking cannot fully capture the multiplicity, fluidity, and heteroglossia of social phenomes and the objects incessantly made, negotiated, and co-configured (Agamben, 2000). The rhizome is an alternative image of thought to disrupt the hierarchical ways of thinking prevalent in tree-shaped structures (Deleuze & Guattari, 1987). In botany, a rhizome refers to horizontally proliferating subterranean fungus-roots through continual interconnections among multiple and heterogeneous shoots. A rhizomatic network is presented in Figure 2. The figure illustrates the rhizome characterized by a lateral network of nodes without a centralizing taproot. Multiple shoots respectively have distinctive roots. They are horizontally connected for survival and growth (Simard et al., 1997).



Figure 2. Pine seedlings with a mycorrhizal network (Read, 1997).

A rhizome has no territorialized habitats. Instead, continuous interconnection with other shoots enables indeterminate expansions and horizontal movements. The shared fungal symbionts enable carbon, the energy currency of plants, to flow from tree to tree and possibly from species to species in a forest (Simard et al., 1997). Fossils of the earliest land plants and molecular studies confirm that roots co-evolved with fungal partners to form amalgam structures known as mycorrhizas or fungus-roots:

These are almost universally distributed through present-day terrestrial plant communities, yet most researchers (deterred, one suspects, from experimental analysis of mycorrhizal function in natural communities by the complexity of these systems) have instead used excised roots or pot-grown plants to examine the relationships between partners in the symbiosis. Unfortunately, reductionist approaches cannot answer larger questions about the effect of symbiosis on interactions between the individual plants that form natural ecosystems (Read, 1997, p. 517).

Similarly, reductionist research cannot address adaptive, complex historically evolving problems that educators, families, students, and policymakers respond to in everyday collective activities. Imitating—often poorly—the highly controlled laboratory studies of “hard sciences,” reductionist approaches in education take an insulated, rational, self-interested individual as the unit of analysis and prioritizes the knowledge produced in stimulus-response-based linear experimental studies (Bal, 2017). In this approach, academicians produce knowledge *about* and *for* people and disseminate information to change acts and thoughts of individual teachers, families, and students (Bal & Trainor, 2016).

The rhizomatic metaphor provides a tool for understanding the generative interconnectedness of individuals and their context with diverse goals, histories, and practices in collective activity systems. It also shows the possibilities for generative resistance against all forms of homogenization embedded in the tree-like structure to disintegrate rigid boundaries (e.g., individual|context, ideal|material, and research|practice) and collectively design new systems with local stakeholders. A rhizomatic way of thinking is a boundary-crossing endeavor to enter a “smooth space” in which every entity has mobility, in contrast to the rigidity of striated space. To open up the new territory of potentialities, “lines of flight and movement of deterritorialization” (Deleuze & Guattari, 1987, p. 55) drawn in the smooth space require the power of co-generation or creative capacity.

The work of drawing new lines of flight demands transformative propulsion to generate new or refashioned tools and innovative practices for the re-configuration of existing relations. In the rhizomatic image of thought, differences are perceived as sources of generative power rather than deviations from normalcy. Productive hybridization of diverging perspectives and experiences can contribute to yielding unexplored ideas and practices and making new worlds at the margins of existing activity systems. Heterogeneity and hybridity are *per se* acknowledged as assets for the creation of new objects, artifacts, and activity systems facilitating re-arrangement of existing social order. In what follows, we examine how the tree-like image of thought constitutes the striated space of learning and education research in which the singularities of students from nondominant communities are denied and relegated to the categories of deviant, nonresponsive to interventions and inherently incapable.

Historical Sediment of Tree-Like Image of Thought

Racialization of Disability in a Striated Space

The tree-shaped system seeks to force social actors to perform the repetition of supposed homogeneity in a striated space to maintain the status quo (Deleuze & Guattari, 1987). Multiple forms of being and knowing are restrained to emulate the given norms, logic, and belief systems through employing governing mechanisms such as tracking, labeling, and excluding (Bal, 2017). Schools are ideologically, politically, and materially striated spaces wherein the fabrication of normalcy impels students to enact normative narratives of body and mind regarding ability, beauty, smartness, completeness, and perfection (Hatt, 2012; Leonardo & Broderick, 2011). Enduring educational and social maladies—for instance, the racialization of school discipline (Skiba et al., 2011), *de facto* segregation by academic tracking (Oakes, 1985), higher dropout rates of students of color (Darling-Hammond, 2007), schools emulating prison policies (Giroux, 2018), and the mass incarceration of black and brown youth (Alexander, 2012; Puzanchera & Hockenberry, 2013)—are repercussions of historically accumulated systemic contradictions.

The similarity to and difference from an idealized white and able body perpetuate the arrangement of differential power along cultural constructions of dis/ability reinforced by social, political, and economic acts of exclusion (Ferri & Connor, 2005). Lines of homogenization drawn on the essentializing cultural schema of superiority constitute a stifling context wherein the free flows of multiple cultural practices that nondominant students bring to schools are positioned as deviant and disturbing (Artiles, 2011; Hatt, 2012). On the grid of normalcy, epistemologies and ontologies that nondominant communities have developed over generations are repudiated and invalidated through the privileged and naturalized ways of being and knowing. Physical and mental variations and the particularities of students of color become framed as an outlawed being “that is thought outside the normal and as such to need chasing down” (Baker, 2002, p. 674) to confine the creative, dynamic, and rhythmic existence of children into a solid shell of disciplined objects. Students’ diverse acts are classified and assigned to certain spaces in the striated space of surveillance, control, and punishment to produce docile bodies (Foucault, 1995). Signifying lines produce dehumanizing and colonizing labels to dictate students’ multiple modes of being so as to sort them into manageable institutionalized categories (e.g., learning disabled or gifted; McDermott, Goldman, & Varenne, 2006).

In the field of special education, assigning labels of stigmatization has become an effective tool of ostracization to segregate the deviant from predefined categories of normalcy with the intention of providing individualized services and allocating supplemental resources (Ferri & Connor, 2005). Overrepresentation of students of color in special education based on school personnel’s judgment explicitly reveals how normalizing lines of race and ability draw an intersectional grid of oppression. The normalizing processes of racism, ableism, and classism circulated in institutional practices give rise to qualitatively different everyday experiences of students of color identified as disabled (Harry & Klingner, 2014). Racially minoritized students are likely to be placed in more secluded places as compared to their white peers even within the same disability categories (Donovan & Cross, 2002; U.S. Department of Education, 2016). Interlocking lines of privilege and marginalization based on race produce an institutionalized system of disability in which the bodies and minds of students of color are quarantined into the most restrictive spaces such as self-contained classrooms, alternative schools, and prisons (Bal, 2017). In this striated space of disability, students of color with a disability label have restricted

access to the more qualified teaching forces and rigorous curriculum closely related to post-secondary outcomes (U.S. Department of Education, 2016).

Special Education Research in a Striated Space

The tree-like image of thought that has dominated special education research has contributed to the emergence and perpetuation of the rigid regime of truth-producing disciplinary knowledge and authority (Foucault, 1995). The fixating line of research traces the “basis of an overcoding structure or supporting axis, something that comes ready-made” (Deleuze & Guattari, 1987, p. 12). This approach underscores the repetition of sameness by privileging pre-packaged methodological doctrine and patrols the boundary between science|nonscience. As a compelling example of such normalizing line of inquiry, “evidence-based practice” has emphasized the production and use of empirically verified evidence yielded by the meta-narrative of the “gold standard” (for example, Odom et al., 2005 in special education research; Slavin, 2002 in education research in general). Experimental group comparison designs (e.g., randomized controlled trials) based on hypothetico-deductive inference, control, and resultant probabilistic causality take possession of the status of the gold standard for the production of scientific evidence in education that can be replicated universally with high fidelity (see What Works Clearinghouse, 2017).

Other forms of evidence produced by nondominant ways of inquiry have become hierarchically arranged around the centralizing logic of inquiry. An ideological notion of scientific research circulated in the positivist audit culture of academia has been reified through the production and dissemination of quality indicators for conducting intervention research intended to produce generalizable evidence with rigor for students with disabilities (Gersten et al., 2005; Horner et al., 2005). In the United States, federal and state governments funnel millions of dollars to technical assistance centers to address outcome disparities and implementation challenges for top-down systemic interventions. Within these knowledge production and dissemination activity systems, narrow conceptualization of quality intervention research for the generation of scientific evidence has served as one of the technologies of power to engineer all digressing lines of inquiry by drawing rigid lines of division, which generate stratifying dualisms in special education research, namely individual|context and research|practice binaries.

Individual|context binary. A normative notion of experimental intervention research intended to produce scientific evidence has heavily relied on a firm dichotomy between individual and context. Traditionally, intervention studies in the field of special education have built on a medical paradigm of disability, which focuses on the discrete acts and thoughts of “autonomous individuals that deviate from social and developmental norms such as an abnormal ability to listen, talk, act, think, read, write, or do mathematical calculations and outcomes” (Bal, 2017, p. 12-13). The purpose of intervention is to cure identified impairments within individuals, thereby favoring normative notions of the white and able body (Baglieri, Bejoian, Broderick, Connor, & Valle, 2011). If an individual student is diagnosed as having a deficit (rhetorically represented as at risk and nonresponding in MTSS models), the dysfunctional body and mind should be revamped to fit into the system of control. In this deficit-oriented paradigm, the pivotal role of culture in learning and development has been relegated to the status of a set of static variables (e.g., a racial category), otherwise contaminating the production of scientific knowledge.

Accordingly, still-life-like analysis seeking to insulate individuals from daily cognitive and behavioral repertoires and everyday problem-solving activities may lead to ecologically invalid evidence for addressing the multiple and unique needs of historically marginalized communities (Bal, 2017). We do not mean that every experimental intervention labeled as evidence-based practice is ineffective. However, research that does not consider the daily routines, goals, and histories of communities where participants in an intervention employ historically evolving cultural repertoires of strategies unwittingly becomes complicit in justifying the normative ontological and epistemological assumptions (Gutiérrez, 2006). Culture-illiterate research practices continue to aggravate the racialization of disability by deprecating students from nondominant groups as nonrespondents to “culture-blind” remedial interventions favoring the regime of truth (Arzubiaga, Artiles, King, & Harris-Murri, 2008). There is an urgent need for implementing locally meaningful interventions that “involves examining the critical and generative role of culture and contexts to provide fuller and dynamic understanding of human learning, development, and ability” (Bal & Trainor, 2016, p. 326).

Research|practice binary. A hierarchically structured striated space of intervention research practice has polarized researchers as active subjects and educators, students, families, and communities as passive objects. The primary responsibility of an investigator as the knowledge producer is to generate reliable and generalizable research findings (universal, context-free, and culture-neutral) contributing to the meaningful improvement of outcomes *for* students with disabilities. As Engeström (2011) pointed out, in this formulation, “the intervention and its desired outcomes are well defined in advance” (p. 599). The exclusive privilege granted to researchers is predetermining what interventions are required to come to grips with perceived deficiencies based on gaps in the literature (Penuel, 2014). In an asymmetrical power relation, experiential knowledge, practices, and goals generated by local stakeholders, especially those from nondominant communities (e.g., people with disabilities) are disregarded. Instead, special educators and service providers are often forced to take passive roles in implementing prescriptive technical solutions with the help of technical assistance centers.

To make practitioners use research findings, researchers’ attentions have moved toward producing exportable evidence by making research outcomes accessible to practitioners (Erickson, 2014). As many researchers with a critical view of the tree-shaped division in research practice have pointed out, the linear and top-down approach to close the gap between research and practice has heavily relied upon translation and application metaphor (Penuel, Allen, Coburn, & Farrell, 2015; Snow, 2015). To facilitate the translation of basic research findings into educational practices with fidelity, the establishment of a vertical transmission system through providing external resources such as professional development (PD) workshops has been one of the core activities of the educational reform initiatives developed and enforced by a coalition of researchers, policymakers, and technical assistance centers in the name of maintaining efficiency or equity (e.g., regional equity centers).

Local contexts of education systems are “contested terrains, full of resistance, reinterpretation, and surprises from the actors below” (Engeström, 2011, p. 601). External factors (e.g., social, political, and economic pressures) and internal factors (e.g., competing motives of stakeholders, local resources, and constraints) constantly intersect to constitute the complex, fluid, and ever-changing ecological conditions that may contaminate the implementation of pre-packaged technical solutions. When implementing top-down intervention programs imported from outside of the learning context, stakeholders negotiate and interpret pre-designed solutions

depending on local constraints, needs, priorities, and organizational hierarchies. For this reason, the enactment of interventions in local contexts should be reconceptualized as a dynamic adaptation. The intervention researchers inevitably encounter the issue of trans-locality across sociocultural, political, and economic variations embedded in local contexts when they ignore “how students and teachers change and adapt interventions in interactions with each other in relation to their dynamic local contexts” (Gutiérrez & Penuel, 2014, p. 19).

In response to an imagined gulf between research and practice, researchers have suggested alternative approaches by conducting design-based interventions, conducting practice-embedded educational research, or establishing a collaborative network between researchers and practitioners (Buysse, Sparkman, & Wesley, 2003; Penuel et al., 2015; Snow, 2015). These new approaches underscore the importance of conducting intervention research in the everyday realities of schools to transform the unilateral and hegemonic research-to-practice structure into a collaborative participation structure (Penuel et al., 2015). The purpose of the new forms of research is the establishment of a partnership to refine the researchers’ design in local contexts to tackle the historically evolving contradictions (Erickson, 2014).

Despite noticeable shifts in the notion of intervention by both taking entire learning ecologies into consideration and building collaborative partnerships, underlying assumptions of a new form of research fall short of dismantling hierarchical divisions. These new forms of design-based interventions have failed to reach epistemological innovation to achieve the critical remediation of the normative knowledge production process (Engeström, 2011). Researchers still have exclusive power to actualize their own ambitions for the improvement of learning activities by controlling the entire processes and outcomes from design to dissemination. Moreover, the research design is “associated with notions of perfection, completeness, and finality” (Engeström, 2011, p. 600). However, historically accumulated contradictions such as racial disproportionality are social and historical products of the particular diachronic and synchronic conditions continuously evolving in certain geographical spaces (Bal, 2017). For example, racism in the U.S. education system as an adaptive issue is an elusive moving target. The modus operandi of institutional racism has taken different forms over time (Bobo, 2011). While outright institutional racism was ubiquitous and reified through enforcement of *de jure* segregation along racial boundaries (e.g., slavery) in the pre-civil rights era, today’s *de facto* racial segregation is accomplished in a more covert and sophisticated manner (e.g., mass incarceration, push-out, special education placement, academic tracking, and school attendance zoning).

Therefore, innovative interventions to address such matters must have adaptability and broader coalitions. To this end, the design of solutions should be reconceptualized as the process of continuous co-configuration, a new mode of production through which users become active subjects to generate adaptive products (Engeström & Sannino, 2010). The new forms of intervention research should provide a transformative learning activity in which educators, students, families, and community members engage in collective analyses and design to produce adaptive and ecologically valid solutions to tackle adaptive systemic issues as situated in specific social-historical-spatial contexts (Bal, 2018). In what follows, we explore the possibility of drawing lines of flight from the striated space of learning and research so that nondominant communities can have structured opportunities for rhizomatic growth.

Rhizomatic Social Design Research in a Smooth Space

Interdisciplinary work on the cultural mediation of learning in psychology has demonstrated that children's moment-to-moment actions and thoughts are cultural products (Cole, 1996; Engeström, 1987; Rogoff, 2003; Vygotsky, 1978). Everyday cognitive, emotional and behavioral practices of learners are ongoing processes of cultural use, and at the same time are also the products of socially, historically, and spatially constructed collective activity systems. By participating in activity systems, children internalize various repertoires of material and ideal artifacts that provide an interpretive lens and instrumentality to address daily needs in given contexts and change their contexts (Cole, 1996; Gutiérrez & Rogoff, 2003).

Today's youth navigate across multiple and heterogeneous spaces attributable to accelerated trans-regional movements (Vossoughi & Gutiérrez, 2014). In these horizontal social movements, learners encounter and develop diverse repertoires of practice (Rogoff & Gutiérrez, 2003). These informal learning experiences afforded by boundary-crossing and fertilizing have often been excluded and untapped in the striated space of formal schooling (Rogoff, Callanan, Gutiérrez, & Erickson, 2016). Instead, the metaphor of vertical development has been a dominant notion of learning that emphasizes the vertical development of an individual's capacities through the acquisition of a hierarchically pre-structured knowledge system (Engeström & Sannino, 2010). In this tree-like notion of learning, the multiple ways of being and knowing students have developed by historical involvement in valued everyday practices of nondominant communities are trivialized and ideologically constructed as deficiency rather than being acknowledged as the epicenter of ingenuity (McDermott, 2010). Rigid distinctions between school-based knowledge and everyday knowledge as products of engagement in daily horizontal and hybrid movements constitute a system of exclusion wherein students of color's bodies and minds are labeled as defiant, nonresponsive, and/or disabled.

This disconnection yielding the tree-like forms of learning may lose the possibility of rhizomatic expansion through which the multiplicities and peculiarities of under-served communities become the locus of individual and social transformative learning. In this respect, the everyday horizontal movements of students, educators, families, policymakers, and local communities should be employed to form spaces for expansive learning (Engeström, 1987). In such spaces, students from nondominant groups can actualize their potentials for rhizomatic growth by exchanging diverse perspectives, experiences, and goals in problem-solving and decision-making activities.

There is an urgent need to create new forms of learning activities in which students engage in innovative and bold experiments for rhizomatic growth into a zone of proximal development. In these newly imagined activity systems, a cultural toolkit developed by the dynamic movement of students across multiple, interacting activity systems virtual or material such as media culture, disability culture, and cultural heritages of households constitutes a smooth space in which to draw lines of creation for rhizomatic expansion. A rhizomatic conceptualization of learning requires reframing and nurturing human variation. The new mode of activity systems for rhizomatic development seeks to rupture firm boundaries that produce the hierarchical divisions of life. An entanglement of formal and informal learning experiences must be leveraged to stimulate the construction of transformative knowledge (Rogoff et al., 2016).

Rhizomatic Social Design Research

In the dominant form of knowledge production activities in academia in the United States, the governing logic of inquiry privileging color-evasive racial ideology has served to reproduce dominant ontologies and epistemologies (Bonilla-Silva & Zuberi, 2008; Gutiérrez, 2006). The resultant knowledge base has been utilized to ensure students of color are sorted, tracked, and policed. To rupture normalizing grids of inquiry, new directions of research should build on epistemological, ontological, and axiological transgressions of the tree-shaped structure. We propose a paradigm shift toward a rhizomatic research design via the generative appropriation of the idea of rhizome (Deleuze & Guattari, 1987) combined with Vygotskian cultural-historical activity theory (Cole, 1996; Vygotsky, 1978) to lay out activity systems for transformative learning. The rhizomatic research design aims to de-territorialize dehumanizing learning strata in which normative notions of whiteness and ability have drawn a matrix of oppression. It can be instrumental in building dynamic inter-cultural connections where hybridization becomes a generative asset for the re-mediation of learning and development (Gutiérrez, 2016). Below we describe the central features of the rhizomatic research design using six principles of the rhizome (Deleuze & Guattari, 1987).

Connection and heterogeneity. The rhizomatic design fosters plurality: “Any point of a rhizome can be connected to anything other, and must be” (Deleuze & Guattari, 1987, p. 7). It encourages expansive forms of learning, which “puts the primacy on communities as learners, on transformation and creation of culture, on horizontal movement and hybridization, and on the formation of theoretical concepts” (Engeström & Sannino, 2010, p. 2). In national education systems, the bureaucratic and hierarchical educational processes have marginalized local stakeholders (e.g., families, students, paraprofessionals, community representatives), particularly those who are from nondominant groups (Bal, 2018). In the United States, access to decision-making processes for minoritized communities has been limited and constantly challenged. Such exclusion of diverse perspectives, experiences, everyday realities and goals in conducting interventions is a historical residue of societal inequity due to the dominant group’s control over the means of production.

The rhizomatic design seeks to validate multiple and heterogeneous ways of being and knowing that local stakeholders bring into knowledge-production activities in education. This new form of research practice takes advantage of the heterogeneous repertoires of everyday practice resulting from historical involvement in everyday activities for locally meaningful solutions. The new mode of research promotes nonhierarchical decision-making and exploring and creating institutionalized processes, methodologies, and tools for inclusion, collective agency, and critical dialogues in schools (Sannino, Engeström, & Lemos, 2016).

To facilitate generative connections and concerted efforts among multiple stakeholders, the rhizomatic research design adopts a notion of participatory social justice, which emphasizes a democratic participation structure in which marginalized stakeholders from nondominant groups have equal access to the decision-making processes (Bal, Afacan, & Cakir, 2018). This design seeks to create an open space in which the interlocking of diverse and sometimes conflicting goals of participants engender new tools for innovation, which is related to the transformation of problem-solving and decision-making activities in schools and local education agencies. In such a dialogical space, the motives of diverse actors are contested, negotiated and compromised through iterative works of co-configuration (Engeström & Sannino, 2010; Gutiérrez, 2016).

The rhizomatic research design utilizes “relational agency” (Edwards, 2017) as a design tool. The relational agency is indispensable for building a strategic coalition with a shared equity agenda. As the capacity to enable collaborative work, relational agency emphasizes the acknowledgment of multiple motives, expertise, and cultural resources of co-participants as well as the alignment of one’s viewpoint through others. Attunement and negotiation of competing motives enable boundary-crossing work and the building of hybrid repertoires in response to constraints and possibilities of specific social-historical-spatial contexts.

Multiplicity and a-signifying rupture. In the rhizomatic research design, traversal lines crossing boundaries are encouraged to rupture dichotomizing lines that seek to maintain the status quo. The striated space of research that privileges the static and hierarchical structure between researcher and practitioner should be reconceptualized to create a contested space in which multi-directional and decentralized movements take place to address moving systemic issues. To create adaptive solutions, this new design requires interdisciplinary work in which iterative connections and ruptures of distributed expertise generate adaptive systemic solutions as living artifacts (Bal, 2017). Developing and implementing solutions to address fleeing targets (e.g., the racialization of disability) should not be understood through the metaphor of completeness. Given the fact that systemic issues are adaptive in nature, innovative solutions should have adaptability through productive and flexible ruptures and the synthesis of multiple perspectives, experiences, and distributed cognition.

The process of designing a new intervention should be characterized by the proliferation of multiplicity so that “it ceases to have any relation to the One” (Deleuze & Guattari, 1987, p. 8) through constant changes and transformations away from the totalizing technocracy that emphasizes the implementation of pre-determined technical solutions. The rhizomatic research design validates singularities of iteratively evolving interventions developed in locally meaningful ways. Erickson’s (2014) appropriation of Aristotelian notions of “phronesis,” “episteme,” and “techne” may provide critical insights into designing interventions with adaptability and ecological validity. Developing innovative intervention should be conceptualized as the process of using phronesis—that is, practical wisdom concerned with how to judge and act in response to particular contextual conditions. This approach requires an understanding of spatiotemporal particularities and value judgment ability to create practical solutions to tackle uncertain and complex local pending issues rather than applying universal scientific knowledge (episteme) and pre-defined technical solutions (techne).

In the process for situated and distributed innovations, there are no pre-defined roles for participants. Incorporating the epistemological legacy of participatory action research (e.g., recognition of situated knowledge of local actors, McIntyre, 2008), the rhizomatic design pushes participants to undertake the role of a collective, reflexive inquirer whose object of knowledge production activities generate transformative knowledge to address problems of practice. One distinguishable feature of rhizomatic design research from participatory action research is putting issues of equity in educational opportunities and outcomes—maldistribution of power and privilege—in the center of collective, critical design activity to transform social institutions and fulfill emancipatory goals (Gutiérrez, 2016; Sannino et al., 2016). By rupturing the conventional boundaries of the researcher, professionals, students, families, and community representatives, rhizomatic research positions stakeholders as co-designers of interventions in productive solidarity for the creation of a new object and activity system to solve systemic contradictions.

Cartography and decalcomania. “A rhizome is not amenable to any structural or generative model” (Deleuze & Guattari, 1987, p. 12). To create locally meaningful solutions, rhizomatic social design research encourages transgression of the paradigm of tracing in which duplicating methodological dogma based on normative white logic becomes the single pathway to produce legitimate knowledge (e.g., evidence-based practices, Bonilla-Silva & Zuberi, 2008). As the rhizome is drawing a new map (cartography), not tracing an inscription of normalcy, mapping “is entirely oriented toward an experimentation in contact with the real” (Deleuze & Guattari, 1987, p. 12). To pioneer uncharted pathways toward expansive learning not yet there, the rhizomatic design promotes interactive and iterative experimental lines of flight for the collective agency and systemic changes rather than following technical solutions prescribing the limits of what can be actionable. The new experiment of potentiality builds on the imagination, aspirations, everyday needs, resilience, resistance, tribulations, and agonies of stakeholders as historical actors and active agents (Gutiérrez, 2016).

Prolepsis means the actualization of the folded potentialities of the futures. In this processes of proleptic becoming, the cultural past as embedded in everyday practices of households and communities becomes a valuable resource within the historical imaginations of stakeholders in designing new emancipatory tools, which lead to “a radical transformation of possible social, political, and educational future[s]” (Gutiérrez, Engeström, & Sannino, 2016, p. 277). As a form of justice-oriented intervention research, the rhizomatic design advocates generative resistances and desires of local stakeholders to become agents who can draw innovative trajectories in shaping their own futures (Sannino, 2015). In this respect, mapping out the uncharted pathways for the re-mediation of an oppressive learning ecology is “proleptic” becoming in nature (Cole, 1996). Designing intervention as a cartographic work has no endpoint and *per se* becoming for the actualization of the infinite potentiality of youth, communities, and practitioners. To facilitate the proleptic becoming of local stakeholders, the rhizomatic design encourages them to “refuse the verb, *to be*, which establishes identity, stability, and closure” (St. Pierre, 2018, p. 2, italics in the original). It facilitates the proleptic becoming of researchers to refuse a paradigm of possibility wherein the identification of conditions of causal possibility and subsequent development of technocratic solutions are a territorialized practice of inquiry (Deleuze, 1994). In what follows, we present a materialized form of rhizomatic research, the Culturally Responsive Positive Behavioral Interventions and Supports project, as a case in point.

Culturally Responsive Positive Behavioral Interventions and Supports (CRPBIS)

In the U.S. education system, African American, Latinx, and Native American youth have been the main target of exclusionary disciplinary practices (e.g., office discipline referrals, suspension, and expulsion; Skiba et al., 2011). Addressing this disproportionality in school discipline is an urgent issue. It contributes to negative academic and social outcomes that racially marginalized students face such as higher drop-out rates, academic failure, stigma, segregation, and involvement in the juvenile justice system (Gregory, Skiba, & Noguera, 2010).

Grounded in cultural-historical activity theory and critical pedagogy, the CRPBIS project aimed to facilitate the development of schoolwide culturally responsive behavioral support systems with local stakeholders to address the racialization of school discipline (Bal, 2018). The CRPBIS project targeted building an authentic researcher-practitioner-family-community partnership to develop novel, adaptive solutions for racial disproportionality in disciplinary

outcomes and special education placement. CRPBIS conceptualized culture as local community's ever-changing cognitive, emotional, and behavioral repertoires of problem-solving. Culture can be an interpretive lens and toolkit for remediating everyday acts of stakeholders.

In education research, cultural responsiveness is “a floating signifier” rather than a fixed entity (Bal et al., 2018). As a floating signifier, the concept of cultural responsiveness enables communication and coordination among educators, administrators, students, families, policy makers, funding agencies, and researchers. The CRPBIS research team did not impose a pre-determined, static definition of cultural responsiveness. Instead, they provided a collective knowledge production and systemic design process, *Learning Lab*, through which local stakeholders develop their *own* culturally responsive behavioral support system in response to their everyday realities and goals (Bal, 2017). Learning Lab is a catalytic problem-solving activity to examine daily disturbances within the school system and envision new tools, concepts, and practices to resolve paralyzing contradictions (Bal et al., 2018; Bal, Kozleski, Schrader, Rodriguez, & Pelton, 2014). Learning Lab consist of multiple sessions wherein multiple participants with conflicting motives engage in critical dialogue, form collective agency, analyze systemic disturbances, co-design locally meaningful systemic solutions, and implement the new solutions (Bal et al., 2014; 2018).

Connection without a centralizing taproot. The CRPBIS project sought to democratize school-decision making processes hitherto monopolized by a few school administrators and educators, by reflecting the heterogeneous voices of students, family, and community representatives. The CRPBIS project intentionally tapped into multiple epistemologies, tools, everyday struggles, and resistance of local stakeholders to create a hybrid space wherein the school community members lead an ecologically valid and sustainable systemic transformation. From the recruitment stage, Learning Lab sought to diversify its membership to incorporate historically marginalized voices such as parents of color or immigrant, youths of color, paraprofessionals, and community activists (Bal, 2018).

Learning Lab is a dialogical space in which administrators, teachers, parents, students, and representatives of civic organization working with the school and the community (e.g., Urban League, YMCA, Boys and Girls Club, and Centro Hispano) collectively examine institutional practices for the creation of actionable knowledge leading to institutional changes (Bal et al., 2014; 2018). It reconceptualized multiple and sometimes conflicting goals as generative tensions to de-familiarize naturalized assumptions and practices and imagine transformative solutions to address paralyzing contradictions in the schooling system (e.g., racial disproportionality). Through Learning Lab, participants formed transformative agency (Sannino, 2015) to coordinate differently perceived object of discipline system among members, construct the object of their school's existing system (e.g., a disturbing student) and expand the object, activity system, and its desired outcomes of the school system from control and punishment to positive and inclusive behavioral support.

Blurring boundary. Learning Lab took a different epistemological and axiological approach to knowledge production to address racial disparities in school discipline. For instance, mainstream scholarship has targeted reductions in school personnel's “implicit bias” by providing skills training delivered through PD workshops on “perspective-taking” or “awareness of vulnerable decision point,” which is developed and led by academicians, consultants, or technical assistance centers (see for example, Ispa-Landa, 2018; McIntosh, Girvan, Horner, &

Smolkowski, 2014). This line of research locates the source of the problem within the deep psyche of transcendental individuals at the expense of targeting systemic inequity.

Learning Lab sought to democratize knowledge production to leverage “the transformative potential of people in communities that are vulnerable, yet replete with possibility” (Gutiérrez et al., 2016, p. 275). In Learning Lab, stakeholders became co-designers of their school systems through rupturing the rigid boundary of roles (e.g., researcher|practitioner or teacher|student). The central purpose of role cultural re-mediation is developing “politicized trust” among participants, where “broader objectives of the community as well as the research team are rooted in shared notions of social transformation” (Vakil, Royston, Nasir, & Kirshner, 2016, p. 205). Learning Lab members had opportunities to systematically investigate multiple sets of mirror data (e.g., statistical data on racial disproportionality at the school, district, and state-level, community resources, and schoolwide behavioral goals) to “stimulate involvement, analysis and collaborative design efforts among the participants” (Engeström, 2011, p. 14). Through engagement in a collective mapping activity, participants had the critical experience of iterative connections and ruptures of distributed intelligence and expanded relational agency through which members’ conflicting motives are negotiated and attuned for the creation and refinement of locally meaningful behavioral support (Bal et al., 2018). Engagement in initial data analysis and system mapping enabled members to identify daily disturbances as manifestations of inner systemic contradictions (e.g., disproportionality).

Transformative cartographic work. Through a cycle of six expansive learning actions (questioning, analyzing, modeling, examining, planning for implementation, and reflecting on the Learning Lab process), members engaged in critical dialogue to draw lines of flight from the territorialized practice of exclusionary school discipline (Bal et al., 2018). To facilitate transformative cartographic work, members utilized multiple designing tools (e.g., mapping out the existing system and design the ideal system) to enable creative experiments for the development and refinement of locally meaningful behavioral support systems within schools led and owned by stakeholders.

Learning outcomes of collaborative experiments were anything but pre-established. Learning Lab built an organizational memory of inclusive and productive problem-solving activities to develop sustainable and adaptable solutions (Bal et al., 2014; 2018). Learning Lab has been implemented in five public schools in the United States so far. Participants revealed expanded transformative agency to bring about the transformation of the striated space of behavioral normalcy as well (Bal et al., 2018). Four of the Learning Labs were able to complete the whole cycle of systemic change and developed new behavioral support systems to be implemented in the following year (Bal, 2018). However, the actual implementations of the new systems have not yet been reported.

As a collaborative design process for rhizomatic experiments toward radical possibilities, the Learning Lab methodology can be used to re-mediate an oppressive learning ecology in which human diversity and plurality are negated and should be remediated based on presumed normativity. Adaptive solutions to address systemic issues (e.g., racial disparities) require building equity-oriented coalitions through intentional avoidance of working in silos. Learning Lab has the potential to design and implement schoolwide service delivery programs for the rhizomatic growth and prosperity of local school communities.

Conclusion

In this article, we conceptualized school-going as a dynamic field of experiment. New encounters and connections ignite productive ruptures and re-arrangements from a normative territory of life to design and implement adaptive and innovative interventions. We made a case and offered conceptual tools for the strategic and deliberate creation of a new, expansive learning activity system through the rhizomatic research design. In rhizomatic research design, historically marginalized communities have adequate learning opportunities and equal access to problem-solving and decision-making in schools to make playful connections and ruptures for rhizomatic growth and prosperity. We suggested that special education interventions should take a transformative role that breaks away from the normatively given logic of inquiry to create an innovative space in which crossing boundaries and moving individual to collective become strategic actions to nurture and utilize voices that have been excluded and silenced by the homogenizing institutional acts of normalcy. The rhizomatic design is a persistent attempt at innovation that Deleuze and Guattari (1987) refer to as “nomadism.” Like a nomad constantly moving to find a new land of possibility, the rhizomatic design galvanizes local stakeholders to become a generative nomad, capable of drawing lines of flight away from the normative ideology deeply embedded in the tree-like system.

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