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Looking at SoLD through an equity lens: Will the science of learning and development be used to advance critical pedagogy or will it be used to maintain inequity by design?

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These are exciting times. That was my initial reaction as I read how Darling-Hammond, Flook, Cook-Harvey, Barron, and Osher (in press) begin to translate our growing understanding of the science of learning and development into practices that have promise for improving outcomes for the most vulnerable children in our nation's schools.

In many ways it was a full circle moment. I remember as a young educator getting my copy of the landmark publication, *How People Learn* in 2000 (National Research Council). I had just moved out of the classroom into more policy-oriented education reform work centered around equity and closing the achievement gap. I had become fascinated by cognitive neuroscience since hearing Asa Hilliard talk about the malleability of intelligence for marginalized children of color through an equity lens in the mid-1980s, which built upon the work of Reuven Feuerstein (1980). In addition, I devoured Resnick's, *Education and Learning to Think* (Resnick, 1987), and it fed my interest in the science of learning. The idea of improving education through a deeper understanding of how the brain learns was growing in popularity at that time but was certainly not mainstream thinking in education (ironically). There were even fewer scholars centering this emerging science of learning within an educational equity context with the exception of Asa Hilliard (1974), Reuven Feuerstein (1980), and Gloria Ladson-Billings (2009) to name a few.

Whereas they may not have called what they were sharing "brain-based" learning or the "science of learning" specifically, their work was directly related to how we prepared educators to understand how to use this knowledge to build their capacity to be cognitive mediators of students' intellectual capacity, especially those students historically marginalized. I remember that the notion of intelligence as malleable and that we could grow it was a hard sell to the average classroom teacher I interacted with in professional development settings. Fast forward a decade. By 2010, the term "brain-based learning" had crossed permanently into the educational lexicon. And, here we are now with Science of Learning and Development Initiative (SoLD). I wholeheartedly believe the advocacy around this initiative has the potential to take public education to the next level of effectiveness.

Yet, at the same time I am concerned about how the principles of practice will actually be applied in everyday teaching and learning situations. While Darling-Hammond et al. touch on the issue of implicit bias in the classroom and raise issues of equity, the larger question remains: how will we understand and apply the science of learning and development within the current socio-political context of education systems that are still inherently inequitable? The science of learning and development as outlined in the article highlights a reality: all children are wired for expansive learning, high intellectual performance, and self-directed learning given the right conditions in schools where they spend the majority of their time. Therefore, if all brains are wired for high intellectual performance and self-directed learning, then why are a disproportionate number of Black and Brown students still underachieving? If all students are wired for expansive learning, how do we use the science of learning and development to activate high levels of teaching and learning so underperforming students of color can accelerate their own learning?

A key fear I have is that many educators will want to decontextualize the science of learning and development and make its application "color blind" to the point that it does not help the neediest students. It is important for all those promoting these implications to be able to articulate their centrality to the quest for

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educational equity. These two efforts have always been connected in past education reform efforts. If we look historically, we can see that our growing understandings of brain science in education always ran parallel to the push for educational equity. In 1985, Jeannie Oakes published *Keeping Track: How Schools Structure Inequity* (Oakes, 1985) that exposed how inequity was engineered within schools based on policy and practice. As a result, we pushed for disaggregating school achievement data. Before the early 2000s, most state education agencies and districts only shared aggregate data on students enrolled in public schools, hiding disparities in the academic outcomes for students of color. Mandates to disaggregate data exposed achievement gaps, opportunity gaps, learning gaps, and other inequities the dominant power brokers in education traditionally tolerated and, in some cases, actively perpetuated. This focus on equity moved beyond just unpacking quantitative data. For the first time, schools had to address the implicit bias that undergird tracking and engage in "courageous conversations" regarding White privilege and marginalization of diverse students.

O'Neil (1992) went on to say: "The widespread practice of tracking students won't be dismantled until we truly believe that schools can help 'make children smart.'" This is where the two parallel strands of equity and brain science began to intersect. Oakes suggests that the equity charge for schools was not just to end tracking rooted in deficit thinking about African-American, Latino, First Nation, Alaskan Native, and Pacific Islander students' intellectual capabilities and increase their access to more rigorous courses. She, along with others, told school leaders they must also embrace and promote the idea that intelligence is malleable, and the right instruction can help historically marginalized students get smarter.

Yet, today we know much more about how to make that happen and the role relationships and emotions play in the process. However, we do not always know how to do this in the service of historically marginalized students. I believe in order to realize the full potential of the principles of practice outlined by Darling-Hammond et al., we have to come to the science of learning and development with an equity lens and situate SoLD firmly in current reality: We live in a racially stratified society. That stratification has its roots in the sorting process that begins in school with unequal access to the type of instruction that allows students to flex their cognitive muscles and become independent learners. As a result, when we place teaching and learning within the greater socio-political context, we have to ask ourselves a hard question: *Do we view the principles of practice that Darling-Hammond et al. offer in ways that are liberatory or will we allow them to be used to reinforce the current deficit-oriented paradigm about "those kids"—namely students of color, English learners, poor, and immigrant students—that permeates many school districts, large and small, urban and rural?*

Recognizing inequity by design as a systems issue

Lest we mistakenly think this is simply about addressing implicit bias in the classroom with more diversity workshops or "courageous conversations," we need to take a step back and understand the roots of school inequity as originally conceived. The founding fathers of our public education systems designed schooling around the concept of "separate and unequal" by using what they knew of the "science of learning" to engineer automated and predictable racial and linguistic stratification within schools. The science of learning has been used historically to create a more efficient process of inequity.

As teacher educators and equity advocates like Jeffrey Andrade-Duncan (2008), Pedro Noguera and others (Noguera, 2008; Noguera & Boykin, 2011) often point out: Schools are not broken or failing. They are producing the exact outcomes they were designed to create. This is not about individual teachers behaving badly, with racist intent. Schooling in the United States has a history driven by the use of systemic methods to ensure racialized outcomes, from Americanization schools for immigrants and boarding schools for First Nation children that spanned the 19th and much of the 20th century to a socialization of inferiority in segregated schools serving African-American and Mexican-American students and families.

When we look closely at the institutionalized and systemic process of inequity, we see it rooted not just in some school leaders' and teachers' deficit mindset, but also wired into the system's methodical policies, structures, and processes that keep powerful pedagogies and instruction from marginalized students such that, over time, their cognitive ability to process information and do complex work is diminished.

Martian Haberman (2010) calls this systemic approach to under-developing higher order thinking and problem-solving the pedagogy of poverty. Kozol

pointed it out in graphic detail in *Illiterate America* (Kozol, 1985) and *Savage Inequalities* (Kozol, 1991):

- Restrict access to cognitively challenging work that engages (and grows) the brain
- Withhold effective reading instruction because reading comprehension promotes critical literacy down the road
- Put novice teachers with the neediest students
- Withhold "advanced skills" from at-risk students in favor of teaching "basic skills" indefinitely

Unfortunately, there is a way educators like to talk about the science of learning in "color-blind" terms when it is not colorblind at all. At some point, we have to acknowledge that the under-development of marginalized students' cognitive abilities and academic identities is not a "bug" in the system; it is a central design feature of the system (Jackson, 2011; Noguera, 2008).

Means, Chelemer, and Knapp (1991) in *Teaching Advanced Skills to At-Risk Students: Views in Research & Practice* tied this design feature of structural inequity to the algorithm that creates learning gaps, which will, in subsequent grades, turn into opportunity gaps that then show up as chronic achievement gaps. Their research pointed out how educators typically do the following when confronted with underperforming students of color. We see this play out in countless classrooms where teachers fail to provide cognitively demanding work to grow students' brain power.

- They underestimate what these students are intellectually capable of doing.
- As a result, they decide to postpone more challenging and interesting work until these students have mastered the "basics" (which usually never comes).
- Consequently, by focusing on low-level cognitive work and compliance-focused pedagogies such as those that Haberman (2010) lists, students are deprived of opportunities to practice flexing their cognitive muscles that prepare them to carry more of the cognitive load during instruction.

Given this historical context, I want to highlight three of the four key areas of the SoLD synthesis that hold some tension for me and where I believe we have to be vigilant that the science of learning and development is not used to maintain inequity by design:

- Supportive environmental conditions
- Support for the development of social, emotional, and cognitive skills; habits; and mindsets
- Productive instructional strategies

Supportive environmental conditions

I would like to start with a review of the synthesis area of supportive environmental conditions as an important area for wholistic affective, social, and cognitive development, because as acknowledged by Darling-Hammond et al., environmental conditions create the container within which teaching and learning are expected to happen. This environmental "container" provides the structures, processes, policies, and practices that operationalize the relational developmental systems framework:

> This work [science of learning] is situated in a relational developmental systems framework that looks at the "mutually influential relations between individuals and contexts" (Lerner & Callina, 2013). This framework makes it clear how children's development and learning are shaped by interactions among the environmental factors, relationships, and learning opportunities they experience, both in and out of school, along with physical, psychological, cognitive, social, and emotional processes that influence one another—both biologically and functionally—as they enable or undermine learning (Fischer & Bidell, 2006; Rose, Rouhani, and Fischer, 2013).

If we are to believe this about the critical nature of relational developmental systems and that "*… this framework makes it clear how children's development and learning are shaped by interactions among the environmental factors, relationships, and learning opportunities they experience*" then we also have to believe that there are both negative and positive ways to operationalize it. In its negative application, we allow (knowingly or unconsciously) microaggressions and deficit thinking to create a learning space that not only feels socially and emotional "unsafe," but also "intellectually unsafe" (Cammarota & Romero, 2006; Cervone & Cushman, 2015). Unchecked micro-aggressions and deficit thinking in the form of subtle demeaning, off-handed comments are all too obvious to students of color and immigrant students learning English. Educational researcher, Mica Pollock documents this in her research studies, *ColorMute*: *Race talk dilemmas in an American school* (2004), and *Schooltalk: Rethinking what we say about and to students every day* (2017). Stanford professor Claude Steele (2010), a social psychologist, highlighted the impact of this negative expression on students decades ago in his work around stereotype threat.

Steele (2010) documented how stereotype threat leads to impaired learning through an algorithm similar to the deceleration of cognitive development identified by Means et al. (1991): A student is aware of

the dominant, negative narratives about people in his racial, linguistic, or socio-economic group around schooling, effort, and learning. He finds himself in a classroom where the teacher makes a deficit-oriented comment about his performance or enacts a micro-aggression aimed at him or another student from the same demographic. Steele says it is *after* this point that the student begins to experience stress and a rise in cortisol, not in direct response to the comment or action, but at a later time, in anticipation of needing to disprove he does not fit the stereotype or dominant narrative. Mental focus that should be utilized for important information processing is diverted into managing the distracting stress-response in anticipation of navigating the social dynamics so as not to be perceived as conforming to the stereotype. Most educators like to prescribe mindset work for students of color experiencing stereotype threat, but they miss a key point that Steele and Aronson's (1995) original stereotype threat research highlights: We need to not focus on the internalization of inferiority images or their consequences, but rather examine the immediate situational threat that derives from allowing the broad and free-flowing dissemination of negative stereotypes about particular racial or linguistic groups to permeate the learning environment. It is this condition students are pushing back on.

Steele (2010) points out in *Whistling Vivaldi* that these negative contexts and conditions become the catalyst that kicks off the algorithm of inequity by design, hijacking the brain's safety and threat systems and triggering the amygdala to press the pause button on the work of the brain's executive function where learning takes place. Historically, negative, even hostile, conditions for diverse students went unchecked until there were greater calls for equity. Progress has been made, but the negative conditions and environments persist as evidenced in disproportionate discipline policies and practices that create an unwelcoming, even hostile environment for students of color.

For example, we can see current school practices that aim to police Black and Brown bodies, from dress codes that outlaw students of African descent from wearing their natural hair in Afros, braided styles, or dreadlocks to practices that penalize Native students and immigrant students for speaking to each other in their mother tongue. This can be seen in the overt "man-handling" of Black female students as in the October 2015 video of a police officer slamming a young Black girl to the ground in a South Carolina high school classroom as a method of discipline (Fausset et al., 2015) or the arrest of an young 11-year old African American boy for a confrontation resulting from his refusal to stand for the Pledge of Allegiance during home room (Hauser & Haag, 2019) or the four 12-year old middle school Black girls allegedly strip-searched by administrators for drugs for the "suspicious" behavior of being "giddy and hyper" after their lunch break. (Griffin, 2019) Students of color are routinely subjected to institutionalized conditions that contradict their interests and their humanity.

If we do not help school leaders understand that these practices are antithetical to relational developmental systems that create a genuinely safe environment then their leadership efforts to improve school climate in ways that positively impact student learning are for naught. School leaders have to be able to recognize and neutralize overt and more subtle, but equally harmful, microaggressions along with narrow-minded deficit-oriented policies that other diverse students and underestimate what they are capable of as emerging intellectuals.

Support for the development of social, emotional, and cognitive skills; habits; and mindsets

The other area we have to closely examine is the social and emotional supports for holistically helping students become more competent and confident learners. Emotion and cognition are irrevocably linked. This is a key point made in the SoLD synthesis by Darling-Hammond et al. Yet, there are ways in which this information about social neuroscience and social-emotional learning (SEL) have been used to further pathologize and stigmatize students of color and other diverse students because they may express and manage emotions in culturally congruent ways that are different from the dominant culture. These differences are often not seen as differences at all, but deficits in their moral, social, and behavioral character (Gorski, 2010). There are those well-intentioned educators who, looking through a deficit lens, see SEL as a "treatment" for diverse students who need "character training" that promotes compliance rather than to offer support for authentic self-regulation.

We have seen how SEL can be "weaponized" as an instrument of assimilation when we try to decontextualize it and make it color-blind. And, by extension, there exists a focus on trauma in ways that stereotype and pathologize families of color and immigrant

families. The assumption is that home is the cause of the toxic stress and that students of color live in communities that are "broken," which cause them stress when that stress is most often the result of parents living and navigating a racially stratified society. At the same time, we do not keep the toxic stress students of color experience from the policies and practices school front-and-center of the issue. Instead, SEL and development is reduced to decontextualized lessons around "Mood-Meter Monday, Trust-Building Tuesday, Thankful Thursday, or Feeling-Connected Friday." We routinely divorce relational SEL and development from self-regulation *during* learning, which denies a student the chance to learn ways to keep cortisol in check such that he has full access to his executive function for higher order thinking and processing.

Productive instructional strategies

In addition to recognizing how relational systems can work as part of a vicious rather than virtuous cycle, we also have to recognize how instructional practices have been used to under-develop students' cognitive capacity by focusing on low-level cognitive work and strategies under the guise of brain-based learning.

Whereas many schools are trying to improve teaching and learning based on emerging understandings of affective and cognitive neuroscience, many standards-based best practices run counter to what we understand about information processing and the science of learning, namely the need to give students complex work that stretches them into their individual zone of proximal development so that through productive struggle they turn inert information into useable knowledge.

There is a way in which teachers still do not believe diverse students who are underperforming are capable of doing deeper learning or carrying more of the cognitive load during instruction. Even some of the most promising strategies such as thinking routines from the popular text, *Making Thinking Visible* (Ritchhart, Church, & Morrison, 2011) have been reduced to generic sentence frames that become cognitive crutches rather than temporary scaffolds that are internalized, so students build their capacity to carry more of the cognitive load over time. There is a way we are providing teachers new instructional strategies, but do not build their capacity to be cognitive mediators in order to help students learn how to learn and become aware of their own internal information process algorithm. Instructional strategies should work to increase student agency, not just move students through a lesson to complete a worksheet.

Ritchhart et al. (2011) call this aspect of student agency being *metastrategic* as opposed to simply being metacognitive. Metacognition focuses on being an observer of one's learning in the moment, while being metastrategic, as Ritchhart et al. describes it focuses on cognitive planning and strategizing around possible information-processing moves. For example, the student is faced with an academic task. He has to reflect on what the task is asking him to do, and then think about what type of cognitive protocols, tools, or strategies it calls for. Then, he must sort through the 10 strategies he has learned in class and identify the two best suited to help him perform the mental processing the lesson calls for. Too few teachers ask this of students.

Despite teachers feeling they are using standards-based best practices, they are not offering underperforming students the opportunities to engage in activities that will allow them to increase their cognitive bandwidth, accelerate their pace of learning, and back-fill their learning gaps.

A unique opportunity: Using the science of learning to expand critical pedagogies and liberatory education

We come back around to our essential question: *Do we view the principles of practice that Darling-Hammond et al. offer in ways that are liberatory or will we allow them to be used to reinforce the current deficit-oriented paradigm about "those kids"?*

I think in each of the three areas reviewed, Darling-Hammond et al. show us ways to use the science of learning and development proactively to promote equity even if it is not named as such. But, that equity-focus will need to be explicit because the default setting in our schools systems is still the inequity by design paradigm (Delgado & Stefancic, 1993).

However, if the science of learning and development and its practice principles are to be used for good, then we have to understand what that looks like beyond offering new brain-based strategies. Instead, we will have to focus on using the science of learning as a catalyst for critical pedagogy.

If, generally, pedagogies are ways to coordinate cognitive processes and systems for the process of learning, then critical pedagogies are concerned with using those processes to transform the dynamics of power in education that generate stratified outcomes based on race, language, and class. The science of learning and development can be an important

element of a critical pedagogical process that promotes more equitable outcomes as it helps educators humanize and empower marginalized learners. This view of SoLD is consistent with the Cantor et al. finding that says that in effective teaching and learning "students are active agents in their own learning, with multiple neural, relational, experiential, and contextual processes converging to produce their unique developmental range and performance" (p. 4). This means that classroom teachers and school site leaders will need to be in a continuous process of unlearning, relearning, and reflecting with regard to the effects SoLD-based teaching practices have on students' learning moves.

This type of critical pedagogy positions students to be researchers and positions classrooms to be laboratories for the investigation and interrogation of one's own learning process as an act of agency. It positions teachers to be "problem-posers" that deftly concoct complex questions and challenging tasks to generate productive struggles for students that facilitate maximum dendrite growth. Critical pedagogy asks teachers to also become researchers of their students' learning and understanding in order to help facilitate the framing of problems and the "chunking" of content to make it relevant and "sticky" in ways that augment schema rather than just offer surface-level learning. Darling-Hammond et al. call out these types of practices in their implications for effective instruction.

Science of learning and development as a counter-narrative to deficit thinking

Importantly, Darling-Hammond et al. outline how SoLD can be an opportunity to upend inequity by design's primary engines: narratives that underestimate what diverse students can do intellectually and the belief that they need "basics" before complex cognitive work. As part of a virtuous cycle, the science of learning and development can become a counter-narrative that pushes hard on inequity by design's master narratives.

Delgado and Stefancic (1993) define these master narratives, also known as *majoritarian stories* or *dominant narratives*, as the "bundle of presuppositions, perceived wisdoms, and shared cultural understanding accepted as truth by people in the dominant culture" and considered to be "normal and natural" in American society based on a history of privilege and internalized superiority among those in the dominant culture (p. 462). If the science of learning's principles of practice are operationalized through an equity lens, then we might make progress in helping our education systems reconfigure themselves as engines of equity that effectively dismantle these deficit narratives.

Connecting culture and cognition: Expanding pedagogical content knowledge

Another important opportunity these implications and principles of practices present to educators is the chance to deepen our understanding of the role culture plays in cognition. SoLD can be used in the service of critical pedagogy if it is utilized to reverse the systematic underdevelopment of diverse students' cognition as documented by Hilliard (1974); Ladson-Billings (2009); Jackson (2011); Means et al. (1991), as well as others. This would allow us to leverage the science of learning for liberatory education that is at heart of social justice education.

This means we will have to help educators see the culture-cognition connection. Too many teachers think of culture erroneously as superficial multiculturalism focused on promoting racial and social harmony in the classroom by offering a feel-good "It's A Small World" environment. Others only see it as adding literature or topics to diversify the content in hopes to increase diverse students' motivation, engagement, or self-esteem. But, these are grossly limiting views of culture.

In reality, culture—how one makes meaning of the world based on shared beliefs, norms, cosmology, and so forth—is the software to the brain's hardware. Cultural mental models, understandings, and experiences create cognitive "hooks" or reference points that help to organize our schema into a knowledge network that facilitates our understanding of how thing work around us. Our cultural frames of reference reflect the ways our beliefs, knowledge, and behaviors are patterned on a neurological level (Jackson, 2011). This neurological patterning dictates how the brain processes information in order to facilitate that transfer and integration into one's schema. For example, collectivist cultures process information in ways that are similar to individualistic cultures, but also in some significantly different ways, and these ways that have been pathologized in schools.

Darling-Hammond et al. outline what it looks like to build on and expand children's knowledge and experiences:

- Teaching students within their zone of proximal development
- Scaffolding their learning so they can advance to more complex skills

- Providing cognitive supports [to facilitate deeper learning for transfer]

If these are fundamental to teaching so students learn, then we will have to ensure teachers utilize them. Teachers need to understand cultural reference points as a critical part of getting students into their zone of proximal development (ZPD) or scaffolding by using cognitive hooks behind chunking. Leveraging these neural pathways for learning require teachers to have greater pedagogical content knowledge (PCK). Lee Shulman (1999) highlighted that pedagogical content knowledge goes beyond just knowing one's subject matter. It requires teachers to have the most useful analogies, illustrations, examples, and demonstrations that help make the content comprehensible to the student. These examples, metaphors, and explanations have to be relevant reference points to students in order to match their cognitive hooks.

My point here is simply to highlight that to implement the principles of practice shared in the Darling-Hammond et al. article, we are going to have to help educators become more culturally responsive, not out of some misguided sense of multiculturalism, but because it goes to the heart of the science of learning.

So what … now what?: Closing the knowing-doing gap

As we share the emerging science of learning and development, we have to keep equity squarely in focus. We have to help educators resist the impulse to be reductive regarding the principles of practice that operationalize SoLD, especially for underserved diverse students who struggle with learning. In the past, we have seen neuroscience co-opted and findings "cherry picked" to be hammered into one-size-fits-all strategies, eroding its synergistic effect that results in powerful teaching and learning. We need to see providing productive struggle and cognitive complexity in our instruction as a key social justice goal.

How will we ensure every teacher is grounded in the science of learning and development and has integrated the principles into their practice? This challenge is our equity charge going forward. Only then can we leverage SoLD as an instrument for liberatory education.

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