



We know what leads children toward healthy development. We just need to build it.

Pamela Cantor and Nora Gomperts

What Learning and Developmental Science Says about Optimal Learning Environments

Children's environments, experiences, and relationships drive how they learn and develop—more so than their genes.¹ This finding, which is supported by burgeoning scientific research, poses both challenge and opportunity. Because the brain's developing structures and the expression of genetic endowment are sensitive to context, children exposed to stress and adversity can face tremendous obstacles in school, work, and life. But because the brain is malleable and context sensitive,² educators can transform students' lives by designing learning environments that nurture their skills and talent, buffer against and alleviate stress and trauma, and unleash potential.

Given the right conditions, what any child is capable of,³ almost all children are capable of. Furthermore, research reveals what the right conditions are. State boards of education can help ensure

that these conditions are built into all educational settings.

When the American education system was designed almost two centuries ago, its purpose was to produce efficient, effective workers who could support the industrial revolution. Educators prioritized delivery of content over higher order skills such as agency, problem solving, and critical thinking. Rote memorization and the preparation of select students for postsecondary education were marks of success.

The job market has changed significantly since then. More jobs require higher order skills and postsecondary training than not. Scientific understanding of how children learn and develop also evolved.⁴ Yet the education system has remained largely the same—organized around antiquated goals and false assumptions not grounded in science, with enormous risk for students who

are marginalized because of race, gender, and economic background.⁵

Based on preconceived notions about individuals' potential and with inadequate approaches to measuring individual progress, schools have sorted students into groups—those who are ready for and deserving of postsecondary education and well-paying jobs and those who are not. In doing so, the education system perpetuates institutional racism, sexism, and classism. It continues to reinforce zip code as destiny. By applying the core principles of the science of learning and development and attending to students' health and well-being, however, educators and state policymakers can transform education in the service of equity, ensuring that all children can thrive.

Core Principles

Malleability and the Role of Context. Genes are chemical followers. Although humans have over 20,000 genes, fewer than 10 percent are ever expressed. The contexts to which people are exposed determine which genes are expressed and how and when.⁶ This malleability, coupled with the fact that humans develop well into early adulthood,⁷ means that contexts have tremendous impact. There is no such thing as development independent of context.

The most common example of *negative context* is the experience of stress. Stress causes release of the hormone cortisol, which produces a “fight, flight, or freeze” response. When stress is mild or tolerable, the release of cortisol is healthy and adaptive; it helps individuals prepare for important events or respond to threatening situations by increasing focus, attention, and concentration.

However, stress that is extreme, long-lasting, severe, and unbuffered by the presence of a trusted adult exacerbates cortisol's effects, impeding healthy development. Research on adverse childhood experiences (ACEs)—including exposure to violence, neglect, abuse, and racism—has documented the impact of these stresses.⁸ Children with multiple ACEs are likely to experience health, behavior, and learning challenges because of what stress does to their brains and bodies.

The extent to which a child's stress response to adversity becomes toxic and leads to serious

health and mental health problems depends on the child's biological makeup, the characteristics of the adverse conditions (such as intensity and duration), and the presence of other positive childhood experiences.⁹ At school, children experiencing significant, unbuffered stress are often easily triggered and struggle to focus, creating challenges for learning readiness and learning itself.

The most powerful example of *positive context* is having positive developmental relationships, such as those between educators and students.¹⁰ These relationships produce the hormone oxytocin—the “love hormone.” Oxytocin counterbalances cortisol. It literally protects children, at a cellular level, from the negative effects of stress and adversity. Positive developmental relationships are characterized by consistency, emotional attachment, reciprocal interactions, and trust. They create feelings of safety, predictability, and belief in oneself.¹¹ Learning environments that promote physical and emotional safety, predictability, and sense of belonging are another example of positive context. Effective learning environments help deactivate the hyper-alert stress response systems of students who have experienced significant adversity, enabling students to engage and invest in their own learning and development.

Individuality and Variability. There is tremendous variation in how individuals develop and learn, and no two individuals develop in the same way.¹² Individual interests, values, performance on tests, and other attributes also vary over time. If we quantified and plotted these attributes over time, they would form a jagged, not straight, line. As Cantor et al. explain, complex skills develop in fits and starts, with forward movement and backward transitions.¹³ These facts reveal the inherent flaws in quantifying individual and group progress through averages and annual snapshot measures. Indeed, no one score or average adequately represents the attributes or potential of a person in any sample or population.

Skills and Mind-Sets. Our organization, Turnaround for Children, has developed the Building Blocks for Learning Framework that articulates skills and mind-sets that research across many disciplines has shown to be critical for success in school and beyond. These include self-regulation, attachment, self- and social

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awareness, and stress management, which in turn lay the groundwork for resilience and agency.¹⁴

Each of the skills and mind-sets included in the framework is measurable, malleable, and correlated with academic achievement.¹⁵ They are also extremely sensitive to stress and thus are likely to be underdeveloped in students who have experienced unbuffered stress. This research underscores the critical importance of explicit instruction around these skills and mind-sets, opportunities for students to practice them during daily instruction and classroom activities, and targeted, developmental supports for students who struggle with them.

Whole-Child Development and Thriving

Students' range of skills—and ultimately their potential as human beings—can be significantly enhanced by exposure to highly favorable conditions: learning environments and experiences designed to optimize their development (see also the article by Linda Darling-Hammond

and Jennifer DePaoli, page 6).¹⁶ Based on the principles articulated above, we propose a setting-agnostic framework to make whole-child development and thriving a reality (figure 1).¹⁷ It includes these elements:

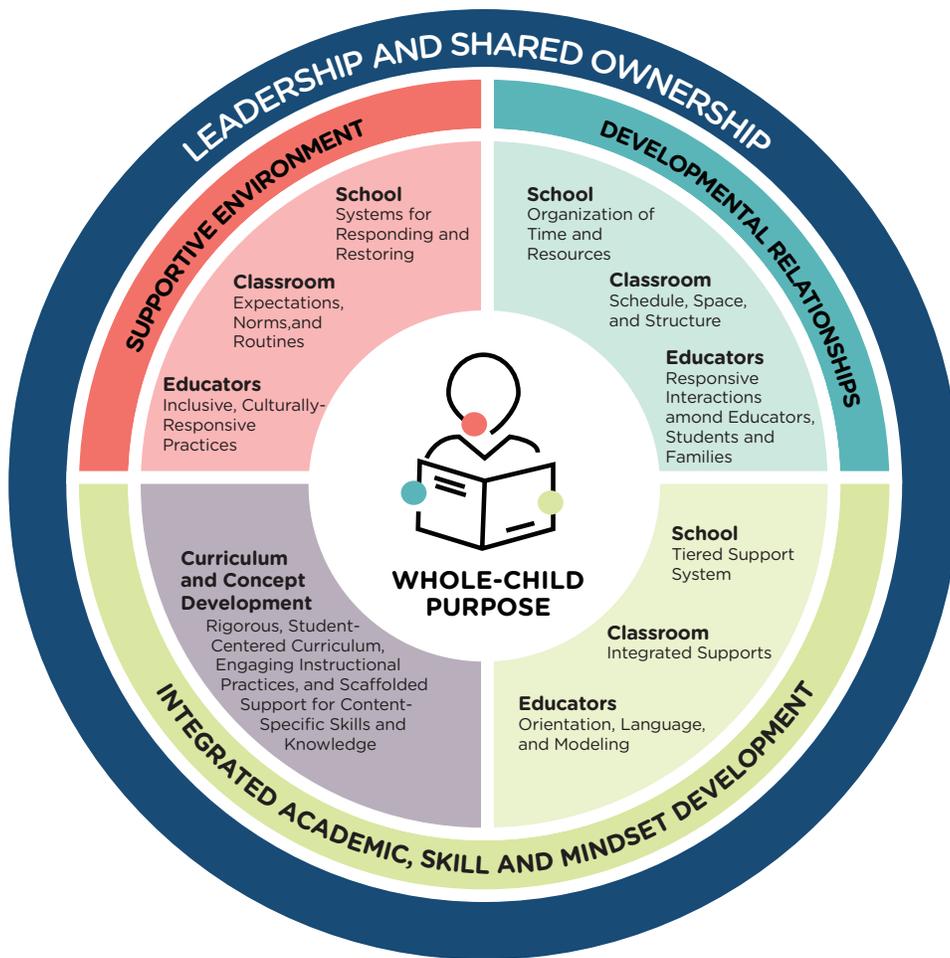
- **positive developmental relationships** characterized by trust, consistency, and reciprocity to buffer the effects of stress and provide a critical foundation for students' engagement, positive identity formation, healthy development, and academic success;
- **environments filled with safety and belonging**, including physical and emotional safety;
- **integrated supports** to identify variations in students' wellness and readiness for learning and to provide universal, group, and individualized supports to ensure that each student's needs are met, enabling them to engage effectively in learning;
- **intentional development of critical skills, mind-sets, and habits** that are integrated with

Figure 1. Five Non-Negotiables for Whole-Child Design



Source: Derived from SoLD Practice Principles. Linda Darling-Hammond et al. "Implications for Educational Practice of the Science of Learning and Development." *Applied Developmental Science* 24, no. 2 (2019).

Figure 2. Vision for School and Student Success



Source: Turnaround for Children, 2020.

academic instruction, prioritized through daily routines, and reinforced through individual supports as necessary; and

- **rich instructional experiences**, characterized by rigor, personalized student-centered curriculum, engaging instructional practices, and scaffolded support for content and skill acquisition.

Learning environments designed with these integrated elements can serve as an ecological vaccine, inoculating children against the effects of adversity while promoting and accelerating healthy development and learning.¹⁸

Bringing whole-child development to life in educational settings requires that environments be designed to promote safety, belonging, and relationships; that adults have knowledge of how the brain develops and how learning happens; that adults provide integrated, individualized

supports; and that educators use tools and platforms to integrate academic instruction with intentional development of skills and mind-sets of successful learners. Settings designed in these ways optimize each student’s developmental range and reveal the talent, skills, and potential that all children have.

Turnaround for Children helps build educators’ capacity to transform schools into spaces that optimize whole-child development, promote student engagement and positive identity formation, engage learners in rigorous instruction, and drive authentic equity for students. Our “Vision for School and Student Success” articulates the integrated systems, structures, and practices of a school that is organized to effectively promote each child’s learning and development (figure 2).¹⁹

The whole child stands at the center of this vision. A focus on whole-child development

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grounded in science ensures that schools are not focused just on what students learn, but also how they learn, their interests and identities as learners, and their holistic needs as they develop.²⁰ This focus has implications for school-level decision making and prioritization of time, resources, commitments, and energies.

Surrounding this central purpose are supportive environment, developmental relationships, and integrated academic, skill, and mind-set development—three key elements to positive youth development. Children develop most fully when they feel emotionally and physically safe, connected and valued, and challenged and supported to develop relevant skills for their future. Relationships are the active ingredient of the environment’s influence on healthy development because they show students that they are valued and help them define and achieve their goals.

The three elements are actualized through a set of schoolwide systems, classroom structures, and educator practices. These systems, structures, and practices are associated in the graphic with one of the three elements to ensure that they are visible and actionable. But in practice, they are multifunctional and integrated to bring coherence to the school’s purpose and capitalize on the integrated nature of development. For example, a school may redo its master schedule to include a daily advisory or class meeting that is a predictable and sacred space to build relationships, cultivate a sense of inclusion and belonging, and support students’ skill and mind-set development.

Transformational school change relies on consistently strong school leadership and shared ownership of all school community members. Leaders must articulate clear roles and expectations for staff, create a team that monitors progress toward goals, and distribute responsibility across staff members. These practices build relational trust and collective responsibility, which in turn help educators work through challenges, implement sustainable change, and continuously improve toward their goals.

Conclusion

Education leaders can help transform the antiquated U.S. education system into one that drives toward equity and prepares all students

for thriving in school and in life. Informed by recent advances in the science of learning and development and building on years of practice knowledge and experience, schools can be designed to foster the holistic development of engaged, self-directed learners who have the knowledge, competencies, and higher order skills they need for success in a changing world.

A redesigned education system will recognize that talent is plentiful and that skills exists in a potential state in all children. Such a system will be equitable and consist of schools with a shared goal of revealing the talents, passions, and interests of students; building on their skills and competencies; and addressing the effects of adversity on development and learning. Students will attend schools designed for positive developmental relationships; environments that foster safety and belonging; integrated individualized supports; the intentional development of the skills, mind-sets, and habits of all successful learners; and rich instructional experiences that achieve mastery-level competencies and enable students to know what they are capable of.

Education leaders should broaden their definition of student success and adopt new measurement techniques that reflect a holistic view of student development and the reality of diverse, variable, adaptive development and performance. This shift would transform the existing system and should be the goal and charge of the entire education ecosystem.

State boards of education play a critical role. They have the power to articulate a vision and mission for the state’s education system that is grounded in a broader conceptualization of student success and a new purpose of education—to create educational contexts that develop the whole child and enable all children to succeed as learners and to thrive.

State boards can promote policies that incentivize and support schools to become positive environments for development and learning, with educators who see and unleash the talents of all students. They can require educators to be trained in the science of learning and development and ground preservice training and ongoing professional development in scientifically grounded practices and tools to more effectively drive learning and development.

State boards can implement teacher residencies that further the profession of teaching.

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educator-prep/standards/adopted-tpes-2016.pdf; Hanna Melnick and Lorea Martinez, "Preparing Teachers to Support Social and Emotional Learning: A Case Study of San Jose State University and Lakewood Elementary School" (Palo Alto, CA: Learning Policy Institute, 2019).

⁷Leib Sutcher et al., "Learning to Lead: Understanding California's Learning System for School and District Leaders," research brief (Palo Alto, CA: Learning Policy Institute, 2018).

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They can adopt new measurement and evaluation techniques that rely less on averages and instead measure individual growth over time. In doing so, state boards can significantly contribute to transformative, equitable change from the goals and purpose of the current system to a new system that establishes positive life trajectories and substantially different outcomes for many more students. ■

¹Pamela Cantor et al., "Malleability, Plasticity, and Individuality: How Children Learn and Develop in Context," *Applied Developmental Science* 23, no. 4 (2019): 207–37.

²George M. Slavich and Steven W. Cole, "The Emerging Field of Human Social Genomics," *Clinical Psychological Science* 1, no. 3 (2013): 331–48.

³Benjamin S. Bloom, "The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring," *Educational Researcher* 13, no. 6 (1984): 4–16.

⁴Todd Rose, *The End of Average: How We Succeed in a World That Values Sameness* (New York: HarperCollins Publishers, 2016).

⁵Pamela Cantor et al., *Whole-Child Development: A Dynamic Systems Approach* (New York: Cambridge University Press, forthcoming).

⁶David S. Moore, *The Developing Genome: An Introduction to Behavioral Epigenetics* (New York: Oxford University Press, 2017); George M. Slavich and Steven W. Cole, "The Emerging Field of Human Social Genomics," *Clinical Psychological Science* 1, no. 3 (2013): 331–48.

⁷Richard M. Lerner, *Concepts and Theories of Human Development*, 4th ed. (New York: Routledge, 2018).

⁸Jack P. Shonkoff et al., "The Lifelong Effects of Early Childhood Adversity and Toxic Stress," *Pediatrics* 129, no. 1 (2012): 232–46.

⁹Vincent J. Felitti et al., "Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults," *American Journal of Preventive Medicine* 14, no. 4 (1998): 245–58.

¹⁰Richard M. Lerner, *Liberty: Thriving and Civic Engagement among America's Youth* (Thousand Oaks, CA: Sage Publications, 2012); E. Tobach and T. C. Schneirla, "The Biopsychology of Social Behavior of Animals," in R. Robert E. Cooke and Sidney S. Levin, eds., *Biologic Basis of Pediatric Practice* (New York: McGraw-Hill, 1968).

¹¹Cantor et al., *Whole-Child Development*.

¹²Rose, *End of Average*; Lerner, *Concepts and Theories of Human Development*.

¹³Cantor et al., *Whole-Child Development*; Rose, *End of Average*.

¹⁴K. Brooke Stafford-Brizard, "Building Blocks for Learning: A Framework for Comprehensive Student Development" (New York: Turnaround for Children, 2016).

¹⁵Ibid.; Cantor et al., *Whole-Child Development*.

¹⁶Ibid.; Bloom, "2 Sigma Problem"; Kurt W. Fischer and Thomas R. Bidell, "Dynamic Development of Action and Thought," in William Damon and Richard M. Lerner, eds., *Handbook of Child Psychology, Vol. 1: Theoretical Models of Human Development*, 6th ed. (Hoboken, NJ: Wiley, 2006).

¹⁷Drawn from scientific literature as summarized in three papers published in *Applied Developmental Science*, with emphasis on the 2019 article "Implications for Educational Practice of the Science of Learning and Development," by Linda Darling-Hammond and others. We modified the graphic to ensure applicability to and beyond K-12 settings while retaining the core design principles.

¹⁸Cantor et al., *Whole-Child Development*.

¹⁹Turnaround for Children, "Vision for School and Student Success" (New York and Washington, DC: TFC, 2020).

²⁰Cantor et al., *Whole-Child Development*; Lerner, *Concepts and Theories of Human Development*.

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English only. The EDSCLS can be downloaded and administered free of charge. Education agencies administering the survey can store the data locally; ED has no access to the data.

Directories of Federal School Climate and Discipline Resources. This set of directories, last updated in 2017, includes federal resources on school discipline and climate for different groups of education stakeholders. The directories contain information on capacity-building tools; data, measurement, and reporting; policy guidance; and a compilation of technical assistance centers. There are specific resources for state staff. ■

¹Washoe County School District, "Welcome to the School Climate Survey Project," web page, <https://www.washoe-schools.net/domain/231>.

²For example, Linda Darling-Hammond et al., "Implications for Educational Practice of the Science of Learning and Development," *Journal of Applied Developmental Sciences* (February 2019).

³Amrit Thapa et al., "A Review of School Climate Research," *Review of Educational Research* 20, no. 10 (2013).

⁴See, for example, David Osher, Deborah Moroney, and Sandra Williamson, *Creating Safe, Equitable, Engaging Schools: A Comprehensive, Evidence-Based Approach to Supporting Students* (Cambridge, MA: Harvard Education Press, 2018).

⁵David Osher et al., "School Influences on Child and Youth Development," in Zili Sloboda and Hanno Petras, eds., *Defining Prevention Science* (Boston: Springer, 2014).

⁶On how climate affects attendance, see Hedy Chang et al., "Using Chronic Absence Data to Improve Conditions for Learning" (Washington, DC: AIR and Attendance Works, September 2019).