



CompetencyWorks

Teachers Making the Shift to Equitable, Learner-Centered Education

Harnessing Mental Models, Motivations, and Moves



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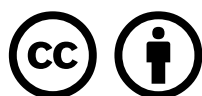
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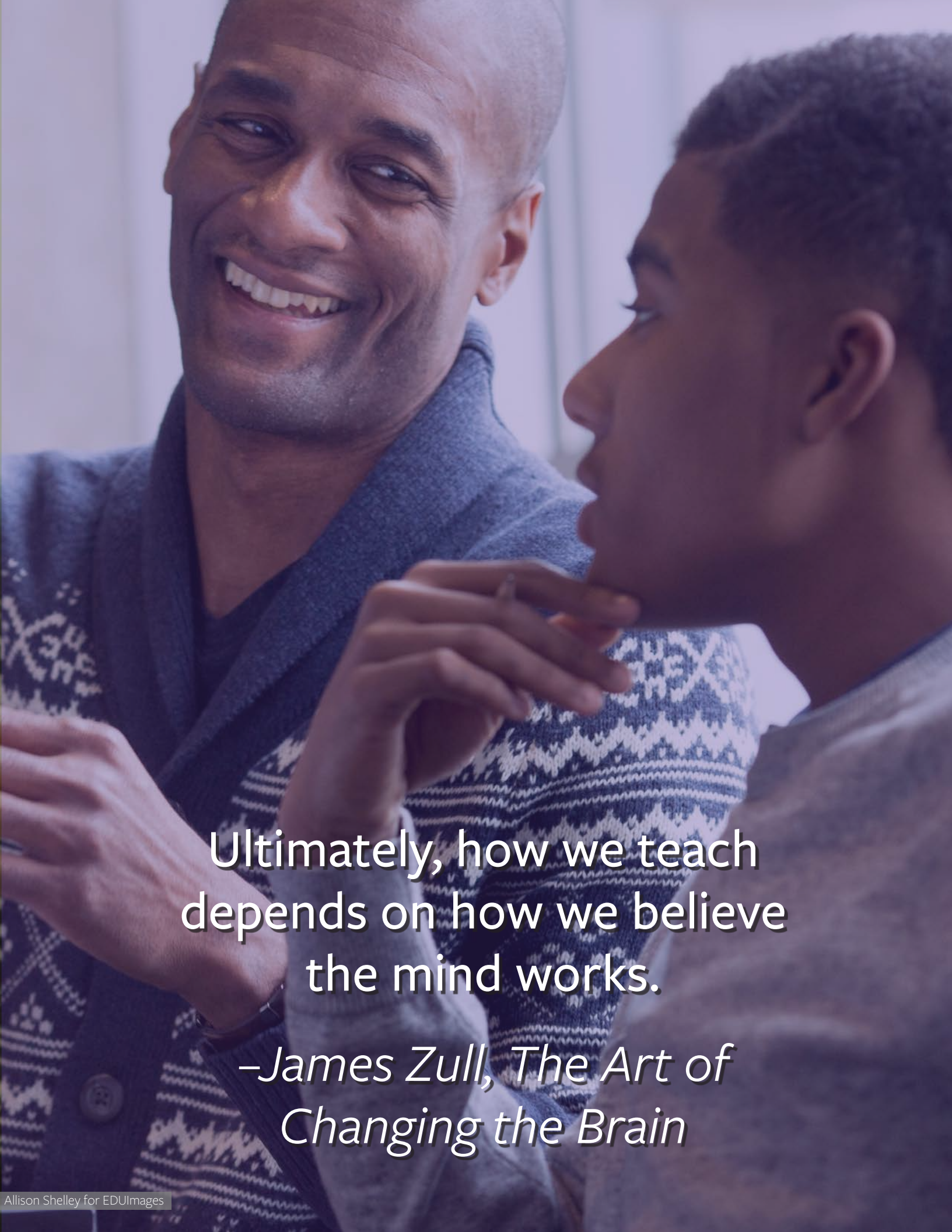
About the Aurora Institute

The Aurora Institute's mission is to drive the transformation of education systems and accelerate the advancement of breakthrough policies and practices to ensure high-quality learning for all. Aurora is shaping the future of teaching and learning through its work in policy advocacy, research, field-building, and convening. With a national and global view of education innovation, we work on systems change in K-12 education, promote best practices, examine policy barriers, and make recommendations for change to yield improved outcomes for students. Aurora envisions a world in which all people are empowered to attain the knowledge, skills, and dispositions necessary to achieve success, contribute to their communities, and advance society.



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A close-up photograph of a man and a young boy. The man, on the left, is smiling warmly at the boy. The boy, on the right, is looking back at the man with a thoughtful expression, his hand near his chin. They are both wearing patterned sweaters. The background is softly blurred, suggesting an indoor setting with light coming from a window.

Ultimately, how we teach
depends on how we believe
the mind works.

*–James Zull, The Art of
Changing the Brain*



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Overview

The Promise

Most educators agree that the traditional “sit and get” classroom will not help us achieve greater educational equity or promote the deeper learning skills our students need to succeed. In response, a growing number of schools, districts, and states are embracing approaches that are more equitable and learner-centered—where each student’s unique profile of strengths, needs, interests, goals, family and cultural background, and experiences are nurtured and leveraged to enable them to succeed. In Section 1, The Promise, we outline the key features of an equitable and learner-centered approach; highlight research that suggests that this approach can reduce educational disparities and promote deeper learning outcomes for students; and show how an equitable, learner-centered approach is bolstered by learning science that suggests these approaches are well aligned with how humans learn.

The Problem

Despite the promise of equitable, learner-centered education, too many districts and schools struggle to move beyond the pilot phase. In Section 2, The Problem, we consider the reasons why so many districts and schools face challenges when trying to scale equitable, learner-centered approaches. We explore the contextual factors that can make or break change efforts and examine the nature and extent of changes teachers must make if they hope to adopt a learner-centered approach. We conclude by turning to the learning sciences to better understand the key factors that may help or hinder teachers’ efforts to shift their practice and highlight the need for teachers to engage in their own deeper learning.

The Opportunity

We can build on the principles of equitable, learner-centered practices to create a new frame for how we design teacher learning experiences. In Section 3, The Opportunity, we present the theoretical rationale for an approach to designing professional learning that embraces the learning sciences. We introduce key research-based strategies we can use to explicitly address three hidden factors that drive teacher practice: 1) Embracing and harnessing teachers’ emotional responses to change to help them become more authentically **motivated** (rather than coerced) to change; 2) uncovering and refining teachers’ **mental models**, such as underlying theories, biases, and assumptions about their students and about teaching and learning; and 3) helping teachers translate their new pedagogical beliefs into their everyday classroom **moves** by identifying and weakening undesirable habits and helping teachers construct new ones. We show how explicitly addressing teachers’ mental models, motivations, and moves in our design of professional learning could help bring about more substantive changes more effectively and more efficiently than our current efforts alone.



The Promise of Learner-Centered Education for Deeper Learning & Equity

Introduction

Our capacity to grasp and apply complex ideas, view problems and opportunities from varying perspectives, and adapt to rapid change have become essential skills for the 21st century. They are essential because our world is becoming increasingly volatile, uncertain, complex, and ambiguous—commonly referred to as “VUCA” (Bennett & Lemoine, 2014). The growing diversity and interconnectedness of our society enable us to collaborate and innovate in new and powerful ways. Unlimited access to information and big data, daily advances in technology such as machine learning and artificial intelligence, and medical breakthroughs such as gene editing, smart cancer treatments, and wireless brain sensors bring unprecedented opportunity. At the same time, with the sudden and catastrophic losses and disruptions associated with the COVID-19 pandemic, racial injustice, political unrest, and anticipated threats from climate change, it is more important than ever that we strengthen our collective capacity for rapid change, leverage our differences as assets, and work together to face the many global challenges that lie ahead.

To thrive in such a complex, diverse, and uncertain environment, today’s students—and the educators who work with them—will need to be equipped with a whole new toolkit of knowledge, skills, and dispositions. While in prior generations, the focus was on building students’ content knowledge and procedural skills, today’s knowledge economy necessitates a “greater reliance on intellectual capabilities than on physical inputs or natural resources” (Powell & Snellman, 2004, p. 199).

The educational priorities of the 20th century now have far less value. For instance, knowledge of facts now has a shockingly short shelf life, as the amount of new information increases at an exponential rate and is available instantly at the touch of a fingertip. Similarly, the mastery of procedural skills, once a central focus of education and training, is now recognized as helpful primarily for addressing familiar, well-defined problems—not complex, messy ones. As our society has become more diverse and our lives more interconnected, it has become clear that understanding and responding to the world and its problems from a single cultural lens will fail to produce viable solutions for all. To thrive in today’s complex, fast-moving, and diverse world, students and educators need cultural competence, a grounding in a set of core disciplinary ideas, and the capacity to apply broad perspectives, disciplinary understanding, and cognitive skills across varying contexts as they solve complex problems, innovate, and iterate. This broader set of knowledge, skills, and dispositions is often referred to as deeper learning (Hewlett, 2013; Pellegrino & Hilton, 2012; Zeiser et al., 2014) and includes cognitive, interpersonal, and intrapersonal competencies.

Leveraging this kind of deeper learning can enable students and educators to become “adaptive experts” (Hatano & Inagaki, 1986; National Research Council, 2000). Adaptive experts have skills and knowledge that are flexible and enable them to adapt to external demands more readily than routine experts who excel at performing familiar tasks efficiently. And adaptive experts do not rest on their laurels. As the authors explained, adaptive experts view themselves not as all-knowing experts but rather as an “accomplished novice ... [someone] who is proud of his or her achievements and yet also realizes that there is much more to learn” (National Research Council, 2000, p. 45).

Because of inequities in past and present educational policies and practices, sadly, we are not on a path toward achieving deeper learning—or even basic learning—for all students. In fact, according to the National Center for Education Statistics (2020), the basic academic achievement levels for eighth-grade Hispanic and Black students in 2019 continued to trail nearly 40 points behind white and Asian students in mathematics, and 30 points in reading. The Programme for International Student Assessment (PISA), an international academic proficiency test in reading, mathematics, and science, is administered every three years to 15-year-old students across the world and includes items that assess students’ 21st-century skills, such as critical thinking and collaborative problem-solving—a standardized measure more closely aligned with deeper learning. Yet the 2018 results for the United States (U.S. DOE, IES, 2018) showed similar race-based disparities in students’ higher-order thinking skills. For instance, the average scores for white and Asian students in reading were 531 and 556, respectively, while scores for Hispanic and Black students were 481 and 448, respectively. Math scores showed an even greater disparity between white and Asian students and Hispanic and Black students.

Addressing educational inequities is not only a moral imperative but also a sound investment. According to the OECD’s report “Equity and Quality in Education: Supporting Disadvantaged Students and Schools” (2012), having a better-educated citizenry is associated with increased civic participation—resulting in more vibrant and stronger democracies, political and social stability, healthier lifestyles, and better capacity to weigh evidence and make informed choices. Improved academic and technical skills are associated with higher levels of employment and productivity. Education that fosters 21st-century skills that promote creativity and problem-solving will help unleash the student talent and innovation we need to fuel our economy and ensure progress for all our social communities (OECD, 2012).

Most educators agree that the traditional sit and get classroom will not help students achieve the deeper learning they will need to thrive in our diverse, complex, and rapidly changing world. To address educational inequities and build students’ deeper learning capacity, a growing number of schools, districts, and states are embracing approaches that are more learner-centered. For instance, results from a 2014-2015 National Survey on High School Strategies Designed to Help At-Risk Students Graduate found that more than half of all U.S. high schools report using personalized learning plans with their students (U.S. Department of Education, 2017). Similarly, a scan of state plans for fulfilling the Every Student Succeeds Act (ESSA) (2015) revealed that over three-quarters of states identified “personalized learning” as part of their state strategy to improve student learning (Pace, 2018). The Aurora Institute’s annual policy scan shows that the number of states adopting policies and promoting the adoption of competency and personalized learning models has more than doubled since 2012, estimating that eight out of 10 U.S. school districts are working toward competency-based learning models (Truong, 2019; Patrick, 2021).

In recent years, the education field has also seen a dramatic increase in public awareness about, and commitment to, addressing the need for greater educational equity. To advance equity goals, educational organizations large and small have released position statements, developed new standards, and produced guidance and resources dedicated to addressing educational disparities (CASEL, 2022; CCSSO, 2017; Council for Chief State School Officers, 2020; Lopez et al., 2017; OECD, 2012; Schlund et al., 2020).

Many educational leaders believe that learner-centered and equitable practices are well aligned and that when combined, they can become a powerful lever for change. At the same time, educators recognize that good intentions are not enough. To realize our transformative vision for deeper learning for all students, we need to be intentional and explicit in how we address barriers to equity as we adopt learner-centered approaches (CASEL, 2022; CCSSO, 2017; Great Schools Partnership, 2020; Lopez et al. 2017; TNTP, 2018).

What Is an Equitable, Learner-Centered Approach?

A learner-centered approach represents a philosophical perspective on education that reflects fundamental changes in what, how, and why students learn (Education Reimagined, 2015). An array of terms is associated with a learner-centered approach, including personalized, competency-based, deeper learning, and student-centered. Each of these terms has its own particular areas of emphasis. The term “learner-centered” is broad and encompasses these terms and their respective approaches.

First, it is important to note that a learner-centered approach is not prescriptive—and not all learner-centered classrooms and schools look alike. Rather, a learner-centered approach encompasses a constellation of related approaches that acknowledge that each student has a unique profile of strengths, needs, interests, goals, backgrounds, and experiences—and is innately motivated to learn. Realizing the promise of every child is the key to learner-centered approaches that are equitable. According to the National Equity Project, “educational equity means that each child receives what they need to develop their full academic and social potential” (National Equity Project, nd). Learner-centered educators who are committed to equity believe that if all students are provided the right set of opportunities, supports, and contexts, they are capable of meeting a high bar for learning (Education Reimagined, 2015; Lopez et al., 2017; Sturgis & Casey, 2018).

The education field has not yet reached consensus on a single definition of learner-centered education. However, educators embracing a learner-centered approach that is focused on equity typically recognize some version of the following features and educator strategies.

Exhibit 1. Key Features of an Equitable, Learner-Centered Approach

Learning is:	Educators:
Personalized and equitable	Build on learners’ prior knowledge, experiences, and cultural backgrounds through opportunities and supports that honor their backgrounds and identity, meet their needs and interests, and capitalize on their strengths.
Challenging, relevant, and applied	Enable learners to develop, integrate, and actively apply their knowledge and skills, and deepen their conceptual understanding by engaging in authentic, culturally relevant projects, inquiries, work-based learning, and community service activities.
Transparent and transferable	Set clear and rigorous learning targets, use formative assessment to inform learning, and measure success by demonstrated mastery of broad competencies that show how learners applied their learning to challenging, complex, and authentic problems and contexts.
Relationship-based	Build strong relationships with each learner that reflect respect, understanding, and high expectations for their success. Offer ample opportunities for learners to collaborate, critique, and engage in constructive exchange with peers, and create respectful, inclusive, and supportive learning communities.
Varied and flexible	Offer variable pacing, diverse assessment options and timing, access to technology and other learning modalities, expanded numbers of learning partners, and access to connected learning opportunities outside of the school day and school walls.
Owned and driven by the learner	Partner with—rather than direct—learners as they build their understanding of their own needs, recognize and draw on their strengths and interests, and enable them to advocate for their own needs. Guide students in developing skills in managing their own learning and assuming greater responsibility, decision-making, and ownership for when, what, and how they learn, and nurturing a passion for and commitment to becoming a lifelong learner.

The Promise of Learner-Centered Education for Deeper Learning and Equity

The trend toward more learner-centered education is showing promise for achieving greater equity and promoting deeper learning outcomes for all students. For instance, one small study of learner-centered teaching in mathematics (Walters et al., 2014) focused on 22 highly regarded teachers who were recognized for their supportive classrooms and strong track record of teaching. This study examined these teachers' classroom practices and documented the extent to which they employed traditional rather than learner-centered approaches. The study found that teachers who adopted more learner-centered approaches, such as engaging students in sustained discussion to deepen their conceptual understanding and encouraging students to experience productive struggle while tackling relevant and challenging mathematics problems, had students who were more likely to show significant gains in their engagement and problem-solving skills, as measured by the PISA test.

Another study examined the teacher practices and outcomes associated with a competency-based education approach (Haynes et al., 2016). This study included 18 schools, 380 teachers, and 1,419 ninth-grade students in three states. It found that students who reported experiencing competency-based, learner-centered approaches in their classrooms showed more positive changes from fall to spring in their self-efficacy, intrinsic motivation, and ability to self-regulate their learning than did students who reported less exposure to these practices.

More recent studies have focused on the benefits of learner-centered approaches for students from traditionally marginalized groups—including how exposure to learner-centered approaches contributes to essential skills and dispositions, as well as academic success. For instance, a study examining the relationship between collaboration, personalization, and equity (Surr et al., 2018) found that when students had opportunities for high-quality collaborative experiences, they were more likely to be engaged and motivated, and to report greater self-efficacy. For Black students, the benefits of having opportunities for high-quality collaborative experiences extended further to include gains in academic grades.



Similarly, a study of 21 schools led by High Tech High Graduate School of Education (Sharrock & Callier, 2020) examined how teachers' engagement in a networked improvement community, which included lesson study and examination of student work, influenced their use of learner-centered instruction and assessment approaches. This study found that both Black and Latinx students experienced growth in their sense of mathematical agency, including greater comfort in sharing ideas and a belief that they would be successful in math. Also, Latinx students' mathematical proficiency improved significantly, based on standardized tests

and grades. Although the study could not confirm causal links, findings suggest that teachers' use of these strategies could be associated with positive changes in the mathematical agency and academic achievement of Black and Latinx middle and high school students.

A larger study focused on student experiences and outcomes associated with participation in schools that embrace a deeper learning model. This study was conducted in 28 schools with 1,762 students in California and New York (Zeiser et al., 2014). First, it found that schools adopting deeper learning models were more likely to employ a common set of learner-centered structures and opportunities (Huberman et al., 2014) such as project-based learning, internships, collaborative group work, and advisories. Next, an examination of outcomes for students participating in these "deeper learning schools" showed that students scored

higher on the international PISA tests of student achievement, were more likely to graduate high school within four years, and showed more positive gains in their interpersonal and intrapersonal skills, such as engagement, motivation, and self-efficacy, than students enrolled in matched comparison high schools (Zeiser et al., 2014). Subsequent analysis of the results using an equity lens (Zeiser et al., 2020) found that students of color, English learners (EL), and students with special needs were more likely to have consistent access to deeper learning opportunities when they attended a school with an explicit deeper learning focus than those who attended comparison schools. Also, for some student subgroups, such as EL students, there was a stronger relationship between having these opportunities and interpersonal and intrapersonal outcomes such as engagement and collaboration skills. This study also found that the strength of the relationship between deeper learning opportunities and outcomes was stronger for boys than for girls.



Alignment of Equitable, Learner-Centered Education With the Science of Human Learning

How and why do learner-centered approaches promote student learning? Evidence for the validity of these approaches is bolstered by learning science that suggests that learner-centered approaches are well aligned with how humans learn (Ambrose et al., 2010; Hinton et al., 2012; National Research Council, 2000; Osher et al., 2017). This growing body of research is helping us better understand the factors and contexts that enhance and inhibit the learning process. Among the many findings emerging from this important research, several are particularly relevant for learner-centered classroom educators, including:

1. Learning must connect with, and build on, prior understanding as it becomes organized into increasingly complex conceptual frameworks over time.
2. Learning is highly individualized and dependent on culture and context.
3. Learning is an active and dynamic process informed through feedback.
4. Learning is inextricably connected with a learner's emotions and relationships.
5. Learning is driven by the learner's identity and agency.

Practices employed in learner-centered classrooms reflect key findings from learning science research, including the five categories below:

1. Helping learners make connections to, and cognitive structures for, new learning

Based on learning science research, we now know that new learning is built on prior knowledge and experiences. As explained by Ambrose et al. (2010), “new knowledge ‘sticks’ better when it has prior knowledge to stick to” (p. 15). As learners experience the world, they make meaning by associating information and experiences and organizing these into cognitive frames or schema. As explained by John Bransford and other authors of an updated review of learning science research (National Academies of Sciences, Engineering, and Medicine, 2018), “Learners identify and establish relationships among pieces of information and develop increasingly complex structures for using and categorizing what they have learned” (p. 4). For students of diverse backgrounds, teachers must be culturally responsive when introducing new concepts, finding ways to link new ideas with students’ personal and cultural experiences and cognitive frames. As explained by Osher et al. (2020) in their comprehensive review of the literature on learning science, “Leveraging prior knowledge, experience, and interests can reduce cognitive load

and mental effort, creating space for new learning” (p. 7). In culturally responsive, learner-centered classrooms, educators offer applied activities that are relevant to students’ interests, cultural backgrounds, and lived experiences. Educators elicit students’ prior understanding and ideas to determine when and how to introduce new concepts, and then they offer activities that provide the just right level of challenge to extend students’ current knowledge and skills. This approach aligns well with the science that shows that students must find and make connections to newly introduced ideas to expand their knowledge and skill.

2. Embracing individual differences and diverse backgrounds

Research on the neurobiological basis for learning differences provides evidence to support approaches that are personalized and culturally relevant. Rose et al. (2013) found that individuals differ in the nature, pattern, and sequence of their developmental pathways as well as in their dynamic responses to varying contexts and conditions. The authors argue that evidence exists for individual variability in multiple aspects of human functioning, from our physical and psychological health to how we learn and interact with others. A new science of the individual (Cantor et al., 2019), based on theories of dynamic systems, is emerging to help us better understand the extent of individual variations in pathways and responses to context and how best to support these differences.

Similarly, research examining cultural differences has found that the social experiences, norms, and constructs inherent in various cultures influence how people perceive, interpret, and respond emotionally and cognitively to learning experiences and contexts (Chita-Tegmark et al., 2012). These authors argue that in addition to meeting students where they are in their conceptual understanding, educators need to provide a cultural bridge to enable students to link their current cultural values, beliefs, and thinking systems with new ways of understanding and approaching learning. Learner-centered classrooms—where teachers get to know their students well and use this information to design activities and supports and respond to individual student needs, interests, and backgrounds—fit well with the science that shows that individuals differ in their learning profiles, patterns, and pathways.

3. Offering open-ended, applied, and interactive learning experiences

Learning science research is confirming what prominent educational and cognitive theorists have professed for over a hundred years—that learning is a complex and dynamic process in which the learner actively constructs new knowledge and understanding through interactions with his or her environment (Dewey, 1916; Fischer, 2009; Piaget, 1952; Zull, 2002, 2010; Vygotsky, 1978). For instance, a comprehensive review and synthesis of the learning science research (Osher et al., 2017) concludes that “development is an ‘experience-dependent’ process” (p. 6) and that “human development derives from the continuous interaction between the individual and the context of each individual’s relationships and experiences” (p. 1). Another comprehensive research review (National Academies of Sciences, Engineering, and Medicine, 2018) explains:

It has been assumed that brain development always leads the way in cognitive development and learning, but in fact the brain both shapes and is shaped by experience....The reciprocal interactions in learning between the dynamically changing brain and culturally situated experience form a fascinating developmental dance, the nuances of which are not yet fully understood (p. 59).

Learner-centered classrooms that feature active, applied, and culturally relevant learning opportunities—such as projects and inquiries that provide regular, structured opportunities for frequent, formative feedback and that create an inclusive learning context that honors, elevates, and builds on students’ life experiences and cultural values—align well with the science that shows that human learning is driven by our experience and is both active and contextual.

4. Enhancing learning through harnessing emotions and relationships

Learning science research indicates that the extent and nature of learning is always driven by each learner's emotions and relationships (Ambrose, 2010; Hinton et al., 2012; Immordino-Yang, 2016; Zull, 2002). A growing body of neuroscience research offers compelling evidence that emotions and learning are inextricably linked in the brain. Renowned affective neuroscientist Mary Helen Immordino-Yang (2016) explains that our emotions, including our feelings when interacting with others, are at the core of our brain's primitive survival system. Our emotions "steer our intellectual and social endeavors ... and our attentional focus" (p. 18-19). For instance, Immordino-Yang explains: "Emotion plays a critical role in all stages of problem-solving, helping the student to evaluate, either consciously or unconsciously, which knowledge and skills are likely relevant and which will lead to a correct solution" (p. 72). As Ambrose et al. (2010) summarized, based on their extensive review of the learning science research, "Students enter our classrooms not only with skills, knowledge, and abilities, but also with social and emotional experiences that influence what they value, how they perceive themselves and others, and how they will engage in the learning process" (p. 4).

The role of emotions in learning is particularly relevant for learners from traditionally marginalized groups. For instance, most students of color experience the daily stress of race-based microaggressions, and many suffer from a phenomenon called "stereotype threat" (Steele & Aronson, 1995). Stereotype threat is when someone anticipates that others hold expectations about their ability or lack thereof based solely on their

demographic characteristics, such as race and gender. As a result, students experience anxiety and increased cognitive load as they work to manage how their performance compares with the anticipated expectations—ultimately underperforming. In a review of the research on how race-based social stressors affect students' psychological and biological systems, authors Levy et al. (2016) explain that students' experiences of racism are associated with the release of stress hormones and the activation of the autonomic nervous system in an effort to cope. The dysregulation of the students' biological systems, referred to as "allostatic load," is then associated with difficulties in students' attention, memory, and executive functioning, which adversely affect their performance on cognitive tasks.

"'Learn' is an active verb; it is something people do, not something that happens to them."

-John Bransford, National Academies of Sciences, Engineering, and Medicine

Sustained race-based social stress often leads students' mental and physical health to deteriorate, further worsening their academic performance. In contrast, research shows that when students are provided socially supportive environments, their stress response is reduced (Hernandez et al., 2021). A learner-centered approach, which explicitly addresses the central role of students' emotions and attends to their basic needs for belonging, emotional support, and safety, aligns well with this science.

5. Promoting learners' positive identity and agency

Humans are not passive recipients of learning. The old adage "You can lead a horse to water, but you can't make it drink" aptly describes what learning science tells us about a teacher's role in students' learning—that learning can be encouraged and supported by teachers, but it cannot be forced. A 2010 review and synthesis of the learning science research by the Carnegie Corporation (Ambrose et al., 2010) identified seven principles to guide educators that are based on learning science research. Among these key principles, the authors explain: "Learning is not something done to students, but rather something students themselves do" (p. 3). Similarly, learning scientist John Bransford (National Academies of Sciences, Engineering, and Medicine, 2018) explains that "'learn' is an active verb; it is something people do, not something that happens to them" (p. 12).

Because learning must be initiated and driven by the learner, James Zull (2002) argues that enabling students to gain a sense of control is particularly critical. When students have a sense of control over their own learning, it fuels their motivation and contributes to their sense of agency. In contrast, when students feel that their learning is being pressured or coerced by the teacher, Zull argues, they may feel threatened, and their fear centers may be activated, which shuts down cognitive processing. Understanding and managing the power dynamics within classrooms is key to supporting agency in learners from traditionally marginalized groups. For instance, Delpit (1988) argues that schools have a culture of power that must be uncovered and explicitly taught to students for them to succeed in that culture. Delpit also argues that norms and expectations regarding the perceived roles of teachers and students may vary across

cultures. When teachers do not fulfill expected roles, students can experience confusion and frustration. To this end, Zull argues that having students learn completely on their own may not always be productive. When students are confused or overwhelmed, their capacity to learn is inhibited. The key for teachers, Zull explains, is “knowing when to stay on the side, and when to take the lead...a combination of challenge and support seems optimal for learning” (p. 239).



Key to one's sense of agency is identity. According to Berry and Candis (2013): “Individuals possess a cultural identity, significant way(s) in which a person is defined or defines oneself as connected to culture (customary beliefs, traditions, practices, values and language). [Our identity] influences self-construction... [and] the way we see the world and inform our experiences” (p. 45). When our self-perceptions are positive and we feel a sense of competence, we are driven to act, embrace new challenges, and persist through difficulties (Akey, 2006). Yet our identity is

not a fixed psychological state—it is a construct that emerges and continuously adapts based on our social context and interactions. When we feel devalued and disempowered, we avoid risks and refrain from action (Bucholtz & Hall, 2005). Understanding the contextually dependent nature of our identity is especially important for supporting marginalized students. As Berry and Candis (2013) explained:

For all Americans in school, there is a certain way to be, a certain way to act and react, a certain way to live. However, for African Americans these ways of being and living in this place and space often, if not always, do not coincide with the ways African American students live within their cultural communities. (p. 46)

For students of color, the misalignment of their personal and cultural identity within the dominant “white” culture of school may cause feelings of disempowerment, devaluing, and lowered status, ultimately leading to negative feelings about school and increasing disengagement from learning (Berry & Candis, 2013; TNTP, 2018). Delpit (1988) suggests that negative self-perceptions by students from traditionally marginalized groups can be overcome by encouraging these students to recognize and use their “expertise.” For instance, a recent study (Hernandez et al., 2021) examined the effect of asking students who were members of traditionally marginalized groups (such as low income, Black, and Latinx) to engage in a self-affirming exercise where they reflected on how their background and culture were sources of “unique knowledge and strength.” The study showed that when students were encouraged to embrace and value their cultural identity, they showed higher self-esteem, greater persistence when tackling academically challenging tasks, and higher grades at the end of the term. In culturally responsive, learner-centered classrooms, teachers promote positive self-identity, share power, understand their students’ needs for support and direction, and progressively act as facilitators and guides—rather than deliverers and directors of learning—as they enable students graduated opportunities for autonomy and responsibility.

In sum, findings from learning science research have profound implications for teaching and learning. Learner-centered educational practices fit well with the science of human learning when they feature approaches that are personalized and equitable; challenging, relevant, and applied; transparent and transferable; relationship based; varied and flexible; and student owned and driven. These practices also help students develop the deeper learning skills they will need to thrive in our volatile, uncertain, complex, and ambiguous (VUCA) world. A learner-centered approach shows great promise for better preparing *all* students to thrive. To achieve this, we must “scale” learner-centered education by enabling all districts, schools, and teachers to understand, value, and adopt these approaches.

In Section 2, we will consider the reasons why so many districts and schools face challenges when trying to scale equitable, learner-centered approaches. We will explore the contextual factors that can make or break change efforts and examine the nature and extent of changes teachers must make if they hope to adopt a learner-centered approach. We will conclude by turning to the learning sciences to better understand the key factors that may help or hinder efforts to shift teacher practice and highlight the need for teachers to engage in their own deeper learning.



The Problem: Three Challenges Associated With Scaling Equitable, Learner-Centered Practice Shifts

The Trouble With Moving Beyond the Pilot

From Chugach, Alaska, to Lake County, Florida, Harrisburg, South Dakota, and New York City—and dozens of states in between—we can find districts engaged in efforts to shift to a more learner-centered, and competency-based approach (Levine, 2021; Patrick, 2021). Among these districts and schools, the most successful have come to recognize that deep transformation requires a sustained, multi-year commitment to change efforts (Levine, 2020). This requirement explains why, until recently, reports from the field suggested that few districts and schools trying to adopt learner-centered approaches experienced much success moving past the pilot phase (Gross & DeArmond, 2018; Pane et al., 2017; Williams et al., 2014). In particular, education leaders found it hard to expand learner-centered practices beyond those pioneer teachers who may have already been receptive to these ideas to begin with (Gross & DeArmond, 2018). Leaders cited the challenges of insufficient time and resources for professional learning, and of shifting teacher mindsets, as key obstacles impeding efforts to bring veteran teachers fully on board with learner-centered approaches (Jenkins et al., 2016).

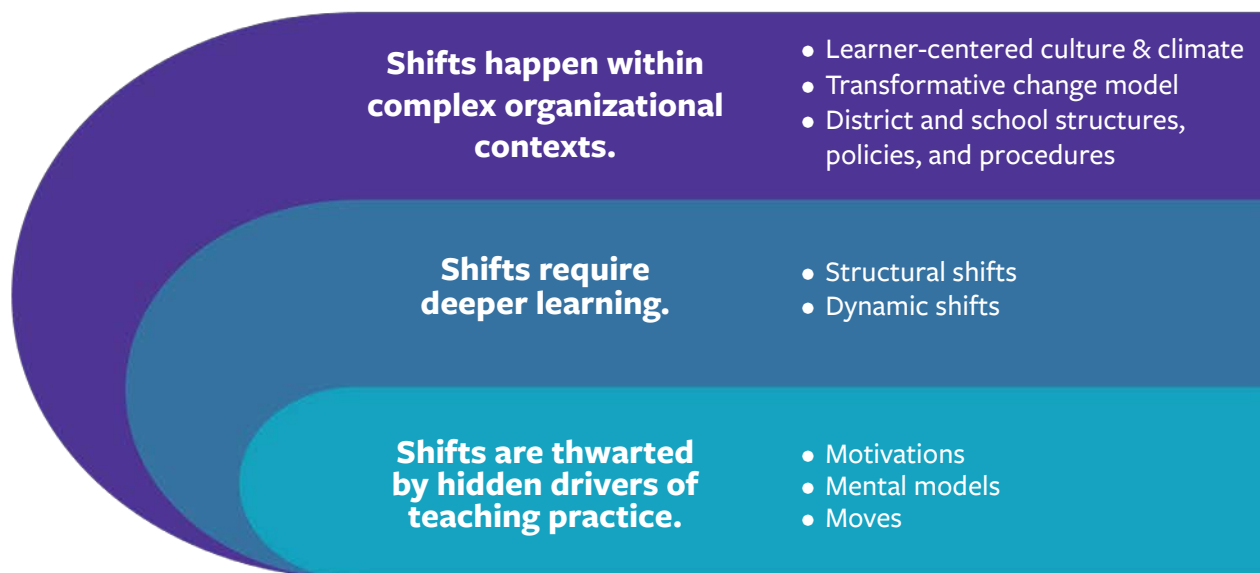
It is important to pause and consider why districts and schools that are committed to learner-centered approaches so often face this challenge. First, to be fair, challenges with adopting and scaling new educational policies and practices are in many ways both normal and expected. New education reforms typically face challenges with broad-scale implementation due to a wide range of factors, from the policy environment, to the level of leadership support, to alignment with schoolwide practices, to teacher buy-in (Casey, 2018; Glennon et al., 2004). The crux of the issue is that teachers operate not in isolation but rather within complex and dynamic organizational contexts. To bring about substantive and lasting change, districts and schools need a foundation that can support and sustain shifts in teaching and learning. Specifically, educational leaders need to:

1. adopt a change management approach that enables teachers to engage in complex organizational change;
2. recognize that, for most teachers, adopting a learner-centered approach will require deeper learning; and
3. uncover and address the cognitive, affective, and behavioral obstacles that can thwart efforts to change practice.



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Exhibit 2. Three Challenges Associated With Scaling Equitable, Learner-Centered Practice Shifts



Shifts happen within complex organizational contexts

Challenge #1: Having the Right Culture, Climate, Structures, and Transformational Change Approach

In her paper “Moving Toward Mastery: Growing, Developing and Sustaining Educators for Competency-Based Education” (2018), Katherine Casey acknowledges that much of the progress we have made toward more learner-centered education has been driven by “pioneers.” She argues that relying solely on these individuals’ efforts and talents is not sustainable. If we hope to bring about lasting, fundamental change, we must address the “systemic and cultural barriers, misaligned preparation programs, professional development supports, evaluation system, schedules, assessment practices and curriculum” (p. 2). Casey offers a road map for change by highlighting how we can “reimagine” teaching and better address key “levers for systemic change” (p. 5) that are equity oriented, learner-centered, and lifelong, such as establishing structures for distributed leadership and collaboration, developing cultures of inclusion, and learning and redesigning credentialing and certification.

In recent years, the field has expanded its focus to consider the organizational climate and cultures learner-centered schools need to achieve greater equity. For instance, in their 2017 “Quality and Equity by Design: Charting the Course for the Next Phase of Competency-Based Education,” authors Lopez, Patrick, and Sturgis identify 16 design principles for ensuring greater equity in schools embracing a personalized, competency-based model. As expected, many of their recommendations, especially those related to structure and teaching and learning, align closely with the structures necessary to support learner-centered approaches more generally. But the authors also argue that schools must take explicit steps to achieve equity, particularly through changing school culture, such as by cultivating empowerment and fostering adaptive leadership. The authors believe that educators and educational leaders must examine their own assumptions and identities and acknowledge the dominant culture if they hope to change it.

Other evidence supports the notion that without an explicit equity focus, teachers may believe they are learner-centered but may not always be achieving equity. An ambitious study conducted by TNTP, “The Opportunity Myth” (2018), examined the classroom practices of teachers in five school districts, including 1,000 observations and review of 5,000 assignments and 20,000 student work samples. Key to their findings was that students were completing the work given to them. However, the level of challenge and rigor offered to students often did not meet grade-level standards, especially for students of color. An analysis of teacher surveys suggested that in some cases, compassionate teachers striving to “meet students where they are”—a learner-centered premise—were inadvertently lowering expectations for students of color, accepting their performance as “acceptable” even when it fell below grade-level standards.

In their recent paper “Overcoming the Inertia of Inequity,” Berg and Homan (2021) articulate the necessity of creating organizational systems that explicitly support learner-centered education.

Efforts to build individual capacity without commensurate organizational development can be ill-fated since structural or cultural features of the organization often stand in the way of putting that capacity to work. Teachers who learn to critically examine their instructional materials for bias, for example, are limited in making a difference if they find they are not supported with the time, training, or funding to adopt or develop stronger materials. A focus on getting teachers to change without equal attention to how the organization needs to shift to make that change possible and powerful will result in stasis. (p. 80)

A move toward learner-centered education necessitates change in every key structure and policy, as well as the overall school culture, from learning goals to curriculum and from instructional strategies and supports to assessment. If schools aim to become more learner-centered, they must create the foundational scaffolding that can support this reimagining of teaching and learning—and they must make equity an explicit focus.

Most schools, even those committed to learner-centered education, have not yet created the right organizational structures, policies, and cultural shifts they will need to achieve their aims. Building the right school context requires change management. Decades ago, Hall and Hord (1987) developed the Concerns Based Adoption Model (CBAM), a conceptual framework outlining the common challenges and stages of adoption that typically occur when schools and educators adopt new innovations. The well-researched and widely recognized CBAM model identifies seven stages of concern that educators and administrators experience as they go through the change process, and eight levels of use, which educators progress through as they learn about, experiment with, and ultimately integrate the new innovation more fully into their daily practice. CBAM focuses on enhancing teacher comfort and receptivity to change, and increasing clarity about and facility in the practices teachers will need to use as part of the new innovation. Districts and schools use CBAM extensively to guide their change efforts (American Institutes for Research, 2015).

While CBAM acknowledges the role of emotions in learning, continuing research in school and organizational development have come to recognize there is more complexity to the change process. Kevin Fahey, an expert in school change and facilitative leadership, argues that to bring about deep and lasting change, schools need to engage in a transformative change process, which he calls the “uncommon theory.” Referring to traditional approaches to school reform as the “common theory,” he says:

What this [common theory] thinking does not do is help schools examine their most closely held assumptions and practices, think deeply about the purpose of schools, or take up troubling issues of race or equitable educational practices. It does not help schools reinvent themselves because the Common Theory ignores what happens in real schools. It ignores the competing commitments, long standing ways of doing things, unspoken norms, varied capacity for leadership, and conflicting assumptions that characterize real schools. (Pegasus Springs Collective, 2019, para. 3)

Central to a transformative change approach, such as Fahey’s uncommon theory, is the notion that schools are complex, dynamic systems. As Groff explained in her paper “Dynamic Systems Modeling in Educational System Design and Policy” (2013):

[M]uch of our world operates in a nest of complexity, where effects of our actions are not immediate or directly observable, and can have far-reaching effects in the dynamics of the system in which the initial problem is situated....These systems are filled with feedback loops where behaviors and actions in one part of the system impact (or are constrained) by other parts of the system.
(p. 74)

Fahey purports that to bring about change in complex and dynamic systems such as schools, leaders and educators must do the hard work of uncovering and confronting implicit assumptions, surfacing unspoken norms and traditions, and tackling ingrained patterns of practice—and they must do so together as a community. Essentially, educators need to grapple with the inconsistencies between “what we say we do” and “what we actually believe and do.” This process is not easy for school leaders and educators. As Fahey et al. (2019) explains:

A deep dive produces anxiety, and the deeper the dive, the greater the anxiety—for both the leader and the organization. Part of the work of “diving” into any dilemma is uncovering hidden assumptions, organizational norms, and patterns of the past that are in operation, and sensing that business as usual is not serving students and teachers well. Few educators are comfortable when the spotlight turns to their practice and uncovers the ways in which that practice is not meeting students’ needs. (p. 39)

Fahey’s uncommon theory builds on what we’ve learned from decades of change efforts—that complex emotions are central in the change process, and we must constructively acknowledge and address them in a developmental manner. Fahey and Ippolito (2014) believe that to be successful with transformative change efforts, leaders must model the very behaviors and changes in culture they aspire to achieve. Fahey and Ippolito also argue that leaders must offer educators opportunities for meaningful adult development where they can develop a “learning practice” as well as a teaching practice, ultimately developing a “socializing learning practice” that allows educators to reinvent their school culture and practice in collaboration with others. Schools committed to adopting and scaling learner-centered educational practice must recognize that a move of this magnitude will be measured in years, not days, weeks, or even months. On a schoolwide level, leaders must help build the structures, policies, and culture that will support both individual educators and the staff as a whole in adopting learner-centered approaches. And leaders must engage educators in an explicit change management process that is designed for deep, complex transformation.



District and school-level structure, policies, and procedures are also essential in supporting systemwide change. In a 2014 resource from KnowledgeWorks focused on the conditions districts needed to scale personalized learning (Williams et al., 2014), the authors pose a similar question: “How do we move from the isolated examples to whole systems designed around providing personalized learning options for all students?” They recommend that districts and schools create the conditions for scaling, including: curriculum, instruction, assessment, learning environments, and student supports.

These recommendations are supported by research. A 2014 American Institutes for Research (AIR) study of deeper learning suggests that these kinds of district and school structures, policies, and procedures do help teachers to be more learner-centered, efficacious, and able to offer greater

opportunities for students' deeper learning (Huberman et al., 2016). This study examined the extent to which schools embracing deeper learning models shared common schoolwide structures to support teaching and learning. First, they found that nearly all of the deeper learning schools offered similar structures to support students, such as advisory periods to reflect their emphasis on personalization and relationship building, and project-based learning, inquiries, and apprenticeships to reflect their value of applied, authentic learning experiences. To support educators' work, these deeper learning schools also had similar structures, policies, and practices. They typically had leaders who cultivated a strong sense of community, offered opportunities for shared responsibility and staff decision-making through a transformational change management process, and enabled staff to assume collective responsibility for student learning by fostering collaboration during professional learning communities (PLCs) and regular common planning periods in the school schedule. When teachers had the chance to be part of these cohesive professional communities, they were more likely to have a sense of teaching efficacy and hold learner-centered beliefs. They were also more likely to have students who reported having more extensive opportunities for deeper learning in their classrooms. These findings align with earlier research that found that when teachers assumed collective responsibility for their students, they saw reductions in achievement gaps for learners from traditionally marginalized groups (Lee & Smith, 1996).

“A shift to learner-centered education will necessitate fundamental changes in nearly all facets of teaching—not just the simple adoption of a new technique, procedure, or technology tool.”

Shifts require deeper learning

Challenge #2: Recognizing the Nature, Depth, and Complexity of Teacher Change Needed to Shift to Equitable, Learner-Centered Education

Nested within an equitable learner-centered culture and climate, bolstered by schoolwide structures, policies, and procedures—and using a transformative change process—we now turn to the challenge of actually shifting teachers' daily practice. School leaders, designers of professional learning, and education school faculty who are striving to help teachers adopt learner-centered educational approaches will likely face challenges in their efforts to change how teachers teach, due to the nature, depth, and complexity of teacher change needed to shift to learner-centered education.

First, unlike other educational reforms that might require following a new curriculum or adopting new technology tools, teachers interested in adopting a learner-centered approach must become skilled, creative, and adaptive designers, facilitators, and assessors of human learning. For many teachers, this will necessitate their own deeper learning, including fundamental changes in both the *structural* and *dynamic* aspects of their teaching practice as they develop critical consciousness (Seider & Graves, 2020) and a new area of expertise. This is a heavy lift even for those teachers who are already excited about and receptive to making the change.

If we hope to scale learner-centered educational practices, we must recognize the nature, depth, and complexity of what we are expecting teachers to do. A shift to learner-centered education will necessitate fundamental changes in nearly all facets of teaching—not just the simple adoption of a new technique, procedure, or technology tool. Shifting to learner-centered education necessitates core changes in the structural and dynamic aspects of classroom practice.

Structural shifts in teacher practice

The *structural* aspects of a learner-centered educational approach are those components of classroom practice that can be planned in advance. Key structural components include learner profiles and personalized learning plans, project-based learning opportunities, a defined set of learner competencies, more flexible schedules and use of class time, new learning management software and other technologies, and performance-based assessment tasks and rubrics. Although these structural components are likely to be challenging for teachers to learn how to use in their classrooms, these kinds of changes are achievable with a sufficient investment of time and resources. The problem is that making learner-centered structural changes may be necessary but not sufficient for bringing about desired changes in classroom-level practice (Nunnery, 1998).

Dynamic shifts in teacher practice

Where the shift to learner-centered education gets even more challenging is in the *dynamic*, real-time pedagogical practices teachers must employ to effectively leverage these new structures within their classrooms. As outlined in [Section 1](#), teachers enacting a learner-centered approach need to craft classrooms and learning experiences that are personalized and equitable; challenging, relevant, and applied; transparent and transferable; relationship based; varied and flexible; and learner-owned and driven.

To achieve these ambitious aims, teachers, especially those who have previously worked in traditional classrooms, must make a wide array of dynamic pedagogical changes in their daily practice. As Fahey and Ippolitano (2014) explained:

[S]ome leaders understand that, in order for students to learn at high levels, the adults in schools must learn new programs, new strategies, new ways of working together, and even new ways of thinking about who their students are and what it means to be a teacher. In other words, there is a lot of adult learning to be done. (p. 31)

For instance, to ensure that learning is *personalized, equitable, and appropriately challenging*, teachers must be able to recognize where students are in their learning and, *based on what they see—not what they may assume about their students*—be able to apply facilitation methods and learning opportunities appropriately to support and advance that learning. As Darling-Hammond and Bransford (2005) explained, “To be effective, teachers must make moment-to-moment decisions based on their ongoing assessments of learners’ current levels of understanding and their zones of proximal development” (p. 74). Similarly, Margaret Kennedy (2019) argues that teachers need to learn strategies and insights, not specific teaching procedures or content knowledge. They must gain “a deeper understanding of how students think and why they say or do what they do” (p. 147). This means teachers must employ a range of strategies that might include posing questions to uncover students’ current level of understanding, challenging students’ thinking and misconceptions, and guiding and encouraging students to reflect on and advance their own understanding and skills.

Another core tenet of learner-centered education is that practices are *relationship based*. Teachers must create a positive, inclusive climate in their classrooms and build trusting, respectful, collaborative, and authentic relationships with each individual student—and among students. To do this, they must establish and maintain norms that ensure emotional safety as well as learn how to make observations and pose questions to get to know their students well, including their lives outside of the classroom. Teachers must then use this knowledge of students’ family backgrounds, culture, interests, and learning profile to deftly calibrate the content, nature, and timing of their suggestions and supports in ways that will support their individual needs, as teachers continue to nurture trust and collaboration with students.

One hallmark of a learner-centered approach is that learning is *learner owned*. Part of earning that relational trust is relinquishing control to ensure that learning is learner owned. This requires one of the most profound changes in teacher practice—shifting from a deliverer to a facilitator of learning, where students co-design the learning in partnership with their teacher. As Darling-Hammond and Oakes (2019) explained, “effective teachers are aware that they are always trying to enable greater independence on the part of the students, while being available for needed assistance. Even as they give students more room to direct their own learning, they are mindful of the indicators that will signal when students can continue to move forward in productive ways and when they will need to step in again” (p. 246). To that end, teachers must adopt an entirely new role in the classroom, shifting the power dynamic away from sole teacher control, and instead encouraging students to exercise autonomy and engage in productive struggle. They also must prepare students to advocate for their needs, take on increasing responsibility for their own learning, and progress over time.

Teachers as learner-centered adaptive experts

As we move toward learner-centered education, it is important to recognize that we are essentially expecting teachers to become adaptive experts in human learning—honing their capacity to orchestrate, attend to, and respond to a dizzying array of factors related to individuals, activities, and relational contexts to maximize learning for all students. In their book *Preparing Teachers for Deeper Learning* (2019), Darling-Hammond and Oakes refer to this challenge as “the problem of complexity” (p. 28). As the authors explain, teachers “need to learn a set of principles and pedagogies that will allow them to bring these opportunities alive ... in busy classrooms they will create and manage” (p. 8). Also, “teaching that aims at deep learning requires sophisticated judgments about how and what different students are learning, what gaps in their understanding need to be addressed, what experiences will allow them to connect what they know to what they need to know, and what instructional adaptations will be needed to ensure that they can reach common goals” (p. 12).



To master such a complex teaching pedagogy, the authors argue that teachers must exercise and develop many of the deeper learning competencies they are seeking to instill in their students. For instance, Darling-Hammond and Oakes (2019) explain that teachers:

will need to engage in thoughtful experimentation, insightful interpretation of complex events, and knowledge-rich reflection, combined with a wide repertoire of strategies that allows them to continuously adjust their teaching based on student outcomes. This means that teachers must become adaptive experts who can not only use routines that help them work with greater efficiency, but also use their knowledge to innovate where routines are not enough—to figure out what the problems are when students are not learning and to adapt materials, teaching strategies, or supports accordingly. (pp. 12-13)

Research supports using a professional learning approach focused on building teachers’ adaptive expertise. In her review of dozens of studies examining the effectiveness of various types of professional development, Kennedy (2019) found that professional learning that reflected learning about strategies and insights (for example, “focused on how to interpret events as they unfolded and how to respond to them strategically” (p. 147)) produced better teacher learning and student outcomes. Kennedy argues

that teachers need to learn how to “make better in-the-moment judgments about how to respond to students” (p. 147). She explains that teachers must learn “about seeing things that might interfere with or facilitate the direction of the lesson ... [they must learn] what to look for” (p. 148).

For most educators, a move toward learner-centered education will necessitate dramatic and fundamental shifts, including shifts in the cultural lens they use to see their students (and themselves), the strategies they use, the roles they play—and, most important, how they attend to, respond to, and support student learning in real time. Guiding teachers in navigating this more complex and nuanced approach to teaching is nothing short of daunting.

Shifts are thwarted by hidden drivers of teaching practice

Challenge #3: Tackling the Hidden Obstacles Teachers Face in Shifting Their Practice

Seasoned teachers already are masters of a well-established classroom practice (Desimone & Stuckey, 2014). Their existing practice has been thoughtfully constructed, honed, and reinforced over many years. We know from learning science that changing the thinking, beliefs, and behavior of experienced professionals is not easy or straightforward. Skilled performance is driven in large part by a set of emotional, behavioral, and motivational factors that guide daily decisions and actions. Teachers cannot simply learn new ways of doing things; they also must “unlearn” their old way of doing things. We know from the science of human learning that this type of deeper learning and shift in practice will require addressing three learning networks—the what, the why, and the how. For teachers, this means addressing changes they need to make in their:

- emotional responses and motivation to change,
- implicit biases and mental models of teaching and learning, and
- ingrained teaching habits, which help or hinder adoption of new moves.

The tricky part is that, for experienced professionals, all three of these networks typically operate primarily outside of their conscious awareness, so they are particularly difficult to change.

Teacher motivation

The first hidden obstacle is teachers’ **motivation**. Teachers’ emotional responses to change can lead to resistance or, conversely, heighten their engagement in change efforts. Neuroscience research suggests that our emotions and thinking are interconnected, with brain imaging studies showing how pivotal our affective systems are in learning (Hinton et al., 2012). We know that change efforts can trigger strong emotional responses, ranging from excitement to fear, anger, and resistance (Mossholder et al., 2000). When teachers face pressure for change, their emotional responses are also influenced by their sense of professional identity, competence, and need for agency and control. Fahey et al. (2019) in their “uncommon theory” and Hall and Hord (1987) in their CBAM model explicitly call attention to teachers’ affective responses



to change. When teachers are expected to make dramatic changes in core practice, as is the case with learner-centered education, these reactions are likely to be more pronounced, yet teachers are not always aware of these emotional responses and may attribute difficulties in achieving change to external factors rather than themselves. If we hope to shift teachers' motivations related to change, we will need to identify and harness their emotional responses, not ignore or suppress them.

Teachers' mental models

The second hidden obstacle is teachers' implicit biases and pedagogical theories of action, or **mental models**. Teachers' mental models reflect their underlying beliefs and assumptions about their students and about their teaching and learning. These mental models are used to assess the needs and capabilities of students, interpret classroom contexts, make predictions, and guide decisions about the best course of action. They develop through teachers' culture, personal life, and educational experiences. These mental models are further shaped by their formal teacher education program and ongoing professional development, and are then solidified through their school culture and direct classroom experience. The tricky thing about teachers' mental models is that they are resistant to change, and teachers typically are not aware that they exist.

Teacher moves

Third is teachers' classroom practice or **moves**. Over time, a teacher's practice is so well established that much of their daily behaviors and decisions just occur automatically (Schon, 1987; Shavelson & Stern, 1981). In fact, we know from learning science that when people acquire solid, routine expertise in a domain, they also gain the ability to perform fluidly and efficiently with little or no conscious awareness of why they do what they do (Crawford & Brophy, 2006; Osher et al., 2017). This is the brain's way of optimizing efficiency while freeing up space in our working memory to attend to new information and new learning (Packard & Knowlton, 2002). If we hope to shift teachers' practice, we must help them to recognize—and explicitly identify and embrace—those aspects of their practice that are already equitable and learner-centered, and to identify and overcome their ingrained habits that go against a learner-centered approach.

Let's revisit the challenge of scaling learner-centered education. We are expecting teachers to operate from a whole new equity lens and learner-centered teaching and learning paradigm, becoming "adaptive experts" who can apply and flexibly adapt their craft across varying conditions and contexts to ensure success for all their students. To do this, many teachers will need to adjust—or even construct a whole new awareness of—their culture and privilege, and a new theory of teaching and learning. This may mean substantially revising or even abandoning assumptions and beliefs, as well as established routines, interaction styles, and teaching practices that they may believe work well. This does seem daunting.

How Are We Currently Addressing Teacher Professional Learning?

Historically, teachers have been introduced to new curriculum content and pedagogical approaches through didactic professional learning experiences (Darling-Hammond et al., 2009), what Fahey and Ippolitano (2014) refer to as an "instrumental learning practice." This approach may work just fine when teachers need to build factual knowledge or learn a new procedural skill, but didactic approaches are more likely to result in superficial learning—learning that does not change the learner's underlying beliefs or understanding (Kennedy, 2019; Johnson & Fargo, 2014; Desimone & Garet, 2015; National Research Council, 2000; Donovan & Bransford, 2004). While teachers who participate in didactic professional development experiences may come away with a new bag of classroom tricks, their fundamental beliefs and approaches to teaching likely will remain unchanged (Darling-Hammond et al., 2014).

New trends in professional learning are embracing more learner-centered approaches. A review of 35 rigorous studies of teacher professional development (Darling-Hammond et al., 2017) identified key features associated with positive changes in teacher practice and outcomes for students. This study identified seven key features associated with effective professional learning: content focus, active learning, collaboration, use of models/modeling, coaching/expert support, feedback and reflection, and sustained duration.

Those who provide professional learning for educators are discovering that [what works best for students](#) also works best for teachers. Teachers learn best when professional learning is learner-centered, including:

- personalized and equitable
- challenging, relevant, and applied
- transparent and transferable
- relationship based
- varied and flexible
- learner owned and driven.

For instance, organizations such as Learning Couture¹ show how learner-centered approaches can drive professional learning experiences for teachers and other educators. Learning Couture has created a Customizing Learning Platform for adult learners, designed to foster an asset-based growth orientation with adult learners. The platform is grounded in universal design and culturally responsive teaching and learning practices so teachers can experience these practices firsthand while using them with students.

Drawing on an array of learning theories, including self-determination theory (Ryan et al., 1997), which asserts that learners need autonomy, mastery, and purpose to be highly motivated to change practices, educators engage in self-discovery as they design a learner profile and use data to develop a personalized learning plan on customizable project boards that they can share with their colleagues. The learning cycle is job-embedded (occurs before, during, and after teachers engage with learners) and is supported with customized learning resources that reflect teacher learners' individual needs at their zone of proximal development.

Although learner-centered professional learning strategies can help achieve substantive changes in teacher practice, they are not without their own challenges and limitations (Talbert, 2009). In her review of the research on professional learning, Kennedy (2019) found that professional learning that focused on building teachers' strategies and insights was more effective than focusing only on content knowledge and procedures in changing teacher practice and student outcomes, but this approach also required substantial time and the expert guidance and support of a seasoned group facilitator, mentor, or coach. Kennedy concluded:

By definition, strategic programs are less amenable to packaging. They aim to engage teachers in classroom-based problem-solving and to help them “see” their own classrooms differently, a goal that seems to require program faculty who have intimate familiarity with classroom life, so much so that they can help their teachers interpret their own experiences differently. (p. 152)

Similarly, unless designed thoughtfully and led by seasoned facilitators, promising learner-centered professional learning structures, such as PLCs, may not work equally well for all teachers. For instance, research suggests that when teachers have sufficient prior knowledge or hold beliefs that already align with professional learning goals, they tend to make progress. In contrast, when professional learning communities include only new and inexperienced teachers (Center for Research on the Context of Teaching, 2002), or when teachers have existing views that differ from the professional learning goals,

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they are far less apt to make changes in their practice (Cochran-Smith et al., 2016). Research on learning communities suggests that this collaborative approach may work best when participating teachers already embrace a shared underlying philosophy of learning. When philosophies are inconsistent, the extent of change may be constrained by these teachers' existing perspectives on teaching (Vesio et al., 2008). Without expert group facilitation and an explicit focus on uncovering and revising teachers' beliefs through iterative cycles of learning, experimentation, and improvement, those participating teachers may be at risk of simply reinforcing and perpetuating current approaches rather than adopting new ones.

Simply employing learner-centered professional learning structures alone may not be enough to shift teacher practice to reflect a learner-centered educational approach. To enact substantive and lasting change, we need to use explicit strategies to uncover and address three hidden drivers of teacher practice needed to realize change: teacher motivations, mental models, and moves.

In Section 3, The Opportunity, we will present a theoretical rationale for an approach to designing professional learning that embraces the learning sciences, to address these three hidden drivers of teacher practice that are key to enabling teachers to shift to learner-centered education.



The Opportunity: Tackling the Hidden Drivers Inherent in Shifting Teaching Practice

Designing Professional Learning That Harnesses the Why, What, and How of Teacher Practice

How might we accelerate and strengthen our efforts to realize the promise of equitable, learner-centered education? Although today's more learner-centered professional learning strategies can help us achieve change, we still are likely to face an uphill battle unless we uncover and explicitly address three hidden drivers of teacher practice needed to realize change: teacher motivations, mental models, and moves.

We can draw on advances in learning science to design professional development that harnesses what we know about human learning to enhance our efforts to shift teacher practice. To fully engage learners and build deep understanding, learning science research suggests that the learner must access and activate three learning networks: affective (the **why** of learning); recognition (the **what** of learning); and strategic (the **how** of learning) (Rose & Meyer, 2002). As Hall et al. (2012) explained, the **affective** networks are the emotional drivers that steer us toward (or away from) new experiences and learning. The **recognition** networks help us make meaning out of our experiences and our world; and the **strategic** networks operate as a kind of executive planning and operations center that designs, guides, and monitors our actions. These three networks do not operate in isolation, nor do they occur in a rigid sequence. Rather, learning is an iterative, cyclical, and integrated process (Kolb, 1984). If we want to accelerate and enhance teacher learning, we can use this framework, along with our [learner-centered tenets](#) to enhance the design and effectiveness of professional learning approaches. These strategies are interwoven across a set of professional learning experiences.

- **Why—Motivations:** To address the “*why*” (*affective*) of learner-centered education, we must help teachers explore their feelings of skepticism, fear, or anxiety associated with change efforts, discover the benefits of shifting to this approach, and help them feel authentically motivated (rather than coerced) to change.
- **What—Mental Models:** To address the “*what*” (*recognition*) of learner-centered education, we must uncover and address teachers’ mental models, including their underlying theories, implicit biases, and assumptions about students’ potential and about teaching and learning.
- **How—Moves:** To address the “*how*” (*strategic*) of learner-centered education, we must help teachers translate their new pedagogical beliefs into their everyday classroom moves. This means identifying and modifying old teaching habits and helping teachers to build new ones.

Exhibit 3. Three Learning Networks

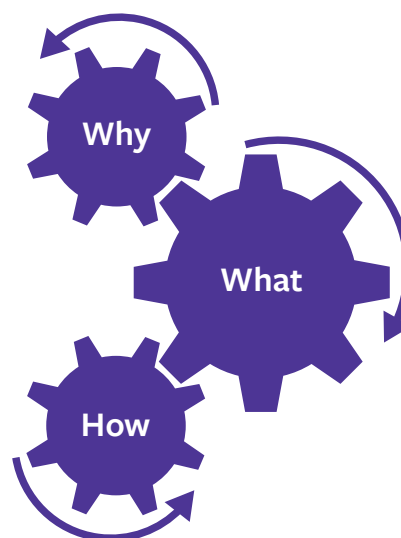


Exhibit 4. Shifting Teacher Practice by Addressing Motivations, Mental Models, and Moves

WHY: MOTIVATIONS Harness emotions & motivations to help drive change	WHAT: MENTAL MODELS Uncover & refine mental models to guide change	HOW: MOVES Build new moves & adjust habits to sustain change
<ul style="list-style-type: none">• Relevance: Increase perceived value and relevance.• Receptivity: Build trust and safety to increase receptivity.• Agency: Boost sense of competence, identity, and agency to drive change.	<ul style="list-style-type: none">• Surface: Explicate mental models.• Align: Identify and address misconceptions.• Expand: Expand understanding, shift theories.• Guide: Craft a revised theory of action to guide change.	<ul style="list-style-type: none">• Assess: Assess current practice through reflection and feedback.• Grow: Develop targeted skills.• Experiment: Test and affirm new practices through iterative cycles of experimentation.• Sustain: Make habits visible and reinforce desired shifts to sustain change.

Explicitly addressing teachers’ motivations, mental models, and moves in our design of teacher professional learning could help us address key hidden drivers of teacher practice and help bring about more substantive changes—more effectively and efficiently than our current efforts alone.



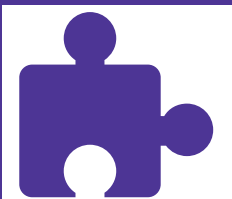
The *Why* of Teacher Learning: Harnessing Emotions and Motivations to Help Drive Change

Neuroscience research offers strong evidence that our emotions and thinking are interconnected (Hinton et al., 2012). Neuroscientists explain that our prefrontal cortex acts as a filter, assessing each new situation and determining whether it is likely to be positive or negative before directing our response. New learning, therefore, cannot occur until new information has been vetted by our affective filter, ensuring that we are safe from perceived or actual dangers. Because our executive functioning also resides in the prefrontal cortex, how we feel cannot be separated from how we think (Immordino-Yang & Damasio, 2007). When learning seems interesting and relevant to us, we are more attentive and receptive to new learning (Baylin, 2010; Immordino-Yang & Damasio, 2007). In contrast, when we feel threatened, stressed, or coerced, our learning is inhibited as we hold on tightly to our existing ways of knowing and resist change (Zull, 2002).

To promote teacher learning about learner-centered education, we must start by addressing the “why” of shifting to more learner-centered practice, by recognizing teachers’ motivations as integral to their learning. This means uncovering and addressing emotional responses that may inhibit action—and harnessing emotions that increase interest and receptivity for positive change. We can use the following three strategies to do so.

1. Enhance teachers’ perceptions of the **relevance** and value of the change
2. Give teachers a sense of safety and trust to increase their **receptivity** to change
3. Boost teachers’ sense of identity, competence, and **agency** to drive change

Exhibit 5. “Why” Goals and Strategies



RELEVANCE | Increase perceived value and relevance of practice

- Help educators identify a problem of practice that reflects their interests and is immediately useful in their daily practice.



RECEPTIVITY | Build trust and safety to increase receptivity

- Create collaborative, supportive learning communities that are safe for risk-taking.
- Establish practices where teachers build trust and feel safe processing feelings of doubt, confusion, frustration, and anxiety.



AGENCY | Boost sense of competence, identity, and agency to drive change

- Offer educators choice and decision-making to provide a sense of control.
- Engage educators in planning and monitoring their own growth.



Enhancing perceptions of relevance and value

A learner’s interest and motivation are piqued when learning tasks are perceived to be relevant to current contexts, particularly when new ideas seem likely to help solve immediate and practical problems (National Research Council, 2000). So it is not surprising that professional learning that is “job embedded” and “problem focused” has been found to be effective in engaging teachers and improving their practice (Darling-Hammond & Richardson, 2009). Helping teachers identify a problem of practice, challenge, or need in their classroom that they would like to address, and then helping them set goals for how they will use a learner-centered approach as a potential solution (Latham & Locke, 2007), may increase interest and the perceived relevance of learner-centered education. For instance, in their report “The Teacher’s Quest for Progress: How School Leaders Can Motivate Instructional Innovation,” the authors argue that educational innovations often fail because they don’t help teachers to solve the day-to-day problems they consider their priorities (Arnett et al., 2018). To address this challenge, the authors explore the “jobs to be done” framework as a potential way to harness teachers’ motivation and interest. Their research identified four key “jobs” teachers saw as essential to their success: improving their school, engaging and challenging students, replacing what doesn’t work in instruction; and keeping on top of school initiatives. The authors suggest that before introducing new innovations, school leaders first must identify the jobs teachers need to have done, and then determine how new innovations and initiatives can best satisfy these immediate needs.

As humans, our motivation is further enhanced when we feel we are making progress in reaching our goals. As Zull (2002) explained, a sense of progress and accomplishment is inherently satisfying and leads to greater interest in pursuing more learning. For seasoned teachers who have a well-established

classroom practice, the prospect of abandoning their current approaches may make them feel like they are going backward rather than forward. For instance, they may be apprehensive about the anticipated costs in time and effort needed to adopt new approaches (Ambrose et al., 2010). The authors of *How People Learn II: Learners, Contexts, and Cultures* (National Academies of Sciences, Engineering, and Medicine, 2018) explain that “a person who has learned how to organize her schedule using a specific tool may be reluctant to learn a new tool because of the perception that it will take too much time to learn to use it, even though it may be more efficient in the long run” (p. 93). In fact, the Concerns Based Adoption Model (CBAM) (Hall & Hord, 1987) identifies a specific stage that acknowledges that teachers might be concerned “about how much time it takes to get ready.” To help teachers overcome these feelings, we may need to help teachers recognize that their progress will be slow, but this delay is temporary. We must reassure teachers that greater effectiveness and efficiency will follow. Giving teachers even small opportunities to experience success and a feeling of progress may help fuel the emotional drive they will need to keep their own professional learning cycle moving forward (Zull, 2010).



Building trust and safety to foster receptivity to new ideas

As humans, we are hardwired to avoid danger. Before we embark in a new direction, we want to be sure that the path ahead is safe. Zull (2002), a biologist, argues that we derive a sense of safety from, and are most likely to trust, our own personal experience. As Fahey et al. (2019) explained, deep change efforts produce a lot of anxiety. They argue that when educators work together in supportive professional learning communities, they can experience the encouragement and social support needed to reduce fears, anxiety, and apprehensions and become “socializing knowers” (pp. 34-39).

Another approach to reduce anxiety and increase interest and receptivity is to invite teachers to experience these approaches firsthand as learners. Research suggests that this approach helps teachers not only increase their comfort but also achieve a deeper understanding and commitment to these new approaches—as they experience the “why” firsthand. For instance, a review of 35 studies that showed links between professional development, teacher practices, and student outcomes (Darling-Hammond et al., 2017), found that many of these successful professional learning models engage teachers in the same types of learning experiences they would like teachers to design for their students. As the authors explain, “The opportunity for teachers to engage in the same learning activities they are designing for their students is often utilized as a form of active learning. Several studies in this review highlighted PD programs that had teachers engage as learners through the use of curriculum and materials that they would then employ with their students” (p. 8). Enabling teachers to experience learner-centered approaches from the perspective of a learner can help them adopt learner-centered practice. It can not only dampen concerns and increase comfort and receptivity to these new practices, but also boost agency and help deepen understanding of how these practices support learning, enabling teachers to better apply and explain these approaches to their peers and students.



Building competence and nurturing a sense of identity and agency

Learner agency is increasingly being recognized as a key factor associated with learning and growth. Research on self-determination (Deci & Ryan, 1985) suggests that people have a natural drive for autonomy and control. A perceived loss of control can be stressful, lead to feelings of resistance, and dampen motivation (Zull, 2002). In contrast, offering teachers flexibility and choice may boost their motivation. For instance, in *How People Learn II: Learners, Contexts, and Cultures* (National Academies of Sciences, Engineering, and Medicine, 2018), the authors cite research that explains that when learners choose a course of action, they are initially uncertain. To assuage their anxiety, learners become more invested in pursuing and succeeding in their chosen activity so they can confirm the wisdom of their decision.

An equally important facet of agency is our drive to feel competent—and this drive is closely related to our identity. Understandably, seasoned teachers with decades of experience may be reluctant to acknowledge shortcomings in a craft that they have so thoughtfully built and that is so intertwined with their conception of themselves as professional educators. When teachers confront substantial change efforts, they may feel like they’ve become novices all over again. This perceived drop in status may be experienced as a threat to their identity and confidence as professionals. As explained in their article “Seven Research-based Principles for Smart Teaching” (Ambrose et al., 2010), the authors explain that “our identity as instructors goes through developmental stages. We have to work to develop a sense of competence and autonomy in teaching, integrity, and purpose as educators....” Similarly, Fahey et al. (2019) explains in *An Uncommon Theory of School Change*:

The deep dive challenges the identity individuals hold; the deeper the dive, the more identity is challenged. Letting go of a familiar identity and envisioning a new identity is uncomfortable, and to be done successfully likely requires a developmental shift. (p. 39)

Offering educators choice and control (Calvert, 2016) and professional learning communities where they adopt a growth mindset and commit to being “accomplished novices” together can help preserve a positive sense of identity and agency.

Learning Couture (see footnote 1), an organization that supports professional learning to promote learner-centered, personalized, and competency-based education in districts, schools, and institutions of higher education, has designed a comprehensive professional development approach that nurtures teachers as learners. Learning Couture’s philosophy is that adult learners’ identity and agency are maximized through developing social-emotional skills and adopting learner-centered language that grounds their learning experiences (Learning Couture, 2021).

Learning Couture believes that teachers need to experience learner-centered practices as learners, and they need to be able to describe who they are as learners and what their unique learning needs are. Until teachers understand how they access their own new learning, engage with new ideas and with people, and express what they have learned and can do, they will be less likely to help students do the same. Learning Couture believes that lived experience trumps theory alone.

Learning Couture also recognizes that being a learner in this new environment may be disconcerting to those teachers who have historically succeeded in traditional schools. Learning Couture’s professional learning facilitators have observed teachers expressing frustration or anxiety when asked to engage in co-construction of quality criteria, proficiency, and performance assessment boundaries with their students, usually because of the ambiguity involved in this new approach. One way Learning Couture eases anxiety and increases teachers’ agency is through inviting teachers to create their own adult learner profiles (Learning Couture, 2021). By drawing on the teachers’ sense of identity and empowering them to make decisions about how they learn best, these tools help nudge teachers toward deeper understanding of the learning process in a way that positively juxtaposes their learning with their role in leading learners. Learning Couture believes that by designing adult learner profiles and by solidifying teachers’ identities as learners, they will become more receptive to the necessary shifts during the journey to becoming learner-centered with their students.



Allison Shelley for EDUImages



The *What* of Teacher Learning: Uncovering and Refining Mental Models to Guide Change

Teachers who are excited about learner-centered education and motivated to adopt new practices still may have a superficial understanding of the approach, so their ability to apply it in practice may be limited. Fully adopting a learner-centered approach requires deeper learning that will enable teachers to become adaptive experts. Rather than focusing on helping teachers master the specific practices associated with this approach, we might be more effective if we start by helping teachers gain a deeper understanding of the broad, foundational concepts, theories, and principles that underlie learner-centered education—how humans learn. Once grounded in an expanded understanding of student potential and human learning, teachers would be more likely to grasp the fundamental rationale that underlies a learner-centered approach. They would also become more aware of their biases and more nimble in applying desired principles and practices—they would know when and how to use them. This deeper understanding of equity and human learning would enable teachers to adopt a more holistic view of teaching and learning that could serve as a broad platform from which they can operate as equity-driven, adaptive, learner-centered experts. Doing so can far exceed the sum of the parts of discrete strategies.

How can we instill this deeper understanding of human potential and learning in teachers? Learning science research has helped us appreciate how we build understanding of new ideas and content. First, we do not learn deeply by amassing a collection of discrete and isolated bits of information. Rather, cognitive science research suggests that humans naturally construct *mental models* to represent understanding of complex concepts and causal relationships (Ambrose et al., 2010; Chi, 2008; 2012; Shute & Zapata-Rivera, 2008). Mental models are our internal representations of the dynamic relationships among concepts, our deeply held beliefs, and our ideas about how the world works that underlie our own personal theories of action (Craik, 1943; Johnson-Laird, 1983, 2005). As Wilke (2008) explained, mental models “can also be thought of as a set of assumptions that is held about a particular phenomenon or system” (p. 1). We use our mental models to interpret and make sense of new information, and to run simulations that help us predict outcomes and the best course of action (Chi, 2008). In fact, we use mental models to understand even the most basic aspects of our world, and children as young as one year already have a grasp of key principles of the physical world—acting surprised if they witness an event that their mental models did not predict—such as when objects simply disappear out of view (Teglas et al., 2011).

Mental models are important because they enable learning transfer, including applying learning flexibly across varying conditions and contexts. This is true for both children and adults. For instance, in their book *Preparing Teachers for a Changing World: What Teachers Should Learn and Be Able to Do* (2005), Darling-Hammond and Bransford argue that, for teachers to master the complexities of modern teaching, they need to gain a deep understanding of human learning, including “a conceptual map of the domain of influences on learning (including both contextual influences and the impacts of different teaching strategies) and they need to develop means for evaluating how these may be operating in specific instances” (p. 78). Similarly, in a comprehensive review of learning science research (National Academies of Sciences, Engineering, and Medicine, 2018), the authors explain, “The strategies that have shown promise for promoting learning help learners to develop the mental models they need to retain knowledge so they can use it adaptively and flexibly in making inferences and solving new problems” (p. 4). Mental models, therefore, act as a conceptual frame for organizing our knowledge and our understanding of the dynamic relationships among concepts. This rich theoretical frame enables us to make sense of and respond effectively to various problems and contexts.

Changing mental models is not simple or straightforward. Despite their influence on our thoughts, assumptions, predictions, and actions, once fully formed, these mental models reside outside of our attention and awareness (Johnson-Laird, 1983, 2005; Senge, 1994). Teachers’ implicit biases and other mental models reflect their deeply held beliefs and theories about who they believe their students to be, and about teaching and learning—but teachers may not be fully aware of these theories and beliefs.

For instance, Fiarman, Kyles-Smith, and Lee (2021) explain in their recent article examining school improvement efforts why inequities are so often overlooked by educators:

[W]hile conscious, deliberate bias exists, many of our biases are so deeply internalized and ingrained that they operate outside our awareness (which allows them to persist). (p. 16)

In fact, teachers can espouse theories—what they say they believe—that differ from their “enacted theories”—what they do in practice (Fahey et al., 2019; Leavy et al., 2007; Zimmerman, 2017). The propensity to perpetuate our views coupled with their implicit nature means that mental models can be exceedingly difficult to change.

Understanding teachers’ mental models of teaching and learning

Research suggests that mental models drive teachers’ behavior and decisions—with some research suggesting that teachers’ implicit theories of teaching and learning may be more influential than content knowledge in predicting the quality and nature of teacher practice (Bryan, 2003; Richardson & Placier, 2001). As Darling-Hammond and Oakes (2019) explained, “The creation of the vision that can shape teachers’ ongoing learning and teaching anchors the schema teachers are developing and makes it possible for them to connect the many things they are learning into a textured and coherent whole” (p. 58). Similarly, in the introduction to her small study examining teachers’ efforts to enact an inquiry-based approach to teaching science, Crawford (2007) argues, “A teacher’s beliefs about how students learn can profoundly affect his or her design of instruction, as well as the role of the teacher in carrying out this instruction” (p. 617).

“Ultimately, how we teach depends on how we believe the mind works.”

-James Zull, The Art of Changing the Brain

What are teachers’ prevailing theories of teaching and learning? Nearly forty years ago, Fox (1983) conducted research to uncover teachers’ implicit theories about teaching and learning. His work identified four basic theories: Two “simple” theories—the transfer or vessel theory and the shaping theory—and two “developed” theories—the traveling and growing theories. As Fox explained:

The simple theories of teaching express a very simple relationship between teaching and learning. If the tea has been poured, the cup must be full (transfer or vessel theory); if the metal has been drilled, it must have a hole in it (shaping theory). This simple relationship between teaching and learning is often expressed in the confident assertion – ‘... of course they can do quadratic equations, I taught them last term.’ (pp. 6-7)

Alternatively, Fox found that some teachers possessed “developed” theories of teaching and learning, viewing the student as an active participant in constructing meaning and understanding. The teacher’s role was to provide opportunities, guidance, and structure in which this individual process can best unfold.

A growing body of research from the learning sciences is providing new evidence to support the validity of “developed” theories of teaching and learning—indicating that knowledge is actively constructed by the learner through his or her experiences and in response to contexts (Ambrose et al., 2010; Cantor et al., 2019; Fischer, 2009; Osher et al., 2017). Despite the prevalent research in support of constructivist theories, evidence from the field suggests that many of today’s teachers continue to hold on to outdated transfer theories of learning, believing that students are empty vessels that must be filled with knowledge (Cochran-Smith et al., 2016; Darling-Hammond & Oakes, 2019; Wilson & Peterson, 2006).

For instance, research examining the role of teacher beliefs in enacted practice found that among education students in teacher preparation programs, “many [preservice teaching] students have an

understanding of teaching that suggests that the role of the teacher is to place knowledge into the heads of students” (Richardson & Placier, 2001, p. 2). Similarly, another study that examined the prevalence of differing theories of teaching and learning (Leavy et al., 2007) found that the vast majority of teacher candidates held transfer theories of teaching and learning “wherein the teacher hands knowledge to children” (p. 1219). Even a more recent review of teacher preparation programs (Darling-Hammond & Oakes, 2019) bemoaned the persistence of teachers’ adherence to outdated transfer theories.

The influence of implicit bias and assumptions

With racial bias, the misalignment of teachers’ espoused theories and enacted practices have particularly adverse consequences for students. In a recent nationwide study of teachers’ implicit racial bias (Chin et al., 2020), researchers used a test of implicit bias to measure the extent to which teachers associate certain positive and negative characteristics with different racial groups. Their results showed an association between these ratings of implicit bias and racial disparities in achievement and disciplinary records. In particular, counties with higher pro-white and anti-Black implicit bias scores were associated with lower achievement and higher rates of suspension for Black students than counties with lower implicit bias scores were. Additional studies and reviews of the research reveal how racial bias actually plays out in classrooms, contributing to lower achievement by students of color. In their extensive study of teacher practices across five school districts, TNTP (2018) found racial bias in the extent to which students are offered opportunities for challenge. Based on 1,000 observations, the researchers found that in classrooms with a high proportion of Black and Latinx students, the level of expectations set by the teacher varied depending on the teacher’s race—with far lower expectations from teachers who did not share the students’ race.



ASCD’s March 2021 *Educational Leadership* journal was dedicated entirely to the subject of equity (ASCD, 2021). In one of the many articles in the issue, authors Shah et al. (2021) explore the dynamics of classroom interactions and discussions and seek to uncover the insidious nature of bias in how teachers facilitate these conversations. The authors explain: “Despite teachers’ good intentions ... research shows that teachers tend to privilege participation from students who look like them, talk like them, and produce knowledge like them” (p. 42).

Addressing these prevalent biases and instructional implications, another set of contributors, Fiarman et al. (2021), write:

[M]any educators do not engage, empower, and challenge Black and brown students in the same way they do their white counterparts many educators hold Black and brown students to lower academic standards and view their behavior more suspiciously. (p. 16)

To adopt a more learner-centered approach, teachers who hold biased assumptions about students must shift their mental models toward anti-racist ideas (Kendi, 2016), and those whose views of teaching are based on transfer theories must shift toward constructivist theories. Both anti-racist ideas and constructivist theories of teaching and learning align closely with what we know about individual variation in human learning and potential (Ambrose et al., 2010; Ansari & Coch, 2006; Deans for Impact, 2015; Dommett et al., 2011; Immordino-Yang & Damasio, 2007; National Academies of Sciences, Engineering, and Medicine, 2018; Zull, 2002, 2010; National Research Council, 2000).

The difficulty is that simply teaching educators about how the brain works does not appear to help them change their underlying conceptions of teaching and learning. Research that has examined the impact of introducing teachers to learning science research has found that teachers with increased factual knowledge about the brain are still inclined to adopt misinformation (Dekker et al., 2012). The prevalence of inaccurate “brain-based” curricula available to teachers may be contributing to the continued acceptance of neuromythologies (Pasquinelli, 2012). However, another possible explanation is that teachers are interpreting these new neuroscientific ideas through a “transmissive theory” lens. In other words, while traditional teachers are taking in new information about the science of learning and believe they are becoming more learner-centered, their exposure to this new information has not fundamentally changed their implicit theories of the teaching and learning process. One compelling example of the disconnect between espoused and enacted theories was evident in the findings from the video component of the Third International Mathematics and Science Study (Stigler & Hiebert, 1997). In this study, teachers’ reports of the conceptual depth and learner-centered nature of their lessons did not align with videotapes of their actual practice, which revealed these same teachers delivering didactic lessons focused on superficial and procedural content.

Efforts to shift teachers’ implicit biases are fraught with challenges as well. In the article “The Illusion of Equity in PD,” Tucker-Smith (2021) explains:

[D]iversity, equity, and inclusion training and professional development (PD) often fall into one of three categories: (1) equity PD that works; (2) equity PD that doesn’t work; and (3) equity PD that looks like it works but doesn’t.

She argues that effective PD strategies aimed at equity help teachers uncover their implicit assumptions about students, foster a growth mindset, and guide teachers in making changes in their practice to be more equitable, until these changes become habits (p. 72).

Similarly, in their article “Who Participates?” authors Shah et al. (2021) propose potential solutions for addressing teacher implicit bias:

*What research tells us, though, is that biases are sticky and difficult to change.... As a first step, teachers need access to data on potential biases connected to the everyday work of teaching, such as participation patterns in class discussions. It’s one thing to know that Black boys don’t get a fair chance at academic success, but it’s another to see how **you** might be marginalizing Black boys in your own classroom. Data can help make inequity a tangible, local problem. (p. 43)*

Confronting the challenge of shifting teachers’ mental models

Multiple reasons likely explain why teachers’ outdated mental models persist. The question is: What are we going to do about it? Professional learning that aims to help teachers adopt more learner-centered education approaches by simply delivering facts and explanations are unlikely to lead to substantive changes in teacher practice. Furthermore, progressive professional development approaches may be constrained by teachers’ prior knowledge and underlying beliefs. If we want to help teachers fundamentally change their practice, we first must help them uncover their underlying mental models about teaching and learning—and revise and refine them to better reflect the science of human learning and potential. Accomplishing this aim will have the added benefit of giving teachers the strong theoretical foundation they can use now and in the future to deftly and appropriately apply learner-centered approaches to complex and varying student needs, as well as other conditions and factors in their classrooms. A mental model is a gift that keeps on giving.

*A mental model is a gift
that keeps on giving.*

Learning science research offers us an array of strategies to help shift teachers' mental models of teaching and learning. For instance, Posner et al. (1982) outlines four conditions necessary to bring about conceptual change: dissatisfaction, intelligibility, plausibility, and fruitfulness. Essentially, Posner argues that a learner must become aware of, and recognize the shortcomings of, their existing views before they can adopt new ones. And before they can change or want to change, they must be able to clearly understand the new perspective, believe that change is doable, and recognize the benefits of changing.

Among the multiple strategies that have been used to bring about conceptual change in both students and adults, four strategies appear most promising for any efforts directed at changing teachers' mental models.

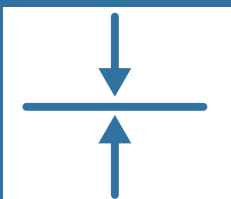
1. Surface mental models
2. Identify and address misconceptions
3. Expand understanding and shift theories
4. Craft an explicit theory of action to guide change

Exhibit 6. "What" Goals and Strategies



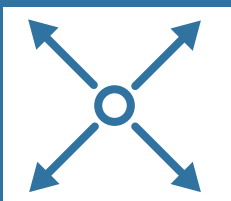
SURFACE | Explicate mental models

- Identify current understanding of the practice using concept and thinking maps.
- Surface and examine implicit theories, assumptions, and beliefs.



ALIGN | Identify and address misconceptions

- Test out theories by making predications and using data to confirm their veracity.
- Grapple with discrepancies to address misconceptions.



EXPAND | Expand understanding, shift theories

- Use metaphor, image, and analogy to shift educators' theories, aligning tacit understanding with their evolving mental models.
- Expand, refine, and add specificity to their theory using examples, models, and research.



GUIDE | Craft a theory of action to focus and guide change

- Develop a specific theory of action to focus and guide change.
- Refine and revisit theories of action over time as understanding and experience yield new learning.



Surfacing mental models

One of the most vexing challenges associated with changing mental models is that they typically reside outside of our conscious awareness. So one of the most important initial steps for shifting mental models is to surface teachers' underlying beliefs and assumptions (Aguilar, 2015; Crawford, 2007; Darling-Hammond & Oakes, 2019; Leavy et al., 2007; National Academies of Sciences, Engineering, and Medicine, 2018; Richardson & Placier, 2001). Pushing teachers to make their implicit theories explicit helps to expose underlying beliefs and assumptions about students and about teaching and learning, and it allows teachers to confront their beliefs, ultimately either defending or amending them (National Academies of Sciences, Engineering, and Medicine, 2018; Senge, 1994; Shute & Zapata-Rivera, 2008). For instance, one review of promising teacher preparation programs (Darling-Hammond & Oakes, 2019) found that programs that are recognized for having graduates who self-report being well prepared to promote deeper learning in their students often began by working with teachers to uncover and articulate their current views of teaching and learning.

Once implicit theories are brought to the surface, teachers can more easily examine and explore their current theories regarding teaching and learning. One potential tool to help learners “see” and analyze the key elements of their current mental models is concept or thinking maps (Hyerle, 1996; Hyerle & Yeager, 2007; Shute & Zapata-Rivera, 2008; Canas et al., 2004). A visual illustration, or map, enables teachers to explicitly articulate and examine their assumptions and beliefs

about how certain teaching practices influence student learning. For example: When I ask an open-ended question, I believe students are more likely to reflect on their own thinking and beliefs. When I ask a closed-ended question, I believe students are more likely to try retrieving factual information.

Another approach to prompt changes in teacher practice is cognitive task analysis (Clark et al., 2008). In a comprehensive review of the learning science research (Osher et al., 2017), the authors explain that the aim of cognitive task analysis is to surface aspects of our behavior that may have become routine. The authors note that cognitive task analysis has been used to prompt positive changes in teacher practice and has been associated with improved student outcomes. Offering teachers tools to help them uncover and articulate their current theories could enable them to add, adjust, or reconstruct elements to explore and, ultimately, incorporate new ways of thinking about teaching and learning.

“Although many people want to claim that teachers are born, not made, we believe that good teaching requires teachers to create and use, expand and reject, construct and reconstruct theories of learning and teaching. Those theories are not intuitions, or ‘common sense’ but carefully crafted lessons learned from years of experience and careful inquiry.”

*-Suzanne M. Wilson and Penelope L. Peterson,
Theories of Learning and Teaching: What Do
They Mean for Educators?*



Identifying and addressing misconceptions

Mental models are composed of various key elements, including objects, relationships, and causal processes that comprise mini-theories learners use to make predictions and explain complex phenomena (Chi, 2008). In cases where new concepts and ideas being introduced differ only superficially from what a teacher already knows, additions and adjustments to the mental model can happen in a straightforward manner (Shute & Zapata-Rivera, 2008). However, when a teacher's current mental model is fundamentally different from the new concepts being introduced, the teacher may need to make a deeper conceptual change—a mental model transformation (Chi, 2008; Shute & Zapata-Rivera, 2008).

Mental model transformations require changes in “pivotal beliefs,” or the central ideas within the theory (Chi, 2008)². For many teachers, a pivotal belief is that teaching is about the transfer of knowledge, and “knowledge” is believed to be an entity rather than the result of someone’s learning process (Fox, 1983; Wilson & Peterson, 2006). Similarly, many teachers hold a pivotal belief that their instructional practices can directly bring about specific learning outcomes in students. In other words, teachers have considered student learning to be the result of a direct process rather than an emergent process (Novak, 1998).

Let’s take a moment to explore how these mis-categorizations might cause differing teacher practices. First, let’s look at the teacher whose mental model is built on the notion that knowledge is a concrete object (entity) and that learning occurs when the teacher enables that object to be physically moved into the student’s brain (a direct, causal relationship). A teacher with this mental model may believe that students are learning once the teacher explained or presented a new concept (such as causes of the Civil War). That teacher may be satisfied that a student has “learned” the new concept when the student can successfully recall the correct answer about this concept (for example, the student accurately lists the commonly agreed upon causes of the Civil War).

In contrast, let’s look at a teacher whose mental model is built on the notion that learning is an emergent process and occurs in a non-linear way. First, this teacher will seek to “teach” the student about these new ideas through engaging them in multiple activities where they can explore, discover, and construct their understanding of the causes of the Civil War. This teacher will assess whether the student has learned about the causes of the Civil War by having them explain and justify their thinking and provide their own original examples as evidence that supports why they believe these causes to be the main causes of the war.

Chi (2008) points out that in cases of mis-categorization, the learner must consciously recognize and address these mis-categorizations if they are to shift their mental models. For teachers, this means we cannot expect them to think differently by simply telling them to correct their theories and beliefs. Rather, we must actively engage them in an iterative process to uncover, revise, and refine their thinking, such as by having them examine and articulate differences between their flawed mental model and one provided by an expert. This approach is called “holistic confrontation” (Gadgil et al., 2012) and it has been found to more effectively spur substantive change than simply addressing specific beliefs or misunderstanding of facts.



In their review of the learning science research, Ambrose et al. (2010) identify other strategies that have been used to help address misconceptions within mental models. One is asking the learner to make predictions based on their current theory, and then giving them the opportunity to test out the veracity of those predictions. They explain, “Being confronted with evidence that contradicts students’ beliefs and expectations can help them see where their knowledge or beliefs are incorrect or inadequate, while motivating them to seek knowledge that accounts for what

they have seen” (p. 37). Similarly, a study examining belief change in teachers (Dana et al., 1998) focused on first creating cognitive dissonance and following it up with classroom experiences to help teachers see why a different view may need to be adopted.

²Chi (2008) explains that common mis-categorizations that inhibit changes in mental models include when the learner has mistakenly categorized processes as entities, and/or emergent processes (non-linear, non-causal) as direct processes (sequential, orderly, causal).



Expanding teacher understanding and shifting theories

Explicating mental models and identifying and addressing misconceptions may not do enough to shift teachers' mental models to reflect more learner-centered approaches. Learners must be introduced to new concepts, broadening and deepening understanding. In *How People Learn* (National Research Council, 2000), the authors describe the learning process as connecting two sides of a bridge—from a learner's current knowledge to the new ideas being introduced. When striving to help a learner make a conceptual change, the authors suggest that both sides must be brought into focus. Similarly, Chi (2008) argues that learners must be introduced to a new category before they can make a conceptual shift. Therefore, if new understanding must be constructed from the learner's starting point, new ideas must make a connection with what the learner already knows. Creating that initial connection is a key strategy for building understanding that may underlie new mental models.

One powerful method of introducing new concepts and ideas is using images, metaphors, and analogies. This allows the learner to draw on disparate pieces of their existing neuronal networks and tie them together in new ways to form hybrid conceptions—to experience an “aha” moment as they connect old understanding with new. As humans, we have a natural propensity for understanding new ideas through images, metaphors, and stories (Fischer, 2009; Lakoff & Johnson, 1980; 1999; National Academies of Sciences, Engineering, and Medicine, 2018; Zull, 2002, 2010). Because we must learn by connecting new ideas with our current understanding, metaphors are most effective and efficient when they already exist in the learner's current repertoire (Fischer, 2009). For example, teachers might adopt the metaphor “teaching a man to fish,” or they could build their own personal images and metaphors from their existing knowledge and experiences.

Carol Dweck's *Brainology* curriculum is one promising use of metaphors and analogies for promoting conceptual change. This curriculum has demonstrated that children's learning and achievement can be improved by training them in a growth mindset (Blackwell et al., 2007, p. 254). A growth mindset is a mental model of intelligence that views it as a flexible and dynamic process, rather than as a fixed entity. The program helps students shift their mental models of intelligence by learning about brain anatomy and how the brain functions during learning. A key piece of the curriculum uses images and analogies to help students understand how the brain learns. For example, it conceptualizes the “brain like a muscle that gets stronger when you use it” (p. 254). Research has shown that the *Brainology* program has had positive effects on student achievement. Not surprisingly, Dweck has also found that when teachers are involved in helping their students learn about the brain, they develop a greater sense of self-efficacy as teachers.

Another promising approach for shifting conceptions using metaphors is founded on the literature on cultural models that people use to frame their understanding of complex ideas. This “strategic frame” approach (Bales & Gilliam, 2004; Shonkoff & Bales, 2011) identifies key elements within complex ideas and then uses the brain's natural propensity for symbols, metaphors, and imagery to create simplifying models that can help convey complex concepts in simple, concrete ways while ensuring that the most important aspects of core ideas are maintained. This approach, developed by the FrameWorks Institute, systematically studies how to bring new understanding of an important social issue to key stakeholders. First, the “strategic frame analysts”³ examine how the social issue is being communicated by the general



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³Individuals trained in [strategic framing approach](#).

media, and then they compare it to how the issue is being understood or “framed” by experts in the field and by those who are among the target audience. By examining the disparities between these frames, the strategic frame analysts can craft and test out new frames that use metaphors, examples, and narratives to convey key concepts and ideas that their target audience can easily and consistently understand (creating an “aha” moment). Key to this approach is that the new frames preserve the intent of, and capture key technical details and accuracy intended by, field experts. The Strategic Frame Analysis approach is being used across the country as part of large-scale public education campaigns (Shonkoff & Bales, 2011). A metaphor that characterized learning as “weaving of skills ropes” was developed and tested through the FrameWorks Institute (Erad, 2013). This metaphor was found to help members of the public better understand developed theories of teaching and learning, such as knowledge being actively constructed.

Researchers are exploring the use of metaphors and analogies as part of teachers’ professional learning. Leavy et al. (2007) conducted a study that explored the use of metaphors to help student teachers in Ireland and the United States “examine, critique and modify beliefs about teaching and learning” (p. 1218). The authors argue: “Within educational contexts, metaphors play a central role in conceptualizing and reflecting upon the nature of teaching and learning.... Metaphors can function as tools by which a teacher gains distance from their own practice and act almost as an external observer looking upon and reflecting upon their own practice” (p. 1220). This study found that most student teachers (both U.S. and Irish) adhered to transfer theories of teaching and learning at the start of their teacher preparation program. By inviting teachers to construct a personal metaphor to represent their theory of teaching and learning, and by having student teachers revisit and refine these metaphors as they engaged in their coursework and early student teaching experiences, these authors found pronounced increases in the percentage of U.S. teachers adopting constructivist views across the study period. In contrast, many of the Irish student teachers continued to hold on to their transmissive views of teaching. The authors attributed the Irish student teachers’ lower rates of change to the more traditional school settings where they were placed.

Another study (Marshall, 1990) employed metaphors to help student teachers reflect on and reframe their role as a teacher in the classroom. When discussing classroom problems, student teachers were cued to start brainstorming a metaphor they might use to characterize how they saw their role in the situation. Teachers were then prompted to consider the implications of this view of their role—including the issues

or challenges it might present. Finally, teachers were encouraged to explore potential new, alternative metaphors they could adopt to assume a more effective role and, ultimately, a better solution to the classroom problem. Teachers experiencing this metaphor problem-solving method were found to be better able to recognize how their implicit view of their role in the classroom influenced their behaviors and reactions to students—and they were motivated to identify new “images” of what their role could and should be.

Learning science research also suggests that we are more likely to engage in, persevere in, and deepen our understanding of new ideas when we have the opportunity to look at things from many different angles (Zull, 2002) and are introduced to multiple, concrete examples (Chi, 2012). This helps us not only maintain our attention and focus on the subject at hand but also forge multiple neuronal connections among new ideas. In their 2017 study of

effective professional learning programs (Darling-Hammond et al., 2017), the authors reviewed dozens of studies to identify seven features associated with effective professional learning. One feature, access to “models” and “modeling,” was found to help improve teacher practice and student outcomes. Models





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included teacher learning through examining, critiquing, and using exemplars from practice, such as sample lesson plans, videos showcasing the delivery of teacher strategies in the classroom, and assessment and student learning artifacts. The authors argued: “Curricular and instructional models and modeling of instruction help teachers to have a vision of practice on which to anchor their own learning and growth” (p. 11).

One of the reasons that offering demonstrations and models may enable people to learn new approaches is our innate tendency to imitate or mimic others. Brain imaging studies have shown that when we observe others, the neurons in our brains fire as if we, ourselves, were engaging in those movements or behaviors. This phenomenon is called “mirror neurons” (Zull, 2002). At the same time, this means that when giving teachers examples and models, designers of professional learning should select these exemplars

carefully and help teachers to examine models with a critical eye—to ensure that selected examples explicitly and accurately illustrate desired learner-centered practices. Giving teachers the opportunity to learn about learner-centered education and related learning science ideas by introducing metaphors and analogies, as well as through models and multiple examples, can help them sustain their interest and attention and build broader connections with prior learning—ultimately helping to shift their mental models. The greater the number of connections a learner can make, the stronger, more accessible, more flexible, and longer-lasting their new understanding will become (National Research Council, 2000).



Crafting an explicit theory of action to guide change

A final step in helping teachers ground their practice with refined mental models is creating an explicit theory of action. As Aguilar (2020) explained, “A theory of action is a hypothesis about what will happen when a set of strategies is implemented.” These theories of action can be living documents that help teachers gauge their progress, and they can be continuously updated and refined as teachers deepen their understanding of learner-centered education through professional learning and classroom experience. For instance, Aguilar (2020) suggests the following frame and prompts to elicit teachers’ underlying theories of action:

Exhibit 7. Aguilar Theory of Action Framing Prompts

IF we take this action... And IF we also take this action... And IF we also take this action...
THEN ___ will happen... Which will THEN lead to...
Which will RESULT in the increased likelihood...



The *How* of Teacher Learning: Building New Moves and Habits to Sustain Change

At the core of all learning is our concrete experience (Lakoff & Johnson, 1999; Willingham, 2017; Zull, 2002). The path to new learning begins with our actions, progresses to our mental representations, and eventually results in abstractions (Granott et al., 2002; Fischer, 2009). Therefore, when new ideas about learner-centered practice are first being introduced, giving a learner an active, concrete experience can set the learning in motion—giving the learner the chance to forge new connections in real time in the act of *doing*. As Zull (2010) explained:

[T]he brain relies on its experiences in the physical world when it thinks.... Abstract meanings grow in clarity as we get closer to the concrete ... underlying the mystery of thinking ... is solid, physical facts. (Zull, 2010)

Teachers' actions in the concrete world provide feedback about the usefulness and validity of their emerging ideas, and this feedback enables teachers to construct and refine their thinking as they connect old and new ideas (Willingham, 2017; Zull, 2002). As Darling-Hammond and Oakes (2019) explained in their review of effective teacher preparation programs, “Acquiring information that is never applied or put into practice reduces the likelihood of transfer” (p. 206).

For educators engaged in the dynamic and complex task of teaching, being able to apply and learn about new practices through their daily experiences in the classroom is even more essential. As explained in *How People Learn: Brain, Mind, Experience and School* (National Research Council, 2000), “teachers gain new knowledge and understanding of their students, schools, curriculum, and instructional methods by living the practical experiments that occur as part of their professional practice” (p. 191). Similarly, included in a report highlighting how teacher mindsets shape the learning experiences of students (Wacker & Olson, 2019), leading teacher development expert Linda Darling-Hammond shares her perspective that “Belief and practices are highly interrelated.... If you change what people experience, then they can believe something else” (p. 16).



Tackling the challenge of creating new moves and shifting habits

Although learning “from experience” is a process that occurs naturally, research suggests that certain professional learning opportunities and strategies can enhance and accelerate changes in teachers' enacted practices, including:

1. Assessing current practice through reflection and feedback
2. Developing targeted skills
3. Testing and affirming new practices through iterative cycles of experimentation
4. Making habits visible and reinforcing desired shifts to sustain change

Exhibit 8. “How” Goals and Strategies



ASSESS | Assess current practice through reflection & feedback

- Self-assess current levels of performance in the desired practice area using a selected competency, pedagogical framework, or tool.
- Reflect and solicit structured feedback from coaches and peers to identify current practices and habits.



GROW | Develop targeted skill

- Identify target skills and personal learning needs and preferences using learner profiles and learning plans.
- Select and participate in new learning experiences to grow skills.



EXPERIMENT | Test and affirm new practices through iterative cycles of experimentation

- Engage with peers in a structured, iterative process (E.g., PDSA or NIC) to systematically apply, observe, and plan refinements to improve practices over time.



SUSTAIN | Make habits visible and reinforce desired shifts

- With a partner, reflect on enacted practice to identify desired and unwanted habits.
- Engage in strategies to explicitly target and shift unwanted habits.
- Integrate new practices and desired habits into ongoing practice.



Assessing current practice through reflection and feedback

Before we can identify specific learning goals, we need to assess the current status of our practice and the extent to which it aligns with desired practice standards or goals.

An example comes from Learning Couture. Learning Couture’s Customizing Learning Platform uses an innovation configuration map of learner-centered teacher practices that span seven principles (Levine & Patrick, 2019) that are key to competency-based education, including learner agency; assessment as learning; just-in-time supports; anytime/anywhere learning; multiple pathways; diversity, equity, inclusivity, and belonging; and deeper learning. An innovation configuration (IC) map differs from a rubric in that it describes rather than rates new practices within an innovation. These descriptions help characterize each level or degree of implementation, which allows users to see a progression from emerging elements to more advanced ones (Hord et al., 2006). In the Customizing Learning Platform, educators assess their level of proficiency with each practice, ranging from “not yet” to “innovating,” and then gain access to personalized data visualizations that provide a record of growth over time within each principle and its related components. Growth reports allow educators to focus on their assets and to choose small steps

they can take individually or with their collaborative teacher teams to become more learner-centered. Each user also has access to their own customized design studio, which is an interactive toolset and project board educators use to create a personalized plan for each professional learning cycle. The range

“There is a great difference between imagining that we have done a problem and actually doing it. No matter what ideas our frontal cortex has created, we cannot know if they are true until they have been tested in concrete and active ways. Until we do that, as Sophocles said, our knowledge is ‘fanciful.’”

-James Zull, The Art of Changing the Brain

of target practices each user sees in their design studio and the learning resources that are generated by their choices are customized for that individual based on their data and their learning preferences. The process is also relationship-based, with each teacher having access to coaching cycles that occur before, during, and after the process of teaching.

Cognitive dissonance or expectation failure may be necessary to bring about even a willingness to make deep conceptual shifts (Senge, 1994). Giving teachers the opportunity to view video recordings of their own practice is a powerful method for creating opportunities for cognitive dissonance (Carver & Scheier 1981; Tharp & Gallimore, 1989). Teachers may believe they are fully implementing desired practices, when in fact, they have made little change in their

instructional practice (Hiebert et al., 2003; Stigler et al., 2000; Stigler & Hiebert, 1997). The disparity between their preconceived notions and evidence of enacted teaching practice that shows otherwise may produce a level of cognitive dissonance that can help teachers modify their practice.

A key aspect of feedback that is often overlooked is the learner’s role. In a review of various feedback models, Molloy and Boud (2013) cite multiple studies that have shown that feedback can backfire and be associated with no change or even negative change, depending on the content, timing, and characteristics of the “deliverer.” More important, however, the authors unpack how feedback interacts with a learner’s own beliefs, conceptions, and goals. For instance, learners will compare externally provided feedback with their own internal “self-evaluative” criteria and conclusions. The authors highlight new trends that suggest that feedback should be used as a strategy to enhance a learner’s own self-evaluative and self-correcting practices. In this view, learners are the ones driving the process by eliciting feedback from others, rather than simply being at the receiving end of a message that reflects the deliverer’s goals.

As with all learning, the learner’s explicit reflection is necessary to translate experience into conceptual shifts in thinking (Darling-Hammond & Oakes, 2019; National Research Council, 2000; Zull, 2010). Because we view the world and new information through the lens of our current mental models, we aim to make sense of, attach, and integrate new information into our current way of thinking, and we will hold on to our mental models as long as they continue to work even modestly well (Chinn & Brewer, 1993; Kuhn, 1962; National Research Council, 2000). Even when our mental models don’t work well to explain phenomena that we observe, we may attribute these failures to external factors—rather than to our own conceptions (Petroski, 1992).



Developing targeted skills

Teachers engaged in learning about learner-centered practice may quickly discover that implementing these new ideas requires a new set of skills that they do not yet possess. Teachers who previously held “vessel” theories of teaching and learning and relied on didactic lecture may come to recognize the importance of asking students open-ended questions to stimulate and scaffold their understanding. Teachers who previously thought students were likely to respond negatively to challenges may come to understand how raising expectations can boost student motivation. If teachers are to succeed in adopting

and embracing new beliefs, they will need to develop the concrete skills necessary to put these new ideas into action in ways that reinforce and strengthen their new ways of thinking about the teaching and learning process. Schools and technical assistance organizations are using numerous skill-building strategies—particularly job-embedded instructional coaching and microcredentials. Microcredentials are professional learning opportunities that focus on and recognize the mastery of “bite sized” competencies that teachers can master and then combine with other microcredentials in a stack to achieve broader shifts in practice.

Targeted skill-building, like other strategies to support teacher learning, does not work well in isolation. To gain new skills, teachers need a framework or set of competencies to guide their growth (Darling-Hammond & Bransford, 2005), they need choice and autonomy in setting their own goals and choosing how they want to learn (Harper, 2018; Vella, 2002), and they need to engage in iterative cycles of learning with the support of a coach and/or learning community (Darling-Hammond & Oakes, 2019) where they can engage in constructive exchange and receive feedback and emotional support from peers and mentors.

Along with setting their own goals, teachers benefit from learning experiences that reflect their unique learner profile, including their readiness level, their learning needs and preferences, and their current theory of action. A useful framework for customizing adult learning experiences to the needs of each learner is Universal Design for Learning (UDL), which centers each learner’s needs within various forms of representation, engagement, and expression (CAST, 2018). Learning Couture has adopted the UDL framework and asserts that the foundation of learner-centered pedagogy is using “an equity lens to examine our practices and to meet each [learner] where they are, paying careful attention to how they best **access** new learning and ideas, how they **engage** with learning experiences and other learners, and how they **express** what they know, understand, and can do” (Stewart, 2021). In keeping with a universal design and to remain committed to the learner-centered approach for adults, Learning Couture believes that targeted skill-building is most “sticky”—most transferable and lasting—when learning experiences incorporate multiple means to access new learning and ideas, engage with content and people, and express what learners know, understand, and can do within the newly acquired skills. Offering multiple modalities across these iterative parts of a learning cycle (access, engage, and express) is central to honoring the learners’ needs and preferences while modeling the learner-centered practices we want for our young learners.

“The learner must evaluate his own work in order to own it. If it is truly his, it must be formed in a cycle of creating, evaluating, recreating, and reevaluating.”

-James Zull, The Art of Changing the Brain



Testing and affirming new practices through iterative cycles of experimentation

Testing out new approaches is key to recognizing, and ultimately overcoming, ingrained misconceptions and replacing them with new beliefs (Ambrose et al., 2010). Teaching professionals are already using this approach in numerous ways. For instance, a growing number of professional learning communities are using short-term trials, such as Plan-Do-Study-Act cycles employed as part of improvement science, to help shift teacher practice (Carnegie Foundation for the Advancement of Teaching, 2020). Similarly, some organizations promote teaching “hacks,” which are “small, scrappy experiments” that lead to bigger changes (School Retool, n.d.). As School Retool defined them, teaching hacks are grounded in three principles: “(1) Bias to action—Don’t overthink it, just try it; (2) Fail forward—Use ‘failures’ as opportunities to learn; and (3) Start small—Keep the goal small, the team tight, and the timeline short.” In other disciplines, simulations have helped learners experiment with underlying assumptions, testing

them out and seeing their results (Chilcott, 1996). Simulations have also been found to help learners better understand the interdependence of elements within dynamic systems (Groff, 2013) and shift mental models (Chi et al., 2012; Slotta & Chi, 2006). Although no high-quality, interactive teaching and learning simulations appear to be widely available yet, technology-based simulations may be another way that teachers can shortcut experiential explorations in the future—speeding up the learning process even further.



Making habits visible and reinforcing desired shifts

Even when teachers have embraced learner-centered education and have begun to adopt new behaviors and teaching practices, a powerful and insidious obstacle may thwart their efforts and best intentions—ingrained habits (Duhigg, 2012; Eagleman, 2011; Fogg, 2020; Wood & Neal, 2007). We would all like to believe that we are aware and in control of our decisions and actions, but research suggests that nearly half of what we do each day is driven by our habits (Wood & Quinn, 2005). Habits are a sequence of repeated behaviors that occur predictably in response to specific conditions and contexts. In his book *The Power of Habit: Why We Do What We Do in Life and Business*, Duhigg (2012) shares research from scientists from the Brain and Cognitive Sciences lab at the Massachusetts Institute of Technology explaining that our brains have a propensity to develop habits to become more efficient. Once established, habits enable us to respond more quickly and also free up more capacity for attention and cognitive processing of new information that may come our way.

Duhigg (2012) explains that when we repeat a set of behaviors in response to certain conditions or contexts, or in pursuit of goals, habits are formed over time. Habit formation occurs in a three-step loop, which includes a “cue” that serves as a trigger for action, a “routine” that includes a set of behaviors or other responses, and a “reward.” We encode these habit loops into our procedural memory (Packard & Knowlton, 2002), and then they occur automatically. Yet, like mental models, habits typically reside outside of our attention and awareness and are devilishly hard to change (Verplanken & Wood, 2006). As Zull explains, “you cannot ‘will away’ existing neuronal networks created to support habits. You can diminish their use, and over time they will fade—but you cannot overwrite their existence—they are a physical fact” (Zull, 2002, p. 127). As Wood and Neal (2007) explained, “habits remain relatively intact in the face of new experiences and conflicting current goals” (p. 853). To make matters worse, even when we have established new habits, if we are under stress, we are apt to resort to our old ways of doing things (Zull, 2002).

Daily teaching practice consists of dozens—if not hundreds—of these habits. As teachers go about their day implementing teaching strategies and responding to their students, many of their decisions and actions occur automatically. For instance, Shavelson and Stern (1981) reviewed over a dozen studies examining teachers’ decision-making during their enacted practice. The authors explained that classroom practice appears to be driven by:

... instructional tasks ... [that] serve as a mental plan for carrying out interactive teaching. These images or plans are routinized so that once begun, they typically are played out ... much as a computer subroutine is. Routines minimize conscious decision making during interactive teaching and so ‘activity flow’ is maintained. ... [T]eachers attend to their mental script or image while teaching, and this focus of attention is broken only when their monitoring of the classroom indicates a potential problem or unexpected event. (p. 484)

If our aim is to help teachers adopt and enact new learner-centered practices, we need to help them recognize and address their ingrained habits of teaching that might be inconsistent with a learner-centered approach. Research indicates that simply declaring a commitment to a new goal is insufficient to bring about change in established habits (Wood & Neal, 2007). In fact, it is the strength of an existing

habit—rather than the strength of an explicit goal—that is most predictive of future behavior. As Wood and Neal explain, “Habits are not easily changed through persuasive appeals that target people’s goals” (p. 860). Despite these discouraging findings, Wood and Neal argue that people can change their habits. Here are a few of the promising habit-changing strategies:

1. Identify the cues that trigger the unwanted behaviors or responses and make a plan to replace the habitual response with the new desired response. This strategy requires high levels of awareness, as well as self-control, so it is least likely to be successful.
2. Identify existing habits that already align with your new goals. Associating the “new goal” with the “old habit” can help reinforce the desired behavior. In other words, find aspects of teachers’ practice that already align, and “rebrand” these as reflective of a learner-centered approach.
3. Remove the situational triggers or cues that prompt the undesired behavior in the first place. For teachers, this might mean changing classroom routines, seating arrangements, or schedules to prevent undesired habitual responses from occurring.

Stanford University behavioral scientist B.J. Fogg, author of *Tiny Habits: The Small Changes That Change Everything* (2020), offers another promising approach for adopting new habits. Fogg has conducted research on habits with over 40,000 participants and discovered a better strategy for changing habits. His strategy, in a nutshell, is to “Take a behavior you want, make it tiny, find where it naturally fits in your life, and nurture its growth” (p. 5). His research shows that when you start small, you can build more substantive behavioral changes more effectively. Specifically, Fogg’s behavior model strategy for wiring new habits is to attach a new behavior to an existing routine or habit. In his book, he shares the “Maui habit” as an example. First, he suggests finding an “anchor moment”—an existing routine, such as putting your feet on the floor in the morning as you get out of bed. Next, execute one small desired behavior (“tiny behavior”) in response to this anchor moment, such as stating, “It’s going to be a great day.” Last, “celebrate” having executed this new desired behavior—such as saying, “I did a good job!” (p. 12). Fogg’s recommended strategy for creating these new habits includes the following prompts:

“After I...”; “I will...”; and last, “To wire the habit into my brain, I will immediately...” Fogg explains that some new habits can grow gradually, while others can multiply—expanding well beyond the initial change to permeate and spawn an entirely new ecosystem of behaviors. Although Fogg does not have specific data on behavior change in teachers, his “tiny habits” approach may be a promising place to start, especially if we can help veteran teachers start a tiny habit that is among those new practices that have been shown to leverage broader changes—such as asking open-ended rather than closed-ended questions.

It is important to recognize that teachers also have teaching habits that reflect racial bias. In her article “The Illusion of Equity PD,” Tucker-Smith (2021) argues that for teachers to address persistent patterns of behavior that reflect bias, they must:

move away from generalities (“I’m a great driver”) and examine specific skills or habits (“I’m good at parallel parking, but I have to admit that I need to stop checking my phone while driving”). When educators expose knowledge gaps related to understanding equity, they shift from saying, “I’m not biased against anyone,” to insisting, “We need to examine our curriculum to ensure that diverse perspectives, cultures, and authors are represented...Effective equity PD fosters a growth mindset

“People often think that they are in rational control of their behaviors and that they act the way they do because they have made a conscious decision. However, the prevalence of habit-driven acts shows that much of our behavior is not consciously chosen.”

-National Academies Press, How People Learn II: Learners, Contexts, and Cultures

among educators and includes structures to help teachers refine application until the changes become daily habits.” (pp. 73-74)

Bringing Equitable, Learner-Centered Education to Scale

Enabling teachers to make the shift in their mental models, motivations, and classroom moves is an important step toward achieving equitable and learner-centered education for all. When we uncover and address the hidden drivers of teacher practice, we help them become adaptive experts—teachers who can flexibly apply their new equity lens and strategically apply a learner-centered teaching and learning paradigm across various contexts and conditions to ensure the success of all their students.

As essential as teachers are in the education ecosystem, it is important to recognize that they do not practice in isolation. The nature of teaching can be positively or adversely influenced by school culture, curriculum mandates, school schedules, and wider educational policies and practices (Fullan & Hargreaves, 1992; National Academies of Sciences, Engineering, and Medicine, 2018; Trilling & Fadel, 2009; Waeytens et al., 2002). For instance, in their extensive review of the research on teacher preparation programs, authors Cochran-Smith et al. (2016) found that, “For the most part, the teacher education programs featured in these studies promoted constructivist views of learning” (p. 481), yet they also found that, “confronted with daily pressure to conform to established school norms, many student teachers eventually abandon the student-centered practices learned at the university” (p. 481). If teachers are to successfully shift their mental models and moves to be more aligned with learner-centered approaches, and if they are to translate these new conceptions and beliefs into lasting changes in their teaching practice, their efforts must be reinforced by the contexts they operate in (Talbert, 2009). Otherwise, these external forces will undermine their newly developed theories, beliefs, and practices over time.

What teachers believe, do, say, and feel directly influences their students’ experiences in the classroom each and every day (Rodriguez, 2012). They sit at the absolute core of the educational ecosystem. Yet teachers cannot enact large-scale change all on their own. Creating educational environments supportive of more equitable, learner-centered teaching practices will necessitate a host of structural and cultural changes—and leaders who can engage teachers in schoolwide transformative change efforts. And it will necessitate shifts in the mental models, motivations, and moves of all the key players within these contexts, such as school administrators, policy makers, designers and facilitators of professional learning, and faculty and administrators in schools of education. If we aim to bring learner-centered education to scale, we must address the what, why, and how of teaching and learning at all these levels. Only then will teachers who have successfully shifted their mental models, motivations, and moves have the contexts and conditions they need to realize the promise of equitable, learner-centered practices that all students need to learn and thrive.

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