Transforming the Education Sector into a Learning System

Harnessing the Power of Continuous Improvement, Research & Development, and Data to Improve Outcomes for Each and Every Child

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EducationCounsel is a mission-driven education consulting firm that works with leading nonprofit organizations, foundations, and policymakers to help significantly improve education opportunity and outcomes. We do this by leveraging policy, strategy, law, and advocacy to help transform education systems, from early learning to K–12 to higher education. We work with partners at the federal, state, and local levels to advance evidence-based innovations and systems change, with a central focus on equity. More information and publications are available at www.educationcounsel.com.

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Preface

This paper argues that for our education system to achieve equity and excellence for each and every student, we must shift it toward functioning as a learning system at all levels. Last year, EducationCounsel hosted a full-day conversation about both what a learning system in education could look like and how we might best shift toward one at all levels of the United States education system. Experts from education and other relevant sectors collaborated to help identify the core elements of an education learning system at the school, district, state, and federal levels; existing bright spots that are leading the way; gaps, barriers, and tensions that impede progress; and even some initial strategies to help shift toward a learning system.

This paper builds from the conversation at that convening and substantial existing research, as well as rich feedback and discussions with a wide cross-section of leaders and thinkers, to present an initial learning system framework. At this stage, we are looking for directional alignment that can be used to advance further conversations and early actions with an even broader range of stakeholders—and then continuously improving our vision over time.

Accordingly, we hope readers will focus first on the substance of what a learning system must look like in education, leaving for another day considerations of the exact best nomenclature to describe them. We acknowledge, though, that there are real debates to have and distinctions to be drawn in this work. Depending on the audience and context, terms used in this paper can carry sometimes widely divergent meanings and connotations, including the following:

- Some hear "continuous improvement" and think only of incremental, technical quality assurance initiatives rather than a true culture shift. Or, more problematically, they think of annual school-level "improvement plans" that are often experienced as compliance-only exercises largely divorced from the actual work of improving student outcomes.

- Many educators object to the use in education of terms more commonly used in the business world like "R&D," "supply and demand," and "commercialization."

- The concepts of "innovative" and "evidence-based" are for some starkly contrasting and for others closely related.

- Similarly, "scale" can convey narrowly as only including high-fidelity implementations or more broadly as also encompassing the reasoned adaptations that practitioners and policy makers may need to make within local contexts to adopt an effective policy or practice such that it integrates widely and deeply to become the "new normal" or "standard of care."

Our oversimplified response to these debates is "all of the above." The vision we propose of a learning system in education does not turn on taking sides among different theories on the proper relationship among innovation, research, evidence, and continuous improvement. We also acknowledge that learning system efforts alone will not always yield the biggest or most urgent changes, especially given political and other realities.

But whether improvements ultimately come in small but steady ways or via breakthrough innovations, our current approach in education must change considerably—in structures, processes, and, critically, culture—to accomplish our ambitious shared goals for all students. As we explore below, these changes must re-orient education from compliance and inertia to learning and improvement. Thus, we invite readers to focus primarily on the ideas presented, to resolve any ambiguities in our prose in favor of the more inclusive vision we intend, and to share suggestions and feedback with us to support our own continuous learning.

Introduction

The history of human progress is built on our ability to work together to accumulate knowledge and skills, and to build upon what came before—from the Cognitive Revolution 70,000 years ago to the birth of the Scientific Revolution 500 years ago to the rise of the information age in our own time. Today, sectors that have developed systems and cultures focused on using data and evidence alongside experience and judgment to continuously innovate and improve have experienced ongoing progress and (periodically) breakthrough successes, such as in health, technology, energy, and athletics. But this learning engine is ironically and profoundly weak in our education system, which instead has systems and a culture more likely to drive compliance and act as barriers to innovation, improvement, and scale. It is not that our education system lacks ideas, but the gaps in its design and culture constrain demand for and development of evidence-based actions. They often force even proven, successful innovations to become fads that are tried, unevenly implemented, and discarded rather than evolved with reasoned adaptation to greater impact and scale.

There is a different way, one that embraces learning and improvement as the primary activities of everyone engaged within our education system—and of the system itself. This shift is not easy but it is absolutely necessary if we ever hope to truly prepare students for success in the modern world.

The science of learning and development tells us of the great potential in each and every child. Successful schools and evidence-based strategies provide hope and guidance. But if we are ever to create a system in which all students have the opportunities and support to master the array of knowledge and skills necessary for college, career, and citizenship—and to achieve their full potential—then we must build an education system that is capable of generating at all levels both demand and supply for its own continuous improvement. This is particularly critical to advancing equity and overcoming longstanding disparities in education opportunity and outcomes by race, ethnicity, poverty, English language proficiency, and disability.

What would it mean to transform our education system into a learning system? Our goal in this paper is not necessarily to produce something brand new or definitive. Rather, we have tried to distill a complex, nuanced topic into a relatively simple framework by building off learning science research, existing approaches within and outside of education, and the valuable insights of leading thinkers and practitioners. We hope our articulation can help advance a shared vision of a thriving learning system across all levels of education. Indeed, establishing a shared vision and framework is itself an important first step in promoting a learning system.

To that end:

- Section 1 briefly makes the case for **why** this shift toward a learning system is so important.

- Section 2 presents an initial draft articulation of **what** may be the most essential components of a learning system in the education context—that is, what would have to be in place in and across all levels to shift our education system toward a new normal of learning, innovation, and continuous improvement.

- Section 3 frames key questions regarding **how** these shifts could best be advanced at all levels of the education system and highlights some potential initial strategies for doing so.

This is hard work. Even the parts of a learning system that exist now need significant strengthening, not to mention the new structures, processes, and culture that must be built to align with this vision. Beyond the specific entry points and recommendations introduced in Section 3, this work needs leadership and political will behind it.

The existing education system has historically worked for and been designed around those who govern it. Making major changes requires the recognition that our shared interests are best served by a system where each and every student can succeed. Whether we can collectively muster the vision, leadership, and political will needed to overcome inertia and sustain these shifts is an open question. We hope this paper can help build and strengthen the awareness and motivation needed to change.

Section 1

Why Do We Need a Learning System in Education?

The time is ripe for education at all levels to shift toward the structures, processes, and culture of a learning system. Such a system would be ready, willing, and able to use its new learnings to improve both in small everyday ways and in big breakthrough ways. The need to make this shift grows more urgent every day.

There is now a broad consensus that a core goal of our education system must be to ensure that all students graduate from high school with the array of knowledge and skills necessary for success in college, career, citizenship, and life, including rigorous academic content knowledge and an array of intra- and interpersonal skills, such as the ability to think critically and solve problems, the ability to work collaboratively and communicate effectively, and the ability to direct one's learning with a strong academic mindset.

This is an ambitious goal, and we are far from achieving it. In particular, critical gaps in educational opportunity and outcomes persist, based in part on our long history of racial discrimination as well as continuing structural inequities. These gaps are made more acute by changing student demographics: today, for the first time, a majority of public school students are from low-income families, and a majority are students of color.

The good news is that we know more than ever before about the science of learning and development, the impacts of adversity, and the untapped potential in each and every child. Modern data systems and technology are beginning to enable us to understand more; communicate insights in timely, tailored, and actionable ways; act in real time; and better translate evidence into practice and policy. All of this empowers us to potentially transform education with the multiple pathways and more personalized systems of teaching, learning, and support that can best meet the needs, interests, and abilities of each and every child to achieve their full potential.

But these are massive shifts. Evidence and experience from history and other sectors involving complex human endeavors affirm that such changes are unlikely to take hold and scale without intentional, sustained focus at all levels of the system on innovation, evaluation, and continuous improvement to drive better student outcomes. Such a focus would develop and/or surface effective approaches that can yield new standards of practice, which in turn provide a stronger foundation upon which to strengthen and spread implementation of those practices as well as develop even more effective innovations.

There is some early but important movement toward a learning system approach in education. For example, increasing numbers of practitioners are engaging in improvement efforts via networked improvement communities (NICs) or design thinking initiatives (e.g., Student Agency Improvement Community, Summit Public Schools). More and more schools, districts, and states are changing how they value and use data to inform, empower, enlighten, and improve efforts and results (e.g., Kentucky Department of Education, Long Beach Unified School District). Research-practice partnerships at the district and state levels are beginning to grow, produce results, and add to the evidence base (e.g., University of Chicago Consortium on School Research, Tennessee Education Research Alliance). And evidence-based approaches and systems of continuous improvement are reflected in federal education laws, including the recent Every Child Succeeds Act (ESSA), and are central to some state plans developed under ESSA (e.g., Massachusetts Department of Elementary and Secondary Education, New Mexico Public Education Department).[i]

But moving the U.S. education system along this path will be a long and difficult undertaking in part because its structure is so diffuse, with approximately 100,000 schools operating in 15,000 districts across 54 states and territories, along with recent shifts under ESSA in the division of authority between the federal government and the states. Yet, as ESSA acknowledges, our nation's longstanding decentralized approach to education is also an asset that can help develop and test a variety of approaches. "States as laboratories" that are deeply knowledgeable of and responsive to their local contexts could be critical to generating evidence, making reasoned adaptations to spur knowledge transfer, and, ultimately, scaling effective ideas. As more and more education leaders realize that we cannot hope to reach our goals for students via silver bullets or top-down policy mandates, the case grows stronger for a more nimble approach that empowers learning at every level to fuel improvement.[ii]

Given all of these trends, this is a critical moment to make more evident to those leading change at every level of our education system what a continuously improving learning system might look like and how to build and strengthen it. This will be a marathon, not a sprint, but it is one that is long overdue and, we hypothesize, essential to achieving our goals.

Section 2

What Are the Essential Components of a Learning System in Education?

To accelerate and scale movement toward a learning system in education, we need to understand the critical components that must be in place to spur and support such a system. Fortunately, there is much we know about learning systems from improvement science and much we can learn from efforts in other social sectors like health and welfare as well as in education.

While different sectors and approaches use different nomenclature and rightly prioritize different components and elements specific to their context, our research found that they have many similar, critical features. These common features ground our thinking about what a thriving learning system in education would look like.

According to leading efforts in the fields of systems thinking and improvement science,[iii] in order to improve organizational outcomes we must understand and improve the visible and seemingly invisible systems that inform and govern performance. We must collect and marshal data and evidence at all levels (as appropriate) to identify what causes variation in systemic performance. And efforts to improve must be sustained by way of improvement cycles whereby insights from one effort inform subsequent research and improvement efforts. These cycles often take slightly different forms but broadly include purposeful steps related to identifying problems, developing and testing hypotheses, analyzing data, and making adjustments based on the results and learnings.[1] Thus, a strong learning system would have processes to guide individuals through intensive systemic analysis; roles and responsibilities that bring people together to see that their systems impact performance and guide them to hypothesize how systems could improve; timely data that allow individuals and organizations to test ideas and make informed decisions; and structures to support and sustain these kinds of continuous improvement efforts. These improvement cycles would then lead to greater scale and impact through robust systems of research and development, and purposeful knowledge management and sharing.

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[1] For more on some leading continuous improvement models in use in education, see *Examples of Continuous Improvement Methodologies* on page 22.

These common attributes are present or emerging in other social sectors that are further along the path toward building thriving learning systems. For example:

- **In health care,** there is a robust research and development infrastructure with substantial public and private funding, rigorous rules governing quality and use, shared norms around continuous learning and evolving standards of care, and an increasingly sophisticated data infrastructure to support improvement efforts. For example, the Learning Health Community initiative has described a vision for a learning health system that engages all affected by the system in efforts to identify how to improve the system; provides valuable insights to all via effective, interoperable data systems; uses governance infrastructures to guide human interactions towards effective and collaborative improvement efforts; and is grounded in and guided by a five-part continuous improvement methodology.[iv] The National Academy of Medicine's analysis echoes many of these points, especially the importance of engaged and empowered patients who can provide insights on how to improve research processes, data systems, and care delivery methods. It also emphasizes the need for data systems that provide real-time information about a range of outcomes and provide real-time information that can guide decisions throughout the system.[v]

- **In welfare,** federal legal requirements have helped engender significant investment in and commitment to continuous improvement and data systems. For example, Chapin Hall suggested that continuously improving welfare agencies must have an appreciation of evidence and familiarity with methodologies that guide improvement efforts (like Plan-Do-Study-Act or PDSA cycles); "leadership and culture"; "data collection and analytical capacity" to get feedback from those affected by the system; "skill building throughout the agency hierarchy"; and "supportive administrative structures and functions."[vi] The Child Welfare Indicator Project largely echoes Chapin Hall while emphasizing that a continuously improving agency must have robust data systems and staff dedicated to using and improving it; mechanisms to engage and collect insights from staff at all levels and those affected by the system; and ongoing training and support for all staff to help them internalize and master the improvement process.[vii]

Leaders in both sectors are quick to acknowledge that in many ways they are still in the early stages, with much more to do to achieve their learning system visions. But in this document, we attempt to build off of their efforts and experience as well as many other insights gleaned from education experts. What follows is our working articulation of the essential components of a learning system for the education sector, with a particular focus on what is essential to supporting the shift from compliance to continuous improvement.

A. A Vision of an Education Learning System

The shift to a learning system is both an adaptive challenge and a technical one. This is especially true in education, where a mostly industrial model has created a compliance orientation and has constrained innovation. We therefore must build a **learning culture** at all levels of the education system that deeply values continuous improvement while at the same time establishing the **structures** and **processes** needed to encourage and support it.

Designing the components of a system and getting people to use and see the value of those components (that is, "do to believe") can help create a culture of learning that then, in turn, promotes and sustains continuous improvement. But the experience of other sectors and experts indicates that to truly shift toward a learning system approach, we must invest early and strategically in efforts to make adaptive changes related to shifts in mindset and culture. These are hard but essential changes necessary to break some longstanding norms and instead build trust and belief in a new paradigm. In strong learning systems, both **culture** and **design** decisions ultimately inspire and sustain each other in a virtuous cycle.
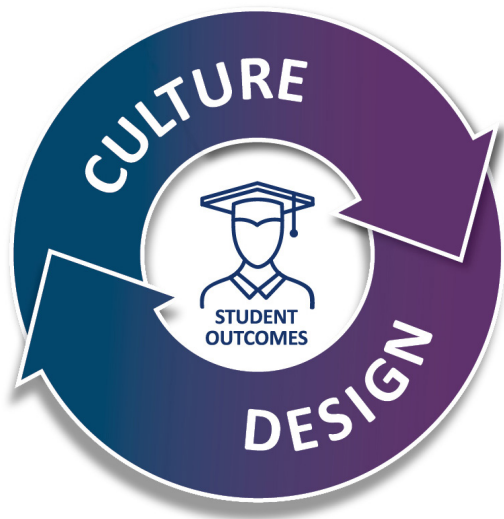
Building a Learning System's Culture: For a learning system in education to thrive, a culture of learning must, among other things:

- Place students at the center of the learning system and orient all decisions toward improving their outcomes, so each and every student can reach their full potential.

- Align around shared goals for students—e.g., preparing all students with the full range of knowledge, skills, and mindsets needed to succeed.

- Instill in every professional and stakeholder in the system the appropriate responsibility, authority, and learning-oriented mindset, so continuous improvement becomes simply "the way we do business." Everyone must feel empowered to engage in improvement work to enhance not only their own performance, but also the performance of the system.

- Invest in a foundation of mutual trust within and across all levels of the system. Individuals with the right mindsets who trust their colleagues and organizations are more likely to take innovative risks, collaborate effectively, contribute to and use data, and share their learnings (including mistakes) to accelerate improvement.

- Question assumptions and challenge the status quo to go where the data lead, with the collective willingness to revise or shed even popular practices, policies, and programs that are not driving improvement.

Designing a Learning System's Structures and Processes: A healthy learning system focused on innovation, evaluation, and continuous improvement needs more than culture, though. It must also design, build, and sustain the infrastructures needed for continuous learning to take place. We envision here three deeply interrelated, mutually dependent, and continuously improving components, which must exist at all levels of the education system. As set forth below, each component (or infrastructure) is itself composed of three to four essential elements.

Education Learning System
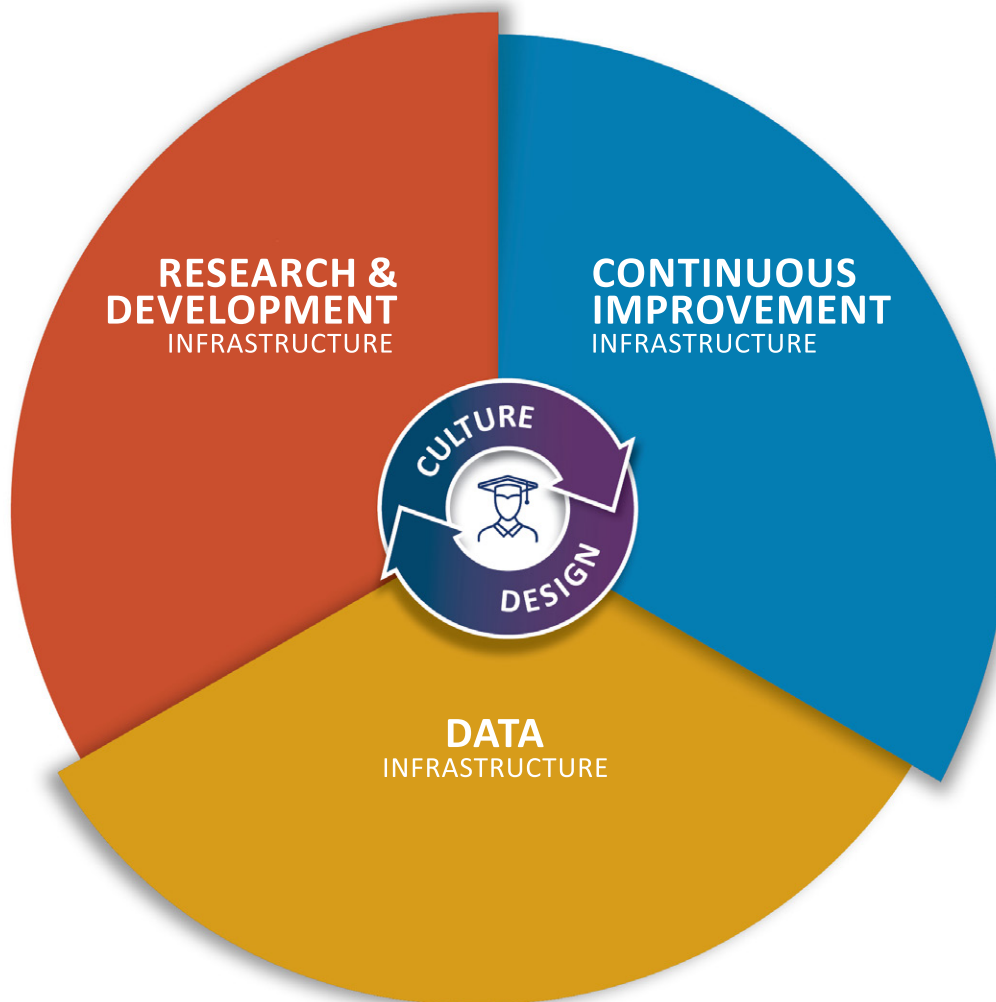
RESEARCH AND DEVELOPMENT (R&D) INFRASTRUCTURE

First, a learning system in education would have a thriving Research and Development (R&D) Infrastructure that generates and evaluates evidence, insights, tools, programs, policies, and practices. It has mechanisms to surface issues and anomalies from practice; coordinate research efforts; generate various forms of research evidence; develop research-based approaches and interventions; and support ongoing translation and dissemination to engage with and empower professionals across the system. These functions can be grouped into the following four essential elements of the R&D infrastructure, which are described in more detail in Appendix A:

1. **Identification, prioritization, and coordination** of relevant and important research questions, including those arising from practitioners (e.g., school leaders and teachers) and other stakeholders;

2. **Research** and evaluation across a broad spectrum of methodologies to build bodies of rigorous, relevant evidence in response to those questions and related hypotheses concerning subjects across the learning system;

3. **Development** of products, tools, and strategies that help leverage research evidence and innovations to support concrete shifts in practice and drive toward scale; and

4. **Aggregation, commercialization, and engagement** efforts to surface research trends, identify the most actionable findings, and translate those findings, so relevant applications are apparent to practitioners and policymakers, and can thus inform implementation as well as further innovation, research, and development.

DATA INFRASTRUCTURE

Second, an education learning system would have a strong Data Infrastructure that makes it possible for every person with a stake in education to have the appropriate information needed to make the best decisions possible in their particular role. We now have more robust data systems that enable stakeholders throughout education to use a wide array of timely, tailored, and appropriate information to support decision making in practice and policy. An effective data infrastructure not only collects and protects the critical data needed to answer end-users' questions, but it also provides transparency about how the system is serving every student. The data infrastructure's critical elements, which are also described further in Appendix A, include:

1. **High-quality longitudinal data systems** that are able, where appropriate, to connect data to inform student-centered approaches; these data include not only formative and summative outcomes, but also critical information about the progress and context of learning that led to those outcomes;

2. **User-friendly reporting** and communication tailored to the information needs of the intended user; this includes, for example, schoolwide report cards for transparency purposes as well as customizable dashboards and other visualizations that inform and empower a range of professionals and other stakeholders;

3. **Privacy and security** controls that protect individual rights and build trust among stakeholders; and

4. **Interoperability** that connects the dots across traditionally siloed data systems within and outside education to provide a more complete picture that can serve individual children while also providing feedback data to inform decisions and strategies for system alignment and improvement.

CONTINUOUS IMPROVEMENT INFRASTRUCTURE

Third, a learning system in education would have a wide-ranging Continuous Improvement Infrastructure that supports ongoing efforts in practice and policy to implement, refine, and provide feedback on the insights, tools, programs, policies, and practices that are both generated by effective research, development, and practitioner-led innovation and informed by the data infrastructure to maximize impact and get better results. The continuous improvement infrastructure also studies and iteratively enhances itself and the other two learning system components (R&D infrastructure and data infrastructure).

As more fully discussed below, the continuous improvement infrastructure must include at all levels the following three critical elements:

1. **Organizational design** that aligns with the vision and needs of a learning system;

2. **Continuous improvement methodologies** that are embedded in and guide innovation and improvement efforts; and

3. **Collaborating communities** that advance and accelerate the learning beyond what is possible on an individual basis.

These three components (or infrastructures) of a learning system overlap significantly and engage with each other in dynamic, purposeful ways. These interactions take various forms, arise through different entry points, and will often follow organic, context-specific pathways.

To illustrate the connections among the components of an education learning system, consider the following example:

A **LEARNING SYSTEM** can use data to identify an intervention—whether evidence-based or innovative—that is effectively addressing problems and showing positive impacts in a particular context.

An effective **R&D** infrastructure could then surface these positive anomalies, shape an appropriate research agenda, and examine more fully whether and under what conditions the intervention is scalable.

The **CONTINUOUS IMPROVEMENT** infrastructure would then incorporate that research into "best" practice and/or policy, iteratively improve the intervention, and scale the intervention through reasoned adaptation to maximize its impact and reach.

Throughout, all actors would leverage the **DATA** infrastructure to access timely, relevant, and actionable data aggregated at the right scale to inform each step of the continous learning and R&D efforts described to the left.

KEY DRIVERS

Finally, each component of the learning system is powered by four key drivers of change (described more fully below on pages 28-30). These drivers are themselves part of the learning system as well as early action areas that can help establish and strengthen the learning system's culture and each of the three components. These drivers exert influence within and across each level of the education system and include a focus on:

- The **Leadership** needed to set a vision of a learning system and execute on it;

- **Human Capacity** with the necessary skills, knowledge, and mindsets to facilitate and engage in improvement efforts;

- Sufficient and sustained **Resources** to build and strengthen the learning system over time; and

- The right mix of **Policies and Incentives** to remove barriers and empower people at all levels to embrace a learning orientation.

Education Learning System

The full articulation of our vision for a learning system in education includes the learning culture, the three main components (with the critical elements of each infrastructure), and the four key drivers. Taken together, they illustrate a vision for an evidence-based, continuously improving learning system in education—one that must be in place in and across each level of the education system.
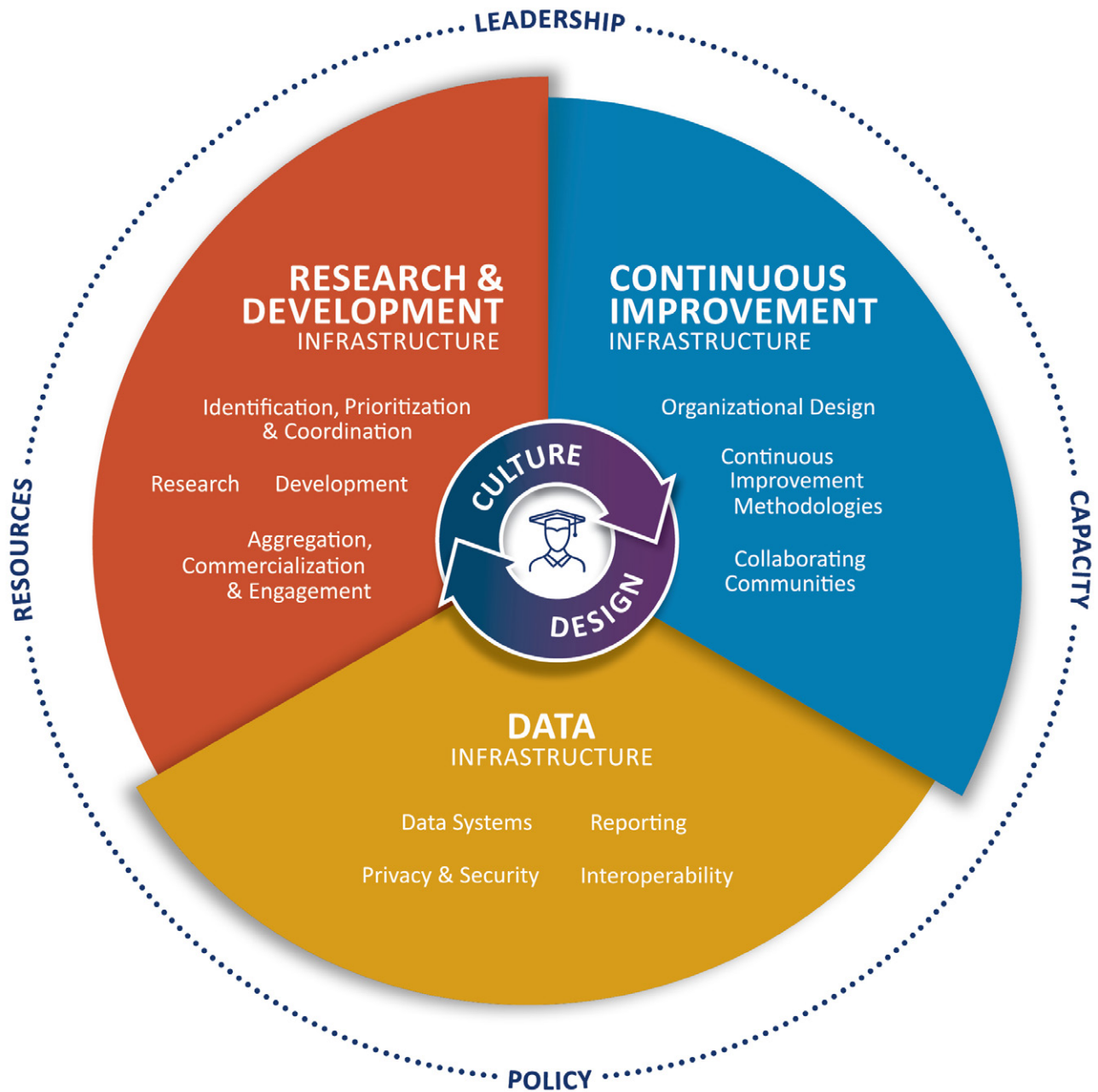
However, no matter how much we unpack the parts, we are actually discussing one (greater) whole—a learning system where the components, elements, and drivers are enmeshed in complex, dynamic, human ways. As a learning system develops, it should blur the distinctions between the research and development infrastructure, the data infrastructure, and the continuous improvement infrastructure in a number of ways. For example, research-practice partnerships can break down longstanding silos and help democratize evidence-building by empowering leaders and educators to both inform and benefit from research and development through their own practice and policies. Further, leaders at all levels can employ data less as hammers and more as flashlights to identify opportunities for learning, improvement, and growth; celebrate successes; and nurture a culture of improvement throughout their organizations.[viii]

B. Critical Elements of the Continuous Improvement Infrastructure

In this initial paper, we focus particularly on what is needed to strengthen the infrastructure for continuous improvement at all levels of the system. This is in part based on our belief and finding that this component of the overall learning system has been least attended to in education, likely poses the greatest barrier to scale, and also holds the greatest potential for impact in terms of revving the engine of innovation and improvement. Below we describe three essential elements that must be in place at and across each level of the education system to support movement toward continuous improvement: organizational design, continuous improvement methodologies, and collaborating communities.

Before describing these elements in detail, it is worth noting that they overlap and interact in important ways, similar to the interplay among the three main learning system components (or infrastructures) described above. We are also mindful that no level of the education sector represents a closed system, and we must broker meaningful, ongoing connections of these elements between and among schools, districts, states, and the federal government, as well as partners outside these organizations such as families and community groups.

ORGANIZATIONAL DESIGN

Key entities or organizations at each level of the education system would be purposely designed to support the ongoing, embedded, effective application of continuous improvement methodologies. This means putting in place the structures, processes, and resources that prioritize and support learning as a key part of each institution's and individual's work. Design decisions must be made across an array of areas, including but not limited to organizational charts, human capital, use of time, distribution of resources, and authority. These design decisions create the conditions for improvement efforts to be regularly applied to the core work of education practice or policy—in both formal and informal ways through both individual and collective action.[ix]

In the welfare sector, for example, this component has been described as "[s]upportive administrative structures and functions" that facilitate "an evidence-driven [continuous quality improvement (CQI)] process" and "include establishing policies and procedures for executing CQI activities consistently throughout the agency and oversight mechanisms to ensure adherence to those standards."[x] In health, the Learning Health System, for example, describes this component in terms of norms of "governance" and an "infrastructure" that enable continuous improvement routinely and at economies of scale.[xi]

In the education context, an example might include a clear leadership priority at the state education agency (SEA) or local education agency (LEA) levels to create a dedicated division for performance management (as in some states like Kentucky that have advanced systems around "Deliverology") and/or research and evaluation (as in Massachusetts and Tennessee). At the school level, this could include new systems of embedded, ongoing professional learning in which teachers are provided with time, data, coaching, and facilitation to work individually and together to regularly reflect on goals, data, current and best practice, student needs, and teacher responses to best improve performance for each and every student. This work—using data for improvement, thoughtfully leveraging the evidence base, and building new evidence through rigorous evaluations—often requires dedicated capacity. Increasingly, SEAs and LEAs are forming various forms of research-practice partnerships or finding new sources of internal capacity (for example, via the Strategic Data Project Fellowship program).

CONTINUOUS IMPROVEMENT METHODOLOGIES

Organizations within an education learning system would embed throughout their divisions shared approaches and mindsets for engaging in continuous improvement "that involve[] multiple iterative cycles of activity over extended time periods."[xii] These methodologies would guide, among other things, identifying challenges, creating and testing theories of change, analyzing relevant data, managing performance, and adapting approaches via ongoing feedback loops and the incorporation of broader research and evidence. Aligning around specific methodologies allows all parties to more effectively engage in "disciplined inquiry" to improve outcomes.[xiii] These methodologies can be formal (i.e., branded, multi-step processes that guide improvement, like Deliverology, Design-Based Implementation Research, Implementation Science, Lean for Education, Networked Improvement Communities, Positive Deviance, and Six Sigma)[xiv] or informal (i.e., approaches that support a culture of getting a little better every day, such as formative assessment data cycles or even the regular use of classroom data walls to inform conversations around student, class, and school improvement efforts). Because different methodologies are better suited to particular problems, contexts, and levels of a system, leaders in improvement work would be intentional about selecting, adapting, and implementing their particular continuous improvement methodologies, and continuously improving them over time.

For example, Toyota and other manufacturing sectors have famously used the Kaizen methodology to improve productivity with an intense focus on understanding and improving functions at the front lines,[xv] while technology companies often employ variations on lean design methods to prototype and iterate on new software.[xvi] Many social sectors use some variation of the PDSA methodology.[xvii] The Learning Health Community's own five-part methodology begins with forming a learning community and then takes that community through assembling and analyzing data about the experiences of actors throughout the system, interpreting results, tailoring and disseminating messages to decision makers, and taking action.[xviii]

Within an education learning system, organizations at different levels would likely embrace different methodologies. For example, SEAs might apply a Deliverology approach to guide performance management and improvement activities, including setting delivery targets that can guide activities at the LEA and school level. LEAs, meanwhile, might apply a PDSA approach to address high-priority challenges and strategies to determine and address root causes for evidence-based school improvement. Individual schools might then tackle related (and shared) problems of practice by iterating on different potential solutions within a networked improvement community, or through ongoing, embedded systems of individual and collective professional learning.

Examples of Continuous Improvement Methodologies

There are many models for engaging in thoughtful and systematic continuous improvement efforts—in education and more broadly. Most center on some variation of an improvement cycle (e.g., PDSA cycles), but they each have distinctive features that are best suited to particular actors, contexts, or needs. For example, the following are descriptions of seven leading models being applied in education.

Deliverology is a "quality improvement method designed to help organizations reach their goals by building upon the approaches they're currently using" and "having organizations carve out time to reflect on their improvement work, effectively and consistently implementing strategies for improvement."

Design-based implementation research (DBIR) "emphasizes collaboration between researchers and practitioners to design interventions that can address practical problems of teaching and learning."

Implementation science "concentrates on how education changes are carried out to ensure that the implementation process accounts for local variables in schools and other relevant contextual factors in order to be successful in any setting…. The aim of implementation science is to understand how interventions are adopted, implemented, and spread."

Lean for education "encourages all school and district employees to identify and solve problems that prevent students and others who benefit from education from achieving the highest quality outcomes possible…. Lean organizations know that there is always something that can be improved, and they conduct iterative, rapid cycles of learning."

Networked improvement model is based on "the practice of improvement science and the utilization of networked improvement communities (NICs). There are **six core principles**…that help researchers and practitioners define the problem to be solved and understand the system that produces the problem, test and measure changes, and promote learning through the network."

Positive Deviance is "characterized by uncovering and adapting resources and activities used by organizations, communities, or individuals that succeed in the face of great odds. These outliers, or 'positive deviants,' manage to overcome complex problems and significant adversity where others who are similarly situated continue to struggle."

Six Sigma aims to "reduce variance in outcomes by using data and statistical methods to improve system performance…. Six Sigma is predominantly a project-based model used to improve discrete processes with a team of experts on that specific issue and experts in the Six Sigma methodology."

Note: These descriptions are excerpts from a series of blog posts, by Sarah McKay of the Carnegie Foundation for the Advancement of Teaching, which are themselves summaries of deeper explorations of each model in the special issue of Quality Assurance in Education cited in endnote xiv.

COLLABORATING COMMUNITIES

Although in many ways collaboration is baked into the first two elements described above, it is so central to a healthy learning system that it merits treatment as a standalone element. A continuous improvement infrastructure would need both formal and informal mechanisms for colleagues and/or stakeholders (both internal and external) to work together on improvement activities. Although some important continuous improvement activities are conducted by or focused on individuals, collaborating communities—such as various forms of networks—help break down silos that exist within and across organizations, share knowledge and diverse perspectives, and accelerate learning and improvement.[xix] A strong learning system would make it easy and productive to collaborate by, for example, building collaboration into roles and responsibilities, ensuring collaborating communities have timely and actionable data, and providing network participants with the necessary resources and capacity, including time and expert facilitation. Such collaboration would create "dynamic engagement and better alignment between researchers, practitioners, and policymakers around research, data, experience, and shared improvement goals" and ensure the "perspectives of practitioners, who have a unique vantage point on the problems that need improving, are part of the process of defining research agendas and implementing evidence-informed reforms."[xx]

Collaboration is present in the most successful models we reviewed and is increasingly understood as essential. In health care, for example, the routine practice of many medical professionals not only includes consulting data and current research, but also collaboration within and across medical departments and disciplines, all in pursuit of the best medical decisions for individual patients.[xxi] Some systems, such as the Patient Centered Outcomes Research Institute, even bring patients in as integral members of the team to help identify research questions relevant to their experiences with conditions, define metrics worth evaluating, and interpret results.[xxii] In the child welfare context, leading models invite welfare service providers such as case workers to provide rich qualitative data, explain the stories underlying the data, and make recommendations for improving welfare systems with which they work.[xxiii]

Collaborating communities in an education learning system would exist at each level, albeit in different forms. For example, the ninth grade on-track initiative in Chicago, which has helped dramatically improve graduation rates, illustrates the power of embracing collaboration as a central design feature of an improvement effort. The project is the result of ongoing teaming between Chicago Public Schools and the University of Chicago Consortium on School Research. In addition, the on-track work itself regularly brings teams of educators together with skilled facilitators in cycles of improvement through which they review on-track indicator data, design personalized interventions, and progress monitor their implementation.

Examples of Collaborating Networks in Education

There is a growing focus in education on the power of networks to advance and accelerate positive change. Similar to the various continuous improvement methodologies discussed above, there are different types of networks—each with its own purpose, structure, and degree of formality. For example, some networks focus on addressing specific problems of practice while others may be designed to engage a group of similarly-situated people or institutions to advance in a step-by-step way a shared enterprise or systems change initiative. For example:

The **Carnegie Foundation for the Advancement of Teaching** supports an array of networked improvement communities (NICs). For example, the Student Agency Improvement Community brings together traditional school districts, charter networks, scholars, and others to leverage improvement science in pursuit of strengthening students' agency and persistence.[xxiv]

A public-private partnership, the **Baldridge Performance Excellence Program** supports organizations in all sectors, including education, to better understand and improve their organizational design, culture, and performance. The Baldridge Award program and community also supports the sharing of best practices and other knowledge transfers.

The **CORE Districts** is a network of mostly large, urban school districts in California that "work to innovate, implement and scale new strategies and tools that eliminate equity and achievement gaps and lead to successful outcomes for all students." Their network includes, among other things, a shared school quality framework, a data-sharing collaborative, within-network NICs focused on specific challenges, and a research-practice partnership that provides real-time feedback to help drive improvement cycles across the network.

The **North Star Education Community,** led by the American Productivity & Quality Center or APQC, supports almost 40 districts and other education organizations in a community dedicated to benchmarking, best practices, process and performance improvement, and knowledge management.

Proving Ground, an initiative of Harvard University's Center for Education Policy Research (CEPR), provides analytical, continuous improvement, and evaluation support and capacity building to a network of states, districts, and charter networks to help "make evidence-gathering and evidence-use an intuitive part of how education agencies conduct their daily work." The first cohort focused on improving and evaluating the impact of instructional technology, while a second is focusing on strategies to reduce chronic absenteeism.

The **National Network of Education Research-Practice Partnerships (NNERPP)** includes 27 members that are bridging the divide in education, at both the state and local levels, between researchers and practitioners. All RPPs are structured differently, but the NNERPP members share a common mission of "producing more relevant research, improving the use of research evidence in decision making, and engaging both researchers and practitioners to tackle problems of practice."

Setting New Standards of Care

One key function of a learning system is to establish baseline standards of care that can improve and scale over time. In medicine, for example, physicians begin with those baselines, but adapt their decision making to meet the personalized needs and specific conditions of individual patients. Similarly, a learning system in education must generate knowledge about what works, for whom, and under what circumstances. It must then grow that knowledge into a new baseline standard of practice at scale, which in turn supports further innovation and improvement in and through specific contexts and trials. This simultaneous orientation toward both scale and personalization requires that all actors within the system, at all levels, engage in improvement efforts and regularly share their knowledge with others.

Knowledge sharing can take place through myriad channels, including through informal peer-to-peer exchanges, as part of a networked improvement community, through feedback loops from one level of the system to another via scholarship, intermediary organizations, or dialogue among practitioners, researchers, and developers. Although knowledge sharing is not articulated explicitly as a component of the learning system, it is a critical activity that must take place throughout all the components and in their interactions. It thus warrants intentional investments to build appropriate knowledge-sharing mechanisms and to incentivize actors within the system to incorporate sharing in their mindset and engage in it through their daily work.

C. Key Drivers of a Learning System

To advance the shift toward a learning system in education, there are likely several key drivers that serve as both critical cross-cutting aspects of a learning system and strategies for advancing change from the status quo. These drivers are closely related and often interdependent. Although they also play equally important roles in creating the R&D infrastructure and the data infrastructure, here we focus particularly on how they help develop and sustain the continuous improvement infrastructure.

LEADERSHIP

The shift toward continuous improvement in education will require clear, committed, sustained leadership at all levels of the system. This leadership is essential to, among other things, elevating the issue and shift mindsets; dedicating sufficient resources to build and sustain key systems; defining shared goals to guide those systems; establishing supportive policies; energizing and engaging stakeholders; and expressly empowering educators and others to take risks, make mistakes, and learn and improve from them. Key leaders include principals and other school leaders, district superintendents, and state education and other political officials, as well as others who help define and drive the education policy and practice agendas. It may be necessary to focus early efforts on the most receptive leaders (who share the vision, have some capacity, etc.), but achieving continuous improvement at scale will require a through-line in leadership at the school, district, state, and even federal levels. It will also require the buy-in of external stakeholders and advocates who can help add political capital, bridge transitions in leadership, and sustain movement. Leaders among these stakeholder groups and communities are also key participants in this shift, and they need to alter their own practices to value, use, and model systems and cycles of continuous improvement.

HUMAN CAPACITY

The continuous improvement infrastructure requires professionals and other stakeholders who have the knowledge, skills, roles, and mindsets necessary to maintain a learning posture, skillfully use data and evidence to inform decision making, and employ and facilitate continuous improvement methodologies to promote individual and collective growth. Developing this capacity requires efforts across the human capital continuum—from recruitment and training to evaluation, promotion, and (particularly) professional learning. It likely also requires dedicated professionals to lead and support systems of continuous improvement, including relevant career pathways. Those roles may be specific to building the continuous improvement infrastructure (e.g., SEA staff who provide technical assistance to interested LEAs) or they may be essential to transforming an existing system into one that continuously improves (e.g., master educators who work at the school level to facilitate systems of professional learning).

RESOURCES

Establishing the continuous improvement infrastructure in education will require reallocation and/or additional resources at each level of the system to build and sustain key elements, such as new organizational designs and uses of time; human capacity; data systems; and feedback loops. This includes financial resources, but also broader supports such as time, talent, and technology. A purposeful (re)allocation of resources to establish and maintain the components of continuous improvement (even during lean budget cycles) is a hallmark of a functional and sustainable system, as opposed to the add-on and ad hoc efforts we often see in education today. Indeed, as systems at all levels develop annual and long-term budgets, a high-priority consideration should be to ensure sufficient resources will be available to build and sustain continuous improvement systems. This requires particular attention to equity in targeting sufficient resources toward the students and schools that need them most.

POLICY AND INCENTIVES

Shifting to continuous improvement at all levels of education also requires an aligned legislative, regulatory, and administrative landscape. Policy makers must purposely support the development of key components of the learning system and empower leaders and practitioners with the necessary authority and capacity to engage in improvement efforts. Further, the shift requires new incentive structures to drive innovation, research and review, and continuous improvement rather than intentionally or unintentionally discouraging these efforts. For example, the U.S. Department of Education (USED) could transform its monitoring and/or offer competitive preference points in its discretionary grants for proposals that include rigorous evaluation plans; states could offer capacity-building grants to improve key resources and use of data; and districts could look for evidence of continuous improvement routines in their school leader evaluation and professional learning systems. Existing policies that serve as obstacles to continuous improvement must be removed or revised, while new policies may need to be enacted that enable or incentivize professionals and other stakeholders to build improvement structures and engage in improvement activities. In some cases, this will require new autonomies (e.g., carving out more time in a collective bargaining agreement for teachers to regularly analyze what data and experience tell them about how to adjust instruction to improve results), while in other cases, there may be new requirements needed to sustain improvement efforts (e.g., requirements for continued stakeholder engagement and periodic review of school improvement plans). Policymaking itself should follow an improvement cycle informed by feedback loops and data about how particular policies are being implemented and impacting outcomes.

Note on Tensions

As we seek to define the components, elements, and drivers that could help further create an education learning system, we also must identify and grapple with the tensions inherent in making such a shift. For example, while a learning system must value increasing effectiveness and impact on student outcomes—especially given the urgency to close gaps and improve performance—professionals within the system must also feel trusted and have sufficient freedom to innovate and try new approaches even if they do not succeed. We must carefully strike a balance between preserving accountability for results and creating strong incentives for innovation and learning. These tensions are especially acute when considering how an innovative approach impacts equity considerations within a school or system.

Section 3

How Can We Drive the Shift to a Learning System in Education?

Building a strong, sustainable learning system at all levels of the education system—including acting on and through the key drivers of change identified above—will be a long-term endeavor that will require its own research and development, timely data, and ongoing continuous improvement. This is true of any major sector or system effort but also because the U.S. education sector presents some unique challenges. For example:

- Our education system is fractured and decentralized—with many points of entry, different roles, and loose connections. In general, states have overall legal responsibility for the delivery of education, but in many states much of the authority (and funding) lies with districts, particularly with regard to decisions about design and practice at the school level. And with the federal level's authority in a period of devolution under ESSA, there are additional challenges to driving coherent change at scale across the levels of the system. (Note, however, that these conditions may also create more opportunities to innovate and thus develop better approaches, so long as we can identify and effectively scale them.)

- All levels currently lack the dedicated resources and time needed to best develop and implement learning system approaches that lead to improved results. Schools are generally not designed and resourced to support improvement efforts, with their limited funds predominantly paying personnel costs. Meanwhile, a typical LEA or SEA might have multiple offices devoted to compliance with federal laws, but very few staff (much less whole offices) dedicated to identifying, supporting, and scaling interventions with the potential to have an outsized impact on student outcomes.

- Education leaders often face pressure to address the immediate problem at hand and achieve quick improvement within political cycles. Consider, for example, that the average tenures for chief state school officers and urban district superintendents are only about three years, and that education systems are governed by multiple levels of elected leadership. These pressures can make it difficult for systems to embrace and sustain more incremental improvement efforts.

- Many practitioners, especially at the school level, report "initiative fatigue" from implementing a succession of new approaches. They might see efforts to embrace a learning system approach as yet another education fad or push back against what they might perceive as a disruption to their current practice.

- At every level, most education systems are deeply entrenched in a compliance orientation, driven in significant ways by federal law and the response to prior accountability systems for schools and teachers. Shifting mindsets to embrace an orientation grounded in learning and continuous improvement will be difficult, though potentially liberating.

- Some influential education stakeholders have a deep aversion to "experimenting" on children and might view continuous improvement efforts through that lens, adding another cultural, political, and mindset barrier to overcome.

- Many education personnel lack the competencies required for improvement processes, such as using evidence to identify problems, creating a theory of action, determining and using data to track lagging and leading indicators, and making appropriate adjustments to plans of action.

Notwithstanding these challenges, there are several important efforts underway to advance an education learning system. But we need a clear theory of change to advance and sustain these shifts—in terms of what should come next and why, which players are most critical, and how we can use the array of strategies available (e.g., policy, communications, research, technology, practice) to move our education system toward functioning as a learning system.

The systemic nature and scope of the change we seek suggests the need for a comprehensive approach, yet we must be nimble when opportunities arise to elevate bright spots or seed new approaches. Most immediately, the forcing event of implementing ESSA provides a number of these opportunities at all levels, with a federal-to-state-to-local through-line linking USED's approach to grant management and program evaluation to the consolidated state plans to school districts' local ESSA plans to individual low-performing schools' support and improvement plans.[2] ESSA also expressly requires periodic review and improvement across the statute along with various requirements governing and promoting the use of evidence.[xxv]

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2 In an earlier Issue Brief, we discussed in detail the various opportunities to leverage ESSA to advance a learning system approach. *See* Gordon, Dan, Scott Palmer, Bethany Little, and Sean Darling-Hammond. "Shifting from Compliance to Continuous Learning: Leveraging ESSA to Advance a Learning System in Education." EducationCounsel. March 2018. Accessed August 13, 2018. http://educationcounsel.com/?publication=shifting-compliance-continuous-learning-leveraging-essa-advance-learning-system-education.

Identifying all of the highest-leverage strategies and sequencing them appropriately is beyond the scope of this paper. We need to continue grappling with and testing answers to questions including: What would have to be true for each level and unit to function as a learning system? What organizational design decision would be made? Which continuous improvement methodologies would be followed? How would collaboration advance and accelerate improvement? The experts who participated in our convening spent time generating some initial ideas that appear below. Our discussion of how we can work toward the desired state begins appropriately with schools as a critical unit of change and then progresses to districts, states, and the federal government.

SCHOOLS

Schools operating as learning systems should develop coordinated approaches to human capital development. They should also broaden roles and responsibilities to ensure educators and other school staff are empowered to engage in improvement efforts in an ongoing, embedded manner and are granted sufficient time and resources to do so. This has particular importance for the roles and capacity of principals and other school leaders. These schools would also provide the freedom to innovate while encouraging staff to adhere to improvement processes and share what they learn. Additionally, they would collaborate with a wide array of partners (e.g., community organizations, other schools, local businesses), provide districts with usable data regarding school-level improvement efforts, and share their successes with stakeholders throughout the system to serve as models and build political will for continuous learning.

To help schools build these attributes, initial strategies might include:

- Building practitioner-informed data infrastructures and dashboards that allow educators, students, and parents real-time access to actionable information, and strengthening mechanisms for engaging with the data;

- Establishing ongoing, embedded systems of individual and collective professional learning that leverage data and feedback loops to continuously improve teaching and learning, and system performance, with expert facilitation to drive those systems (perhaps through a new role for master educators); and

- Improving teacher and leader preparation programs to ensure they provide a grounding in improvement processes along with data literacy and use, and developing similar modules for current educators.

DISTRICTS

Districts that continuously learn and improve would be organized to integrate district office functions and teams to focus on driving district priorities while avoiding silos. District leadership would align schools throughout the district behind shared goals, specific strategies for achieving them, and a plan for using and sharing resources. Central office and school staff would have a shared understanding about when schools should comply (e.g., when following improvement processes) and when they should exercise professional discretion (e.g., when selecting strategies in response to data). Districts would be transparent regarding progress towards goals and what they are learning through improvement efforts. They would provide data that help students, parents, and teachers work toward achieving goals, and also provide timely, actionable data to their SEA to guide broader improvement efforts and insights.

To help districts build these attributes, initial strategies might include:

• Investing in organizational divisions and staff capacity in data analytics, performance management, and continuous improvement;

• Establishing research-practice partnerships to help buttress capacity and build research and evidence into ongoing decision making;

• Working with leading schools to shift mindsets and build systems, and then lifting up stories about schools using improvement processes to realize shared goals in order to bolster political will and serve as models for other schools;

• Developing or strengthening feedback loops across layers of the system (e.g., postsecondary data to high schools, high schools to middle schools, middle schools to elementary schools, and elementary schools to early learning programs) that are used to review and revise current approaches to improve students' readiness for the next level; and

• Networking with peer districts, especially to help smaller districts afford some of what they will need (e.g., data systems).

STATES

Continuously learning states would develop, administer, and safeguard integrated data systems (connected to other state agency data sets) that can, among other things, help identify positive and negative anomalies. These states also would transparently report data and engage in constant data reviews and evaluation to guide implementation and impact of their key policies. They would model good behavior for their LEAs by using improvement processes to improve the SEA and its work, including, crucially, improving the data infrastructure itself over time. Leadership throughout the SEA, and especially leadership in offices devoted to measurement and support, would signal the importance of this work to districts by both using a lexicon of improvement, rather than compliance, and communicating to districts that they will co-own system-wide outcomes and work with districts to improve them. Finally, the SEA would frequently use its convening power to facilitate state-district and district-district learning, such as via networks across rural and other districts that may lack internal capacity and resources.

To help states build these attributes, initial strategies might include:

- Continuously improving the data infrastructure to keep up with stakeholder information needs; this includes being able to link limited but critical education data sets with those in other state agencies (e.g., health, child welfare, juvenile justice);

- Developing data dashboards and report cards to provide public transparency and trust about how well schools and systems are serving all children;

- Identifying and highlighting success stories and beat-the-odds schools/programs to facilitate collaboration and knowledge sharing through more frequent and rapid information exchanges;

- Establishing state partnerships with research entities to further build the evidence base and begin answering questions in a statewide learning agenda;

- Reviewing all data collections on a regular basis to ensure that the state is collecting only critical information and using it to support learning; publish an annual audit of data collections and their purposes and benefits; ensure that all state data privacy and security laws reflect best practice; and provide training around safeguarding data for all educators; and

- Investing in technical assistance to advance learning system approaches across the state (e.g., data literacy training for SEA and/or LEA staff).

FEDERAL GOVERNMENT

A federal government oriented toward continuous learning would use the powerful incentives at its disposal to encourage SEAs and LEAs to innovate and improve as well as to build the systems needed to engage in those improvement efforts. It would seek to dramatically increase the federal investment in research[3] and better leverage its existing resources to both generate more evidence and support states' and districts' use of evidence. These include most notably the Institute of Education Sciences (IES) and its What Works Clearinghouse, along with the federally-funded Regional Education Laboratories (RELs) and Comprehensive Centers (CCs). The federal government would guide states and districts to adopt continuous improvement as a key strategy and provide technical assistance to help them succeed at this work. It would also pursue new policies and regulations that demonstrate a tolerance for innovative risk-taking. For example, USED could take new approaches to its monitoring, reporting, and grant management that shifted from a compliance focus to one that makes state and local leadership on continuous improvement a precondition for giving greater federal deference to state and local judgments. It would also revise and/or remove policies and regulations that serve as unnecessary barriers to innovation, collaboration, and improvement. A federal learning system would model good behavior by transparently continuously improving its own systems (e.g., via regulations with feedback loops), and it would also use the bully pulpit to extol the value of continuous improvement. Finally, it would aggregate information from state data systems to highlight positive anomalies and promising trends. All of this is in addition to the central role the federal government plays in funding and supporting other key elements of the learning system, including state data systems and nationwide research and development.

To help the federal government build these attributes, initial strategies might include:

- Restructuring or even reorienting USED offices around a focus on continuous learning and improvement goals rather than discrete federal programs and compliance;

- Revising regulations governing the management of USED (e.g., GEPA and EDGAR) to align more with improvement efforts;

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3 USED and the National Science Foundation together fund the majority of education R&D, with spending of about $800 million per year. This federal investment in education R&D pales in comparison to other sectors, with R&D accounting for a mere 0.4% of education spending, compared to 6.3% in health, 12.3% in defense, and 46.1% in energy. See Kane, Thomas J. "Making Evidence Locally." *Education Next* 17, no. 2 (Spring 2017): 52-58. Accessed August 13, 2018. https://www.educationnext.org/making-evidence-locally-education-research-every-student-succeeds-act/.

- Anchoring ESSA state plan monitoring around expanding continuous improvement and discouraging over-emphasis on a compliance orientation by SEAs;

- Improving the effectiveness of RELs and CCs to better build SEA/LEA capacity and serve as hubs for insights gleaned from improvement efforts;

- Clarifying privacy laws and updating them to better reflect the realities of teaching and learning in the digital age, including providing more guidance from the Privacy Technical Assistance Center (PTAC) on ways to better share data and facilitate researcher access while ensuring strong privacy protections; and

- Increasing federal investments in R&D, with additional strategies specifically aimed at strengthening the development infrastructure, such as establishing for education an entity analogous to the Defense Advanced Research Projects Agency (DARPA).

Conclusion

As we stated in the introduction, we hope this paper helps make the case for why a new approach—one grounded in data, evidence, innovation, and continuous improvement—must be a critical pillar of any attempt to achieve our ambitious goals for all students. We have also attempted to establish a common vision for what such a learning system might look like in education and begun to identify how we might initiate the adaptive and technical shifts necessary to achieve that vision.

On one hand, this is a complicated topic that requires careful consideration. On the other, our vision for a learning system can be boiled down to a simple sequence of questions that should be embedded in the design and culture at each level of the education system:

1. What have we done and why?   **2. What have we achieved so far?**
3. What have we learned?   **4. How will we do it better?**

We will have the learning system we so desperately need when every actor in the education system can routinely answer each of these simple but profoundly important questions within their scope of work and in ways that help strengthen the system as a whole. Only then we will know we have the culture, structures, and processes necessary to make sustained changes in practice and dramatic improvements in outcomes for each and every student.

Appendix A

Critical Elements of the Research & Development Infrastructure and Data Infrastructure
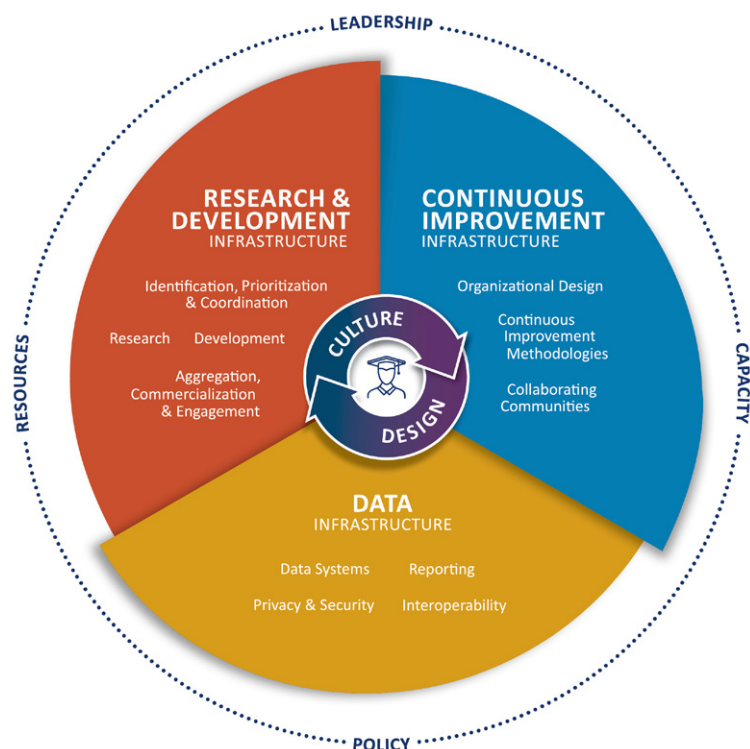
Below are brief definitions of the critical elements of the R&D infrastructure and the data infrastructure. Both merit deeper treatment, but we hope this initial articulation offers a shared vocabulary for thinking about how all three components—the R&D infrastructure, data infrastructure, and continuous improvement infrastructure—support each other within a thriving learning system.

Before unpacking each of these two components, it is worth noting that both the learning culture and the four key drivers apply with equal weight to R&D and data. Neither infrastructure can function properly and strengthen over time unless they operate within a culture of learning, highlighted by student-centered approaches, collaboration, trust, and learning mindsets. For example, in a healthy learning system, data systems would not simply be used as hammers that hold individuals accountable but also as flashlights that identify opportunities for learning, improvement, and growth, and celebrate successes to improve morale and nurture a culture of improvement throughout the system.[xxvi]

Likewise, the four key drivers—leadership, human capacity, resources, and policy/incentives—exist within and exert influence on the R&D infrastructure and the data infrastructure just as they do with the continuous improvement infrastructure. For example, for the R&D infrastructure to be effective, it requires leadership that prioritizes and encourages research-based decision making and invests in sustained human capacity development to ensure professionals can generate, share, and apply insights from research. Similarly, a high-quality data infrastructure must be supported by strong leadership that, for example, establishes a multi-tiered, cross-agency data governance committee to set policy, manage feedback loops, and continuously improve the systems over time.

ELEMENTS OF THE RESEARCH & DEVELOPMENT INFRASTRUCTURE

- **Identification, Prioritization, and Coordination:** Researchers and developers work with each other as well as practitioners and policymakers to identify critical and relevant research questions. Research is coordinated to maximize the leverage of separately operated research initiatives, avoid duplication, promote replication, and achieve key insights in a timely manner.

- **Research:** Various forms of research are conducted to meet specific needs; build bodies of rigorous, relevant evidence; and provide the full array of insights needed to evaluate and develop educational tools and techniques. These include conducting and building on each of the following types of research, which represent a spectrum rather than mutually exclusive categories:

  1. Needs analysis
  2. Basic research
  3. Field scan
  4. Applied/effectiveness research
  5. Implementation research (operational/contextual research)
  6. Improvement research (continuous improvement)
  7. R&D system meta research

- **Development:** Designers and engineers create effective tools, strategies, and products based on strong research that also shows whether they work for different learners in different contexts and that can help leverage and scale the application and adoption of effective practices.

- **Aggregation, Commercialization, and Engagement:** Mechanisms and structures exist that sift through available research to surface trends, identify the most actionable findings, and translate those findings so that the most relevant applications are apparent to inform development, policy, and practice. In addition to ensuring coalitions work together to define, conduct, analyze, and implement research and development, there is a deep and sustained focus on building bridges to connect individuals to one another that allow for meaningful engagement among researchers (and their findings), developers (and their innovations), practitioners (and their findings and innovations), and policymakers.

ELEMENTS OF THE DATA INFRASTRUCTURE

- **Data Systems:** Stakeholders throughout the system have timely access to stable, interoperable, and accessible longitudinal data systems. These systems are designed and developed to continuously and accurately collect, aggregate, and disaggregate large data sets that include, among other things, formative and summative data as well as critical information about contexts that might impact the data (i.e., system variation). System variation data include both characteristics about situations that impact the effectiveness of interventions and individuating characteristics about students that impact the appropriateness of interventions for them. Further, these data systems are appropriate to the particular level of the education system and constructed to evolve as data needs change and new data become available.

- **Reporting:** Data from the data systems are packaged and visualized in user-friendly, accessible, and actionable ways. These include user-informed, customizable dashboards available at all levels that can show stakeholders areas of potential improvement, progress toward goals, and help provide insights about the effectiveness of interventions.

- **Privacy and Security:** Personally-identifiable data are protected and stored securely based on clear rules, procedures, and mechanisms that allow access to the right parties for the right purposes. Those entrusted with managing data systems communicate transparently with stakeholders about the data they collect, the purpose of the collection, to whom they grant access, and the intended and actual uses of the data.

- **Interoperability:** Key data across systems and sectors that serve students are linked to ensure that data follow individuals (aided by individual student identifiers) and can be appropriately shared to foster alignment at the systems level and support for students as they progress in their development and particularly during transitions in their childhood development, education, and entrance into the workforce. Key data that should be available for purposeful linking come from, but are not limited to, early childhood, K–12, postsecondary, workforce, and child welfare data systems.

Appendix B

Experts Consulted and Documents Reviewed

EXPERTS CONSULTED

Sara Allen, Bill & Melinda Gates Foundation

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Elizabeth Dabney, Data Quality Campaign

Ben Daley, High Tech High

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Bart Epstein, Jefferson Education Exchange

*Kelly Fitzsimmons, Project Evident

Claudia Grossman, Patient-Centered Outcomes
Research Institute

*Aimee Rogstad Guidera, Data Quality Campaign (formerly)

Evan Heit, National Science Foundation

Tom Kane, Harvard Center for Education Policy Research

Anthony Kelly, National Science Foundation

Jim Kemple, Research Alliance for New York Schools

Todd Kern, 2Revolutions

Sara Kerr, Results for America

Kylie Klein, The Chicago Consortium on School Research

Jim Lewis, National Science Foundation

Hal Luft, Palo Alto Medical Foundation

*Anu Malipatil, Overdeck Family Foundation

*Michael McGinnis, National Academy of Medicine

Rick Miller, CORE Districts

Ruth Neild, Philadelphia Education Research Consortium

Beth Simone Noveck, The GovLab at New York University

William Penuel, National Center for Research in Policy
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*Jefferson Pestronk, New Visions for Public Schools

*Wendy Robinson, Fort Wayne School District

Todd Rose, Harvard Mind, Brain & Education Program

*Bryan Samuels, Chapin Hall, University of Chicago

*Jim Shelton, Chan Zuckerberg Initiative

Robert Slavin, Center for Research and Reform in Education
at Johns Hopkins University

Abigail Smith, BlueSky Education

*Sandy Speicher, IDEO

*Chris Steinhauser, Long Beach Unified School District

Candace Thille, Open Learning Initiative at
Stanford University

*Vivian Tseng, W.T. Grant Foundation

Jermelina Tupas, National Science Foundation

Bi Vuong, Harvard Center for Education Policy Research

Daniel Webster, California Child Welfare Indicators Project

James Wilcox, Strategic Growth Partners

* Also participated in the 2017 convening.

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Endnotes

i For more promising practices in ESSA state plans that are relevant to the shift toward a learning system, see Results for America's 50-state scan. *See* Results for America. *ESSA State Leverage Points: 50-State Report on Promising Practices for Using Evidence to Improve Student Outcomes.* January 2018. Accessed August 13, 2018. https://results4america.org/wp-content/uploads/2018/01/RFA-ESSA-50-State-Report_final.pdf.

ii Many different forces have conspired to create in the United States a strong compliance orientation in public education. *See* Mehta, Jal. *The Allure of Order: High Hopes, Dashed Expectations, and the Troubled Quest to Remake American Schooling.* Oxford: Oxford University Press, 2015.

iiii Our review of the field of system thinking is largely guided by the foundational works of Walter Shewhart, Joseph Juran, W. Edwards Deming, Peter Senge, and Taiiichi Ohno. Importantly, each thinker focused on different but overlapping aspects of how to improve a system that offer valuable insights for education. Shewhart wrote extensively about improving system performance by reducing variation. *See* Shewhart, Walter A. *Economic Control of Quality of Manufactured Product.* New York, NY: D. Van Nostrand Company, 1931. and Shewhart, Walter A. Statistical Method from the Viewpoint of Quality Control. Washington, DC: Graduate School of the Department of Agriculture, 1939. Juran discussed the importance of identifying and understanding all those affected by the system to glean means of improving it and identifying and improving the 20% of the system that impacts 80% of its performance (the Pareto Principle). *See* Juran, J.M. *Juran on Planning for Quality.* New York, NY: Free Press, 1988. Deming believed that to improve outcomes you must cooperatively develop and iteratively improve theories of knowledge about what causes variations in the system and how those variations affect systemic performance by comparing system outcomes against expectations aligned with theories of change. *See* Deming, W. Edwards. *The New Economics for Industry, Government, Education.* Cambridge, MA: Massachusetts Institute of Technology, Center for Advanced Educational Services, 1994. Senge wrote that systems improve when members of the system collaborate to understand the complex and often subtle systemic causes of variation (at the individual level, and even in terms of how mental assumptions impact individual and group performance) and work together to improve the system. *See* Senge, Peter M. *The Fifth Discipline: The Art and Practice of the Learning Organization.* New York, NY: DoubleDay, 2006.

Ohno, the developer of Toyota's production system, believed that to improve organizations, you must commit to continuously improving those that work within them, and that to understand the causes of current levels of performance of individuals and groups within a system (to find ways to improve it), you must understand the many deep causes of variation in performance by asking "the 5 whys" (for more information about the Kaizen approach to continuous improvement embraced by Toyota and other Japanese companies, *see* Ohno, Taiichi. *Toyota Production System: Beyond Large-Scale Production.* New York, NY: Productivity, 1988; *see* also Imai, Masaaki. Kaizen: *The Key to Japan's Competitive Success.* New York, NY: McGraw-Hill, 1986.). More generally, the National Implementation Research Network's "active implementation" model is grounded in a comprehensive synthesis of implementation research relevant to this paper. *See* "Learn Implementation." National Implementation Research Network. Accessed August 13, 2018. http://nirn.fpg.unc.edu/learn-implementation.

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v Institute of Medicine. *Best Care at Lower Cost: The Path to Continuously Learning Health Care in America.* Report. Washington, DC: National Academies Press, 2013. Accessed August 13, 2018. www.nap.edu/catalog/13444/best-care-at-lower-cost-the-path-to-continuously-learning. Similarly, the Armstrong Institute for Patient Safety and Quality at Johns Hopkins Medicine applies continuous improvement methodologies to enhance patient-centered care and improve safety and outcomes. Until recently, the Institute was led by Dr. Peter Pronovost, whose checklist protocol for reducing the risk of infections in central line catheters is an exemplar for how improvement efforts can dramatically improve outcomes. *See* Gawande, Atul. "The Checklist." *The New Yorker*, December 10, 2007. Accessed August 13, 2018. www.newyorker.com/magazine/2007/12/10/the-checklist.

vi Deming, *The New Economics*.

vii Webster, Daniel. "Continuous Quality Improvement Overview," Child Welfare Indicators Project Center for Social Services Research, University of California, Berkeley, June 17, 2015. Accessed August 13, 2018. https://calswec-archive.berkeley.edu/sites/default/files/uploads/cqi_orientation_rtn_webinar.pdf.

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ix Results for America has articulated for local governments in general a comprehensive checklist of potential indicators of organizational design that support a learning system approach. *See* Results for America. "The What Works Cities Standard." What Works Cities. 2017. Accessed August 13, 2018. www.bbhub.io/dotorg/sites/8/2017/03/WWC-Certification-Criteria.pdf.

x Wulczyn, Fred, Lily Alpert, Britany Orlebeke, and Jennifer Haight. *Principles, Language, and Shared Meaning: Toward a Common Understanding of CQI in Child Welfare.* Report. The Center for State Child Welfare Data, Chapin Hall at the University of Chicago. July 10, 2014. Accessed August 13, 2018. www.chapinhall.org/wp-content/uploads/2014-07-Principles-Language-and-Shared-Meaning_Toward-a-Common-Understanding-of-CQI-in-Child-Welfare.pdf.

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xiii *Id*.

xiv Lemahieu, Paul G., Anthony S. Bryk, Alicia Grunow, and Louis M. Gomez. "Working to Improve: Seven Approaches to Improvement Science in Education." *Quality Assurance in Education* 25, no. 1 (February 27, 2017): 2-4. doi:10.1108/qae-12-2016-0086. Of particular note, many states are using the deliverology approach to define and guide efforts to achieve improvement targets. *See* Nordstrum, Lee E., Paul G. Lemahieu, and Karen Dodd. "Deliverology." *Quality Assurance in Education* 25, no. 1 (February 27, 2017): 43-57. doi:10.1108/qae-11-2016-0078. In addition, many teachers and schools have joined networked improvement communities. *See* Bryk, Anthony S., Louis M. Gomez, and Alicia Grunow. *Getting Ideas into Action: Building Networked Improvement Communities in Education.* 2010. Accessed August 13, 2018. www.carnegiefoundation.org/wp-content/uploads/2014/09/bryk-gomez_building-nics-education.pdf. Finally, many

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