HOOVER EDUCATION

Can't Get There From Here

A Framework for the Start, Spread, and Scale of Bottom-Up Innovation in Education

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INTRODUCTION: EDUCATION NEEDS BOTTOM-UP INNOVATION AND EFFECTIVE SCALING MECHANISMS

Teachers and administrators are the ultimate improv team, adjusting on the fly in response to everything from student reactions to lesson plans, who has showed up for class, or whether the homecoming dance has stolen everyone's focus. Contrary to the narrative that education resists change, the more accurate story is that the education practice is rooted in near-constant informal feedback and is "being reinvented all the time," just not according to any thought-out "macro planning" (Tyack and Cuban 1997, 133). And despite this day-to-day responsiveness, the release of the 2025 National Assessment of Educational Progress (NAEP) scores comes not as a wake-up call but as terrible confirmation of what so many in education already knew: Learners are not improving and, in fact, are performing worse than they did decades ago (Hanushek 2025). These declines extend beyond math and reading to mental health, attendance, and engagement—all at historic lows (Brown and Carrington 2025; Centers for Disease Control and Prevention 2024).

Years of investment in innovation and reform have yielded little improvement but many lessons (Cohen and Mehta 2017; National Academies of Sciences, Engineering, and Medicine 2025; Raymond 2023). Most findings indicate that the current education infrastructure prevents innovation from emerging, spreading, sustaining, and demonstrating measurable improvements in learner outcomes. A major 2025 consensus report from the National Academies of Sciences, Engineering, and Medicine (NASEM) found that "although a number of these innovations have had the potential to impact learners on a broad scale, that potential often remains unrealized" due to fragmented implementation and lack of systemic support, resulting in gaps in equitable impact (NASEM 2025, 1). Or, as Charles Payne stated, "the essential problem in our schools isn't children learning; it is adult learning" (Payne 2008, 179).

A Hoover Institution Essay

January 2026

While researchers have long studied and documented top-down mandates, academic- or outsider-initiated transformation, and other large-scale reforms (e.g., Bettinger 2023; Bromley et al. 2023; Cohen and Mehta 2017; DiPerna 2020; Fullan 2021; Tyack and Cuban 1997; Wolfe and Fernando II 2024), we know relatively little in the education field about how to support and scale bottom-up innovation. This white paper helps address this gap by asking: *If change is inevitable but not always impactful, and if even successful innovation often fails to scale or sustain, what conditions and mechanisms help or hinder growth of bottom-up innovation? How can the United States foster more examples like AVID and avoid the pitfalls of Hungary?* (See sidebars.) To explore these questions, I draw on a broad literature, including studies of reform and education system change, as well as insights from rational choice theory, diffusion of innovation, and organizational change. Despite a well-studied history of entrepreneurship and scaling innovation in fields such as business and medicine, the research literature on innovation—bottom-up or top-down—in the education sphere in the United States is still fairly thin. To supplement this lack of theory and evidence, I also incorporate studies of education innovation in other countries in this synthesis.

ADVANCEMENT VIA INDIVIDUAL DETERMINATION (AVID): FROM ONE TEACHER AND THIRTY STUDENTS TO FORTY-SEVEN STATES AND MILLIONS POSTSECONDARY READY

The founding and growth of AVID is one of the most instructive examples of scaling a bottom-up innovation available in education research (Hubbard and Ottoson 1997). An English teacher in Claremont, California, Mary Catherine Swanson, originated AVID in 1980 out of frustration with her district's inability to support an influx of Latino and African American students after court-ordered desegregation. Without a grand plan or deep research review, Swanson responded to her "dramatically changing context" by applying her professional knowledge of the harms of school tracking to create an elective class (Hubbard and Ottoson 1997, 43). The AVID elective detracked lower-performing students and provided them academic and social support so that they could succeed in more challenging, college-ready coursework. Swanson started with some tutoring for thirty volunteer students who promised to do homework.

Swanson built a following for AVID through relationships with colleagues. Other teachers saw the innovation as a solution to their desire to teach advanced classes that lacked sufficient enrollment. Though innovative, the AVID approach used typical class and curriculum structures during regular school hours, illustrating that "innovations are bound in their development. Context shapes concept" (Hubbard and Ottoson 1997, 45; Ottoson 1995). Diffusion was unplanned but occurred rapidly, driven by immediate, tangible student progress and a clear fit with traditional schooling formats. This success attracted broader participation across the school (Hubbard and Ottoson 1997, 45). Soon even the lowest-income students were graduating and enrolling in good postsecondary placements at higher levels than the rest of the district. AVID spread as teachers left Claremont through natural attrition and brought the ideas and practices with them.

County officials, impressed by AVID's success, approached Swanson to apply for innovation funding, marking the start of institutionalization, a "critical milestone in innovation diffusion" (Hubbard and Ottoson 1997, 47). The productive aspects of institutionalization brought full-time positions for Swanson and staff, credibility, a home base, dissemination tools, research partnerships, guidebooks, and a lab site at Claremont. However, this phase also introduced pressures for accountability and the challenge of adapting the program to diverse district contexts (Hubbard and Ottoson 1997).

Seven years after AVID's inception, San Diego County mandated it for all schools, triggering familiar tensions when "central offices tried to require implementation fidelity, [but] local sites adapted for context and individuals for mindsets" (Hubbard and Ottoson 1997, 51). Over time, this push-and-pull led to characterizing a "good" AVID program less by rigid definitions than by "mutual adaptation [that] mixes knowledge creation and knowledge utilization" (Hubbard and Ottoson 1997, 51). This stage was also marked by program leaders bringing in research partners and others to perform a "more careful, systematic look at program variations matched with program performance [to] determine which of those components . . . are most crucial to its success" (Hubbard and Ottoson 1997, 51). Forty years after the original innovation, in 2020 AVID met the What Works Clearinghouse Tier 2 standard for having strong evidence of effectiveness for graduating high school students and enrolling them in college (Todhunter-Reid et al. 2020).

HUNGARY IN TRANSITION: FROM DECENTRALIZED INNOVATION HUB AND EDUCATION EXCELLENCE TO TOP-DOWN AND LOW PERFORMANCE

Between the early 1990s and early 2010s, Hungary's "decentralized education system strongly supported [bottom-up] innovation," creating a vibrant culture of best-practice sharing supported by robust knowledge-sharing networks (Pálvölgyi and Horváth 2023, 90). Hungary ranked sixth in the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA) between 2000 and 2011, significantly ahead of the OECD average (Pálvölgyi and Horváth 2023). However, beginning in 2021, the state centralized control over school management, financing, and governance, reducing autonomy for principals and teachers. Today the "performance of the Hungarian education system is low by international standards and is steadily deteriorating," a condition attributed to reduced funding, low teacher pay, and teacher shortages (Pálvölgyi and Horváth 2023, 90).

Despite these macro-level conditions, locally initiated efforts continue to show "considerable innovation potential and activity" (Pálvölgyi and Horváth 2023, 90). One might infer from this that a cultural and professional orientation toward innovation remains prevalent once fostered among educators. However, when not supported by infrastructure, policy, and a strong workforce, innovation cannot break out of the local context, nor is it enough to maintain education excellence writ large.

The framework presented in this paper maps the many ways in which local innovation could be supported, from original gestation through large-scale impact. However, it also highlights that the current tangle of policy, regulation, lack of knowledge sharing and alignment, and mismatches within the profession leave us with a situation New Englanders such as myself might sum up as "You cahn't get theah from heah."

IMPERFECT DEFINITIONS OF IMPRECISE TERMS

In education, reform and innovation overlap but remain distinct concepts. This paper focuses primarily on innovation, often used interchangeably with educational change or improvement. *Innovation* does not have a solid definition, and "rather than being intrinsically defined" is often "portrayed as a counterpoint to traditional education" (Quilabert 2024, 267). Given the fluidity of this definition, this paper's research review follows the premise that innovation is a shift in an education practice that represents a "significant departure" from prior routines that holds the "potential for them to become more effective or solve a problem" (Pálvölgyi and Horváth 2023, 86). I further narrowed the literature review by focusing on bottom-up innovation—those ideas originating from school-level practitioners in local contexts.

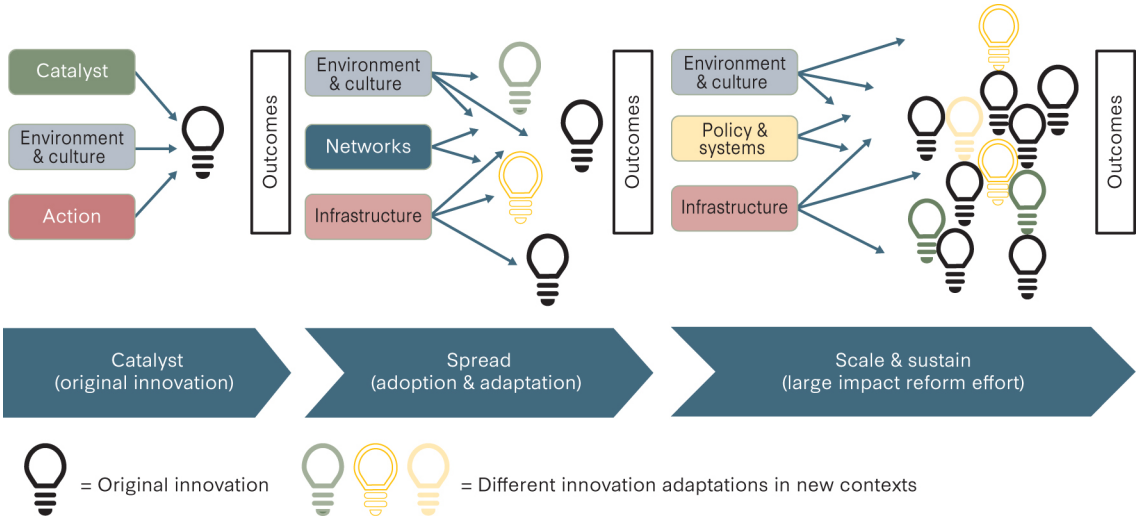
Reform, on the other hand, implies "implementing suites of innovations that collectively transform the mission, goals, processes, personnel, and products of an educational institution" (Dede 2005, 2; see also Berends et al. 2002). Typically top-down or emanating from research institutions, reform requires policy, funding, practice, and/or structural shifts from the outset, and it aims to embed innovations across multiple settings. An imprecise but useful shorthand is that the study of reform examines what happens when multiple actors attempt to embed innovation(s) across multiple settings.

Commonly, educators, researchers, and policymakers define the successful scaling of a reform as fidelity to the original innovation and its spread to many sites. Throughout this paper, I adopt the broader definition of success for both innovation and reform in which productive scaling "requires *depth* (consequential change in classroom practice), *sustainability* (maintaining changes over time and in new contexts), [and] *spread* (diffusion to many classrooms and schools)" along with a *shift in ownership* from the individual to the collective as change becomes embedded in everyday practice (NASEM 2025, 4, emphasis mine; see also Coburn 2003; Cohen and Mehta 2017; Dede 2005). Notably, neither of these definitions considers the impact on learners as central to the definition of successful scaling. Impact undeniably should be the ultimate goal of any innovation and reform. However, for this investigation's purposes, outcomes are held as a constant or a given in order to focus instead on how innovation spreads.[1]

FRAMEWORK OF BOTTOM-UP INNOVATION

Based on research synthesized in this report, successful scaling of educational innovation involves three phases: the initial catalyst; adoption and adaptation beyond the original context; and eventual scaling and sustaining, often taking shape as a larger reform effort. This investigation explores the mechanisms and factors that dominate each phase. In the

FIGURE 1 Framework for bottom-up innovation in education



framework, depicted in figure 1, "outcomes" remain a black box—impact is presumed but not the focus; the emphasis lies on whether and how innovations spread. Some of the key conditions intentionally appear in more than one stage of the spread of innovation or in a different position (i.e., policy is a sub-element in the catalyst and spread stages but a separate element in the scale and sustain stage). The repetition of these conditions underscores their significant role in the spread of innovation, while also providing a way to capture the shifting shape and influences they have at different stages of the process.

As shown in figure 1, the original education innovation arises from the interplay of a problem to solve, an idea to address it, and action to implement the idea. Many innovations stop after solving the initial problem. However, if the outcomes connect with conducive environments, networks, and infrastructure, the innovation may transfer to other schools or districts. During this stage, the innovation shifts as it gets adapted in new contexts, indicated as different-colored lightbulbs in figure 1. In the final scaling and sustaining phase, conditions in the environment, policy, and infrastructure of education systems contribute to the innovation's ability to reach many more contexts, with the potential to become a full-blown reform effort.

In the complex and real world, little happens in the linear and clean fashion depicted in figure 1. Nevertheless, the model provides a means to more clearly identify the various mechanisms that help or hinder the process of productive bottom-up change in education.

The potential for education innovation to emerge exists at all system levels—from classrooms to statehouses. Yet researchers note that it is "very rare for an innovation to get diffused within a school and it is much rarer that it gets diffused between schools" (Pálvölgyi and Horváth 2023, 85; see also Dede 2005). The scarcity of documentation or research related to bottom-up innovation may reflect the fact that bottom-up innovations often appear banal

and get overlooked; as Tyack and Cuban (1995) point out, blackboards and indoor plumbing were the hot innovation topics du jour in the 1920s. Researchers are unlikely to pick up on or study seemingly mundane changes in schools—today's equivalent of adding a blackboard to every classroom. It may be just as likely that a century-plus of a decentralized yet mandate-heavy and demoralized system stifles productive innovation growth and spread, offering little to study. Either way, this report fills a gap by synthesizing existing research into a framework through which to understand the barriers, benefits, and boons to bottom-up innovation.

WHY THE DIFFUSION OF INNOVATION MODEL FALLS SHORT IN EDUCATION

Researchers and implementers may be tempted to equate spreading bottom-up ideas with Rogers's innovation curve (see sidebar). There are a number of reasons this is a false quest when tracking education innovation. In part, this is due to the highly human and relational-intensive nature of teaching and learning, coupled with the "more regulated environment and very different stakeholder relationships than organizations in the private sector" (Pálvölgyi and Horváth 2023, 85). Rogers himself cautioned about a "pro-innovation bias," or assuming innovations ought to be adopted and therefore should diffuse, which is not always true, as in the case of "cigarettes, nuclear weapons and crack cocaine" (Rogers 1995; Simpson 2000, 9–10). Warford (2010) tested the usefulness of Rogers's diffusion curve to study innovation in education, finding it a useful starting point but insufficient due to "dynamic socio-organizational forces" unique to education (16). Even if an innovation reaches critical mass in one education context (e.g., a whole school), diffusion to others (e.g., multiple schools in the same district) is not a foregone conclusion and cannot be used as a predictive model at any level of analysis.

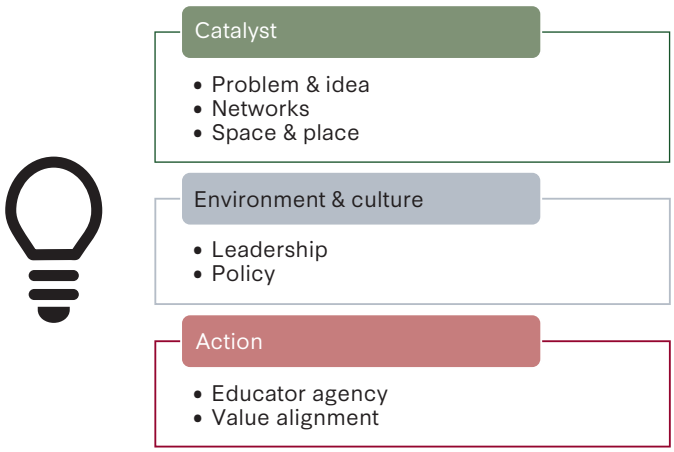
ROGERS'S DIFFUSION OF INNOVATION

In 1962, Everett Rogers proposed a theory of innovation spread in which "(1) an innovation (2) is communicated through certain channels (3) over time (4) among the members of a social system" (Rogers 1962). His empirical research established an elongated S-shaped adoption curve in which the innovation spreads through a small percentage of early adopters, then through a large and quickly growing set of early- and late-majority adopters, and is eventually adopted by the remaining small percentage of highly change-resistant "laggards." In the decades since Rogers first proposed the diffusion of innovation (DOI) model, the DOI curve has become one of the most widely used means to chart the pace and spread of innovation in any number of sectors.

CATALYZING BOTTOM-UP INNOVATION

To understand where bottom-up change originates, we must ask: Where do teachers, school leaders, or district personnel get innovative ideas? How do these ideas spread from classroom to classroom and beyond? What makes them likely to be implemented locally? At this

FIGURE 2 Mechanisms facilitating or hindering the start of innovation



stage, catalysts for moving from idea to action involve defining a problem or need, access to new ideas, alignment with values, and the ability to take productive action (see figure 2).

CATALYST

A bottom-up innovation does not appear out of thin air. Rather, it is a combination of needs, ideas, relationships, and exposure.

Problem and Idea

The sources of innovation boil down to the desire to solve a problem or exposure to a new idea. The innovation itself is a result of interactions with ideas, changes, or examples adapted to one's context (Drucker 1985). Sometimes, this involves repurposing old ideas or combining existing strategies. For example, AVID emerged as a single teacher's response to the "system shock" of newly integrated classrooms in a school that failed to support marginalized learners adequately.

Networks

Knowledge transfer and learning in organizations is a social endeavor, often informal, anchored in the exchange between an individual and their trusted networks (Kauffeld et al. 2025). It comes as no surprise, then, that the genesis, growth, and diffusion of education innovations are deeply rooted in the teachers' relationships, or what network theorists call "relationally embedded and context-dependent" (Daly et al. 2014; Rodway et al. 2021, 151). For example, a study of teachers in Norway found that "the most innovative teachers tend to have the largest personal networks . . . while also being highly interconnected" (Blumenschein and Hannisdal 2024, 2837). The same study found that these informal networks "have a significantly stronger impact than formal organization on individuals' decision to engage in change behavior" (Blumenschein and Hannisdal 2024, 2828).

Collectively, these knowledge transfer and network theory studies indicate that new information is a key innovation source, but specific training or formal exposure to outside ideas (e.g., required professional development) may not be as strong a catalyst as organic networks. Following this, an understanding of how knowledge reaches innovators is crucial. Rodway et al. (2021) identify knowledge brokering as both a function of one's social position (being respected, trusted, and well-connected) and one's defined role within an organization (e.g., part of your job is to interface with new ideas). While even educators often look to external intermediaries and organizations for fresh ideas, school-level practitioners are important but often overlooked knowledge brokers (Rodway et al. 2021). Innovative ideas tend to come from a relatively small number of well-networked or designated personnel at the local level, and they spread because other teachers have relationships with these insider innovators.

Space and Place

Physical space also serves as an innovation catalyst through informal exchanges in hallways, teacher lounges, and department meetings (Sharif 2022; Rönnlund et al. 2021). Corridors, often underestimated as mere passageways, provide opportunities for encounters, learning, collaboration, and celebrations that can disrupt the status quo (Sharif 2022). Despite the image of the teacher as a lone actor behind a closed door, schools are in fact "fairly porous institutions" that change over time to reflect the broader culture, making osmosis a "powerful, if underappreciated, mechanism for change" (Cohen and Mehta 2017, 649). Together, these observations suggest that the use of the school building and community connections can serve as generative spaces to gain new ideas—or to further isolate teachers.

ENVIRONMENT AND CULTURE

The environment and culture in which ideas germinate help determine whether those ideas move from concept to action.

Leadership

School leaders can foster a culture that is conducive to innovation through professional learning communities that focus on collaboration, shared vision, learning, reflective inquiry, and transparent exchange of practices (Puchner and Markowitz 2023; Vieluf et al. 2012). Practical means such as book studies, modeling, frequent communication, weekly emails, and a noncoercive leadership style help embed innovation as a school-wide philosophy (Puchner and Markowitz 2023). Lane et al. suggest additional means for departments to build cultures that "support transformative teaching practices," such as incorporating peer review, student work, or shared metrics into annual reviews and regular reflective practices (Lane et al. 2022, 12).

On the other hand, evidence shows that school leaders may have a tendency to squash a generative culture by preemptively placing restrictions on bottom-up innovation. Miller and Lee found that only 31 percent of 128 barriers that principals identified were actual statutory barriers; the rest were perceived or negotiable with waivers or creative solutions (Miller and Lee 2014). Perceived barriers included "barriers to pursuing instructional innovations, barriers

to changing resource allocation, and barriers to improving teacher quality," when in fact "a minority of these barriers were real" (Miller and Lee 2014, 3).

Policy

Whether real or perceived, the federal and state regulatory environment shapes the culture for innovation. At the individual or classroom-to-classroom level, the ability of an innovation to emerge and take hold relies on the "disposition of the members of a system to accept, implement, and use a certain innovation" (Blumenschein and Hannisdal 2024, 2829). Meanwhile, bureaucracies like the centuries-old education system are optimized for control and efficiency, fostering rigid rules and rewarding compliance (Tyack and Cuban 1997). This rigidity discourages "thinking outside the box" and cultivates a risk-averse culture among civil servants such as educators (Education Futures Council 2024; Kretchmar 2021; Olsen 2021). Decades of emphasis on standardized test scores have conditioned educators to avoid failure, which can stigmatize schools and communities. As a result, new initiatives may evoke fear of failure and loss of the status quo (Nguyen et al. 2023).

In other words, teachers have been conditioned by the policy environment to avoid innovative practices in favor of business as usual. Bureaucratic structures naturally create environments hostile to the agility needed for innovation, leading to a self-perpetuating cycle of resistance (Kretchmar 2021).

TAKING ACTION TO INNOVATE

Innovation will not spread if educators do not try new ideas. While policy and regulation can produce an environment hostile to innovation, teachers may be further inclined to resist innovation when they are shut out of policy development to begin with. Conversely, attention to factors that support educator agency and smooth the path to implementation are more likely to result in action.

Educator Agency

Educators—like most of us—resist when not included in the ideation process. Elementary school teachers implementing innovative practices revealed that those who felt excluded or undervalued were less likely to implement the practices (Puchner and Markowitz 2023). At the higher education level, Lane et al. found that faculty using innovative practices "were less likely to discuss teaching with others who did not use such practices," thus reinforcing silos (Lane et al. 2022, 8). A study of Scottish teachers found that even when educators were encouraged to take part in developing innovation policy, the lack of authentic support for their navigation of the policy process masked a deeper exclusion, leaving teacher leadership fragile and feeling performative (Beck 2024).

Years of focus on standardized testing, the pandemic, political upheaval, and an endless layering of new initiatives on top of each other have led to high educator burnout and loss of collective efficacy (Steiner et al. 2025). Adding expectations of innovation without addressing existing overload can worsen outcomes, causing initiative fatigue and distrust (Nguyen et al. 2023).

Consequently, "burnout-related resistance can occur as a way for staff to conserve their energy and well-being or even as an act of self-preservation" (Nguyen et al. 2023, 3). Confusion, burnout, and exclusion are not a sound recipe to foster the spread of bottom-up innovation, whereas increasing teacher inclusion and agency holds promise.

Align with Values, Address Immediate Issues, and Be Easy to Implement

Studies of school reforms find that teachers are most likely to actually implement the innovative practice when it aligns with their already-held beliefs: "Ideas that stick are philosophically compatible with how teachers think" (Cohen and Mehta 2017, 687; see also Schneider 2014; NASEM, 2025).

Many of us who have spent time coaching teachers have had some version of the realization that "They're only going to pay attention if I give them something they can use in the classroom tomorrow." Research supports that not only is this a strong coaching approach but it also applies to nearly any kind of classroom change or innovation. Teachers embrace new practices that can be used immediately or easily added to existing methods, like chalkboards in the 1920s or overhead projectors in the 1980s (Cohen and Mehta 2017; Schneider 2014; Tyack and Cuban 1997).

A challenge at this early stage is that innovation often introduces new language and ambiguity due to a fluid, trial-and-error approach. Lack of consistency can create confusion, which in turn can cause teachers consciously or unconsciously to disengage (Nguyen et al. 2023; Puchner and Markowitz 2023). Drawing clear connections to known language or existing practice will help smooth the uptake of a new practice or concept.

SPREADING BOTTOM-UP INNOVATION

An innovation moves from the initial catalyst into the next stage when it is adopted beyond the original classroom or school. In the AVID example, this occurred organically at first, as educators moved to other schools in the district or county, and then with more intentionality, when Swanson received funding and research partnerships to spread the work across San Diego County. Factors influencing spread include environment and culture, networks, and infrastructure, all of which either facilitate or hinder growth of the bottom-up innovation (see figure 3).

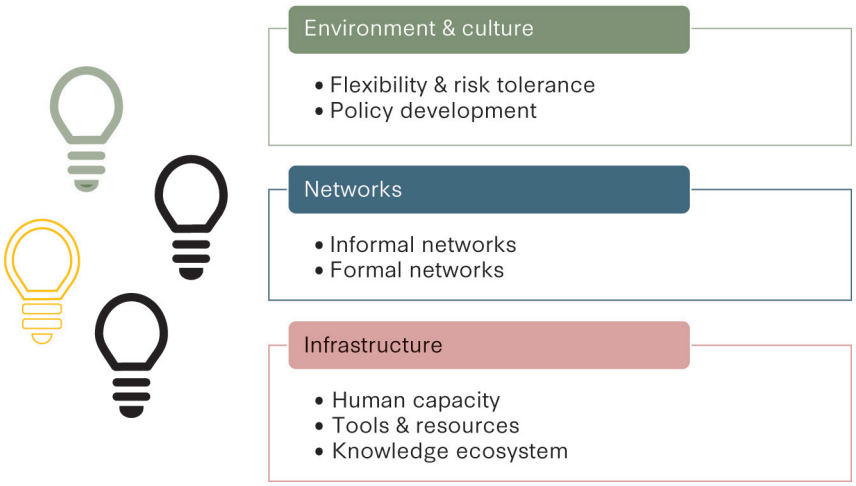
ENVIRONMENT AND CULTURE

Many of the influences on the learning environment and culture at the catalyst stage—facilitative policy, easy adoption, and agency—continue to be important as the innovation spreads to other contexts. Additionally, factors such as flexibility and risk tolerance become more important to keep the innovation growing.

Flexibility and Risk Tolerance

Flexibility and risk tolerance are crucial to the spread of innovation. Numerous studies have shown that both initial spread and large-scale change call for a certain level of risk tolerance,

FIGURE 3 Mechanisms facilitating or hindering spread of innovation



which in turn is bolstered by intentional relationship building; mutual trust; and frequent, transparent communication (e.g., Farrell and Coburn 2017; Rodway et al. 2021; Wolfe and Fernando II 2024).

NASEM found that spread beyond initial classrooms is more likely when innovations have a clearly stated core program yet allow room for adaptation to different contexts and learners (NASEM 2025). Despite founders' and evaluators' insistence on the need for implementation fidelity, it is often implementation flexibility that proves more effective to spread change.

Policy Development

At this stage, formal and informal policy—and the kind of environment they produce—intertwine to help or hinder the spread of bottom-up innovation. Innovation is more impactful when teachers collaborate "with each other and with policy advocates, sharing goals and tactics, supporting each other in assessing progress and surmounting obstacles" (Tyack and Cuban 1997, 83).

Likewise, NASEM found that if the innovation is developed by a policymaker, university, or other organization outside the K–12 system, partnering in meaningful ways with school leaders and teachers "can provide developers with in-depth insights into how contextual factors influence implementation and outcomes. These insights can guide subsequent improvements" (NASEM 2025, 5). Involving those closest to the learning enterprise—teachers—is hardly a new concept (perhaps first originating with Horace Mann's establishment of public education and professionalizing of teaching in the 1840s in Massachusetts). In the case of AVID, growth in the 1990s involved formal guidance and regulation through county offices while still retaining the original creator and several teachers as key staff (Hubbard and Ottoson 1997).

NETWORKS

Networks serve to help catalyze innovation by introducing new ideas. As innovations spread, networks play a more central role, serving as a key mechanism for implementation in new places.

Informal Networks

Researchers in both the social capital and network theory traditions agree that connections to individuals with broader networks bring richer resources and broker diverse knowledge that helps to spread the new practice (Rodway et al. 2021, 152). Studies of social capital and network distribution also suggest that indirect means of facilitating implementation are effective, such as setting up feedback sessions where educators can share their experiences using the new practice (Warford 2010). External partners can offer valuable support in this regard, providing "tools, expertise, and other resources to support change and improvement in school systems" (Farrell and Coburn 2017, 137).

Formal Networks

While educators seek new ideas through informal networks, new practices spread when supported by some formal structures. When aligned with educators' orientation and values, formal networks and intermediaries amplify bottom-up ideas for broader impact. For example, a study of an innovative mathematics professional learning network (PLN) across several large districts in California showed that with some "modest" adjustments to a typically informal structure, the PLN was able to increase connections for individuals outside of their "everyday community," leading to higher-quality ties (connections) "as participants strengthened their relationships with colleagues" (Rodway et al. 2021, 149, 159). "The most active knowledge brokers in this network, regardless of their formal organizational position," wound up with more "tools in their toolbox" that they could use to support others in implementing the new practices (Rodway et al. 2021, 159). The spread of innovation is often supported at this stage by other kinds of networks, such as through nonprofit intermediaries and education service agencies (Center for Public Research and Leadership 2017; Rodway et al. 2021).

INFRASTRUCTURE

Ease of implementation helps bring ideas to action in the catalyst stage. However, translating even easy practices across numerous contexts introduces additional complexity in which capacity, tools, and knowledge capture and use become important.

Human Capacity

An educator's ability to implement a new practice in multiple settings rests on the interplay of skills, partnerships, and time. Similar to the catalyst stage, ideas that manage to transcend one talented teacher must be value-aligned and relatively easy add-ons, and, as they spread, must also be "simple enough in their core that they are easily transportable across contexts" (Cohen and Mehta 2017, 687; see also Schneider 2014). However, more complicated innovation adoption is possible when coupled with context-relevant professional learning or other

activities to build the capacities of individuals or organizations to implement the innovation (NASEM 2025, 5).

The spread of a bottom-up innovation means that educators accustomed to immediate peers and leadership face new partnerships with district administrators, intermediaries, researchers, and policymakers and are often unprepared for the changing norms, expectations, and pace that result (Beck 2024). Likewise, external partners tend to underestimate the district and education personnel's readiness and availability to work with them, and they may not allot enough time for the effort or have the kind of flexibility that working with districts calls for (Farrell and Coburn 2017; Pietsch et al. 2023). The inevitable turnover of the original creators and supporters of the idea also threatens innovation's spread. To counter this, it is "critical to build in structured opportunities to 'onboard' new enactors" (NASEM 2025, 227; see also McLaughlin and Mitra 2001). Some of AVID's success may have been due to having the original founder and teachers participate well into the spreading and scaling stages, giving them time to adapt to new partnerships and bringing consistent leadership to the effort.

Last, innovations cannot always be add-ons. Smart capacity building must consider what educators can let go, as layering innovations without adjusting existing practices often leads to burnout and retrenchment. All too frequently teachers are asked to implement the latest innovations "without consideration of how these fit with existing practices and materials, and what might be best to set aside or forgo" (NASEM 2025, 227; see also Schneider 2014; Tyack and Cuban 1997).

Tools and Resources

The spread of an innovation depends not only on building educators' skills to implement the practice but also on the infrastructure in school systems and the ability to produce usable products for schools (NASEM 2025). A recent study from The Common Group and collaborators found that basic tools in schools and districts such as administrative software (e.g., student information systems and human resource information systems) may pose significant barriers to the spread of local innovation from one district to another (Vinton et al. 2025). The NASEM report indicates that spreading beyond initial innovation sites calls for tools and materials, a manufacturing and distribution system, and usually professional development for teachers to implement effectively, "which requires project staff to create and implement training programs on an ongoing basis" (NASEM 2025, 152). Unlike AVID, which benefited from local funding for early tools and materials production, the tendency at this stage is for bottom-up innovation to stall out from the mismatch between the basic resources needed to disseminate ideas and the idea's originators being "ill-suited to selling and distributing products" (NASEM 2025, 152–53).

Knowledge Ecosystem

Innovators and implementers often miss a step in the pursuit of spreading a new idea or practice due to the weakness of the knowledge ecosystem in education. As new practices begin to spread, supporters face a common challenge to determine whether to focus on replication, gather diverse input and test models, or release ideas for adaptation to context. In one

of the few experimental studies of replication versus adaptation, Quinn and Kim (2017) found that experienced educators or those trained in the practice performed better when allowed to adapt the innovation (a reading intervention), while inexperienced teachers benefited from the guidance of a formal replication. Similarly, Pietsch et al. (2023) note that "in situations in which complicated or complex challenges are present (i.e. where radical innovations are required in response to paradigm shifting situations—such as that of Covid-19 pandemic, or the emergence of new technologies, such as ChatGPT AI)," many different partners and formal structures are important to bring in a diversity of ideas and experiences (206). Conversely, incremental innovations focused on sharing effective practices do not require complex and potentially cumbersome structures (Pietsch et al. 2023). Lacking a robust knowledge-sharing and management ecosystem, innovators at this stage are not equipped to do a more careful "analysis of the 'fit' of the reform in the local context" and may overlook important spread factors such as the complexity of the innovation and the receiving educator's skill level (Raymond 2023, 9; see also Quinn and Kim 2017). As result of incomplete or absent knowledge, the means to spread innovation become hit-or-miss and costly in both financial and human capital.

SCALING AND SUSTAINING BOTTOM-UP INNOVATION

Despite many challenges, with the right nurturing conditions, innovations originating locally may persist through early growth stages and achieve midlevel institutionalization, eventually spreading to many districts, often with state or federal support. Few examples follow a pure bottom-up trajectory such as AVID's and the linear approach suggested by this paper's framework. However, we can impart numerous lessons from broader reform and diffusion studies. Again, we see similar mechanisms at play from the first two stages: environment and culture, infrastructure and capacity. In a departure from the earlier stages, policy stands out as being a direct mechanism for scaling and sustaining innovation, whereas in earlier stages it has a more indirect influence through the environment or educator agency (see figure 4).

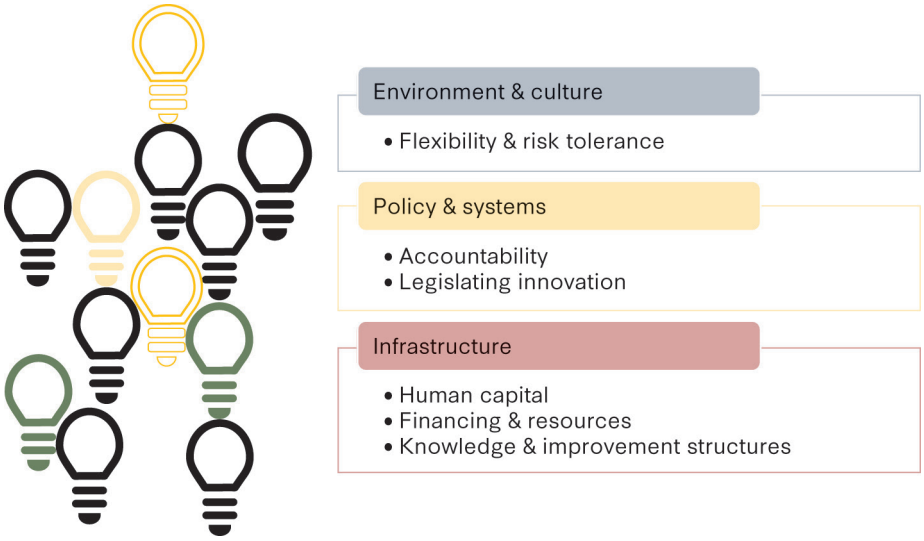
ENVIRONMENT AND CULTURE

Individuals' orientations to flexibility and risk across the education ecosystem significantly affect innovation's ability to scale and sustain.

Flexibility and Risk Tolerance

Earlier, it was noted that school leaders may preemptively block innovation due to misperceived regulatory constraints. Real barriers, such as restrictive labor agreements, further limit principals' ability to staff schools with innovative, risk-tolerant personnel (Miller and Lee 2014). Even if innovative leaders seek to build a culture of flexibility and risk tolerance, the teaching profession as a whole attracts individuals who are more risk averse than the general population (Ayaita and Stürmer 2020; Bowen et al. 2015; Harris 2021). And while the compliance-oriented system causes most teachers to react with fear of failure, policymakers also "tend to be failure-avoidant, linear thinkers while . . . innovations often need a few failures along the way as they're implemented, adjusted, and embedded into widespread practice. So, there lies the rub: The very conditions that social science innovations need in order to flourish are the conditions that public bureaucracies repel" (Olsen 2021, 2).

FIGURE 4 Mechanisms facilitating or hindering the scaling and sustaining of innovation



Collectively, the risk-averse orientations of teachers, leaders, and policymakers often hinder innovation's ability to scale and sustain. And yet, for innovation, adaptability is crucial. Reforms that support adaptation rather than strict fidelity perform better in the localized and individualized contexts of classrooms and schools (NASEM 2025). Dede warns against the "replica trap" whereby misguided or misinformed innovation supporters repeat the "erroneous strategy of trying to repeat everywhere what worked locally, without taking account of local variations in needs and environments" (Dede 2005). Innovative efforts that successfully scaled and sustained, such as Sizer's Coalition of Essential Schools, Levin's Accelerated Schools Project, Comer's School Development Program (which gave rise to the community school movement), and AVID illustrate this theory; all articulated clear design principles and offered significant support and infrastructure without demanding strict adherence to manuals or predetermined steps (Tyack and Cuban 1997).

Along with flexibility, patience is key. To reach scale and sustainability, innovators need time to struggle, improve, and spread the work. AVID took close to a decade to reach a level of scale in one county and forty years to reach What Works Clearinghouse Tier 2 recognition and millions of students. The AVID example is a striking reminder that while organizational culture and structural shifts can be rapid, instructional shifts require time to stabilize and demonstrate results (Raymond 2023, 10). As Raymond explains, the "expectation of quick results creates multiple harms," including not providing enough time for a reform to truly take root or "the space to iterate toward success. Moreover, it seeds unrealistic expectations about the diligence needed to give new approaches their due. From a political vantage, it gives the doubters and pouters a head start on declaring new reforms a failure" (Raymond 2023, 10–11).

While bottom-up innovation favors more organic and patient circumstances, the "bias toward quick returns and the lack of political will or appetite to invest in long-run solutions" cause a sense of constant churn and inability to demonstrate meaningful results (Raymond 2023, 11).

POLICY AND SYSTEM ARCHITECTURE

In addition to the indirect role policymakers' mindsets and biases play in innovation's spread, policy has a direct influence on the ability for new ideas to scale and sustain.

Accountability

The US education system is a confounding mix of open structures and weak central control coupled with top-down mandates and punitive accountability measures (Cohen and Mehta 2017; Education Futures Council 2024). The NASEM consensus report on scaling STEM innovation stresses the need for infrastructure, federal and state coordination, collaborative oversight, and long-term investment. Instead of burdensome regulations and a narrow focus on student achievement metrics, NASEM calls for accountability structures that reward leaders who create opportunities for ambitious teaching approaches (NASEM 2025). Studies in diverse geographies examining Georgia's innovation framework; Sweden's push for classroom-initiated, student-centered changes; and an innovation policy mandate in Catalonia, Spain, came to similar conclusions that bottom-up innovation struggles to emerge "when it's done under the weight of accountability—just as high-stakes accountability on a test will conflict with that test's ability to support formative instruction in a classroom" (Timberlake 2023; see also Quilabert 2024; Rönnlund et al. 2021).

Legislating Innovation

Even when policy leaders acknowledge that a particular top-down mandate did not improve teaching and learning, the related laws often remain on the books, consuming time and focus through audits and compliance mandates (Tyack and Cuban 1997). The federal government acknowledged its own issue in the *Federal Register* in 2020, noting that "institutions of higher education (IHEs) may be dissuaded from innovating because of added regulatory burden and uncertainty about how the Department will apply its regulations to new types of programs and methods of institutional educational delivery" (Department of Education 2020). This quandary has played out in state attempts to carve out space for local innovation. In concept, "district innovation zones" hold promise for fostering local innovation at scale. But these too often succumb to regulatory overload and initiative add-ons (Leadership for Educational Equity 2018). Such was the case in Georgia, which tried to pilot an effort to put local educators in the driver's seat of assessment reform, only to withdraw from the Innovative Assessment Demonstration Authority (IADA) after being stifled by overwhelming federal requirements (Timberlake 2023).

INFRASTRUCTURE

Regardless of where the innovative idea began (top-down or bottom-up), Cohen and Mehta (2017) find that reforms that scale successfully either provide educators with practical tools and guidance or help them leverage existing resources. As they say, "Less-difficult reforms require less capacity building while more-ambitious reforms demand more" (Cohen and Mehta 2017, 646). Researchers observe this commonsensical need at each stage of innovation spread—and yet, it remains underdeveloped in practice. This phase has drivers similar to those of the spreading phase—availability of human capital, resources, and the knowledge ecosystem—with new factors under each to fit the demands of scaling and sustaining the innovation.

Human Capital

Observing the many structural challenges for education insiders, nonsystem actors are tempted to stake their claim on striking innovation gold. And yet, these outside innovators, while "skilled in publicity and politics," have largely been thwarted in actual implementation and learner impact because they do not understand the "everyday lives of teachers," the complexity of serving the needs of a diverse student body, or how to contend with entrenched education bureaucracy (Tyack and Cuban 1997, 113; see also Dee et al. 2023). In fact, "despite this endless churn of reforms, the prevailing institutional structure of 'SEA, LEA school board, district administration, school leadership, grade/class grouping, teacher' remains largely unchanged," demonstrating the system's resiliency in the face of attempted reform (Raymond 2023, 12).

Education insiders do not fare much better, as the education workforce has a tendency toward risk-averseness, as explored earlier. In addition, teaching tends to be a profession defined by pride in autonomy rather than continuous improvement and by high levels of turnover and burnout, leading to a sense of resistance to outside changes (Cohen and Mehta 2017; Nguyen et al. 2023; Steiner et al. 2025). Furthermore, the decentralized nature of the education system and lack of a knowledge ecosystem leave educators without the kinds of professional infrastructure that other innovation-oriented professions such as scientists or business entrepreneurs can access.

Financing and Resources

An innovation's broad scale and sustainability at this stage depend on adequate resources and finance structures. Unlike diffusion mechanisms such as investment capital in business, public education reforms must "mobilize their own educational resources. That affects the scale of these reforms, for it has meant that niche reforms had to scale in—to develop their own infrastructure and other resources—in order to exist and then scale up" (Cohen and Mehta 2017, 679).

For the most part, schools don't have the autonomy or financial structures to create a new "business model" or adapt operational structures to implement an innovative idea. While the permeable borders of the school present opportunity for one-off innovations at the local level, the situation "presents a challenge for how the federal government can incentivize large-scale, sustained, and well-resourced improvement efforts" (NASEM 2025, 3; see also Cohen and Mehta 2017). Furthermore, scaling costs can be prohibitive, as was seen with the small-schools movement (Bettinger 2023). Historically, federal funding has been scarce, short-term, and insufficient to sustain innovation beyond initial grants, leaving initiatives struggling to spread or survive after the startup funding disappears (NASEM 2025; Puchner and Markowitz 2023; Quilabert 2024).

Knowledge and Improvement Structures

Both top-down reform and bottom-up innovation lack resources and structures for real-time or long-term learning or documentation of impact (Raymond 2023). Without robust knowledge structures and coherent frameworks, bottom-up innovators have no buffer between institutional pressures toward compliance demands and policymakers' impatience.

Evidence about the impact of an innovation will continue to be incoherent and not compelling, furthering the cycle that dampens innovation's ability to scale. And even with compelling evidence, the "broken links" between education research, policy, and practice prevent impactful innovation from taking hold (Dee 2025). Coupled with the lack of an "accurate scalability index" or a common definition, bottom-up innovation is reduced to an oversimplified view of scaling as replication rather than adaptive evolution, limiting our ability to capture and understand the innovation's actual impact or outcomes (Dede 2005; see also Raymond 2023).

Education Technology (EdTech) is one of the rare areas in education with documented innovation spread and dissemination capacity. However, rapid product marketing often "outpaces the ability of researchers and decision makers to keep up with evaluating [innovations]," and EdTech's many chaotic rollouts and often lackluster impact on learning outcomes leave much to be desired (NASEM 2025, 190; see also Vander Ark 2023).

Ultimately this lack of systematic knowledge capture leads well-meaning implementers to repeatedly relearn the same lessons from making the same mistakes as their predecessors.

CONCLUSIONS AND IMPLICATIONS

Fostering meaningful bottom-up innovation that has potential to scale and improve outcomes calls for major shifts across policy, practice, and research.

IMPLICATIONS FOR POLICY AND SYSTEMS

Policy and systems actors who wish to support bottom-up innovation must make substantive changes to accountability, include educators in policy-making, build knowledge, and reshape the teaching workforce.

Shift Accountability Structures and Mandates

We are overdue for an overhaul of accountability systems (Marion 2023). New accountability systems need to maintain guardrails for equity and improvement, while moving away from narrow student achievement metrics and punitive accountability approaches (Lake 2025; Marion 2023). Policymakers should build systems that reward leaders and educators who foster ambitious, adaptive teaching approaches. Bureaucrats can write regulations that maintain a clear call for positive outcomes; that still support flexible, context-sensitive implementation; and that avoid rigid replication mandates.

Reorient Policy and Resource Allocation Toward Inclusion and Patience

Policy must move beyond window-dressing involvement of the people with intimate day-to-day knowledge of the classroom (Beck 2024, 30; Grant 2024; Tyack and Cuban 1997). Meaningful engagement means not only adding a seat at the table but also removing procedural barriers and investing in the time and capacity needed for teachers to participate in shaping innovation and policy (Beck 2024; Quilabert 2024). This includes funding and accountability that

support productive risk-taking in the short term and sustainable implementation in the long term. Effective engagement of frontline educators will result in policy that has a better likelihood of taking hold at the local level in the manner intended.

Build a Knowledge Ecosystem for Innovation-Connected Learning

Innovation efforts must be accompanied by infrastructure for professional learning, short-cycle evaluation, and adaptive improvement. Embracing "fail-forward" cycles—where ideas are tested, studied, and iterated—can prevent the rinse-and-repeat pattern of ineffective reforms. Without mechanisms to study, adapt, or abandon innovations, schools continue to use ineffective practices simply because they "feel" like they should work. Many innovations fail (and perhaps should!), but a system that learns from failure can still thrive and grow (Dee 2025; Education Futures Council 2024; Grant 2024; NASEM 2025).

Give the Profession a Makeover

Schools cannot be agile sources of innovation without a workforce that embraces inquiry and experimentation. The current profession attracts and rewards risk-averse individuals instead of those with experimental mindsets. Recruiting, hiring, development, evaluation, and advancement systems must evolve to support risk-tolerant and collaborative individuals (Ayaita and Stürmer 2020; Bowen et al. 2015). Innovation will thrive if teaching is reframed and rewarded as an inquiry-based-improvement profession, not a compliance-and-delivery mechanism (Beck 2024; Tyack and Cuban 1997; Warford 2010).

IMPLICATIONS FOR PRACTICE

Education leaders, intermediaries, and coaches seeking to spread bottom-up innovation need to embrace flexibility, normalize continuous improvement, foster rich networks, and support educator capacity.

Embrace Tight-but-Loose over Replication

Since the 1970s, scholars have argued that mutual adaptation in the innovation process overshadows any specific treatment, replication, or funding strategy (McLaughlin 1976). Yet replication remains the dominant model and mindset (Perry et al. 2022; Peurach and Glazer 2012). As Hubbard and Ottoson (1997) warn, "innovations that are frozen as knowledge creations in time and context . . . cannot mutually adapt elsewhere" (47). Instead, a "tight but loose" framework allows innovations to stay true to their principles while adapting to diverse contexts (Thompson and Wiliam 2008, 1; see also NASEM 2025).

Make Continuous Improvement and Learning the Norm

In addition to the macrostructures needed for a knowledge ecosystem, district and school leaders can instill a stronger continuous improvement mindset and structures at the local level. Leaders can encourage iterative improvement through regular reflective cycles like a plan-do-study-act structure that adapts well to the classroom context (Dee 2025).

Nurture Intentional and Productive Networks

Local diffusion thrives in environments that support collaboration, trust, and informal exchange (Lane et al. 2022; Sharif 2022). Building "collective capacity" is as important as the innovation itself (NASEM 2025, 173). However, ideas and networks are not neutral, as knowledge brokers "are not always prosocial beings nor necessarily equipped with the most up-to-date knowledge," underscoring the need for diverse, well-connected networks (Rodway et al. 2021, 161). Network theorists and others advocate for building more connection points for educators, such as through communities of practice, so that they can be better-informed consumers and users of knowledge, just as they try to impart discerning analysis skills to their students.

Support Educator Capacity to Innovate

At any stage of growth, innovations must be accompanied by smart tools, training, and time to implement. Yet, even with the right tools, teachers cannot simply add new practices without support or letting go of other demands. Layering on new initiatives without adjusting existing practices leads to burnout and retrenchment (NASEM 2025, 227).

IMPLICATIONS FOR RESEARCH

Researchers and evaluators of innovation can use the framework in this report to develop better means to map innovation's spread, advance measurement tools, rigorously document intermediaries, and benchmark change in the era of AI.

Capture the Spread of Local Innovation

Researchers could use geospatial heat mapping and network analysis to more rigorously track where bottom-up innovations originate and how they diffuse across schools and districts. A number of states have tried to establish a policy environment that is more conducive to local innovation (e.g., Kentucky, Indiana). These states offer fertile ground for mixed-methods studies to chart the spread, scale, and challenges of bottom-up innovation in real time. A more accurate understanding of the speed and spread of innovation would open up impact and outcome studies that are not currently possible.

Advance Measures and Definitions of Innovation

The study of innovation suffers from a lack of both more precise definitions and an ability to capture and document impact for the more basic practice changes that can result in significant pedagogical shifts. Without a proper "scalability index," comparability and longitudinal studies are nearly impossible (Dede 2005; see also Raymond 2023). Education researchers could develop more-testable frameworks that account for and better predict depth, spread, sustainability, and ownership shift while also incorporating measures of educator agency, contextual fit, and implementation capacity (Coburn 2003; NASEM 2025). Following the conditions laid out in this synthesis, researchers could now empirically study the barriers and enablers to better refine our understanding of predictability of networks, knowledge brokers, physical spaces, policy environments, leadership culture, and more (Beck 2024; Miller and Lee 2014; Rodway et al. 2021; Sharif 2022). Also, researchers should develop methodologies

to identify and study "mundane" innovations before they disappear, recognizing that small, context-sensitive changes often drive meaningful improvement.

Document the Role of Intermediaries

Researchers, funders, and practitioners have long known that external partners such as nonprofits, universities, and education service agencies play a critical role in supporting innovation (Center for Public Research and Leadership 2017). Yet, their impact is uneven. Future studies could more rigorously document the impact, costs, and capacity for intermediaries so that they better align with educator values, build capacity, and avoid imposing rigid models that stifle local adaptation (Center for Public Research and Leadership 2017; Coburn 2003; Pietsch et al. 2023).

Use the Advent of Artificial Intelligence to Test Innovation Theory

Artificial intelligence (AI) is the first technology since the personal computer and internet to prompt nearly universal expectations that it will create "fundamental changes—for better or worse—in education, the workforce and human cognition and behavior" (Crabtree et al. 2025, 8). In contrast, education change has long been held to slow and steady evolution, despite more than a century of numerous attempts and promises to reform at a quicker pace. The coming AI revolution far from renders the mechanisms of bottom-up innovation immediately obsolete. Future research will benefit from a comparison of the new reality to this paper's framework. This comparison will enable researchers to better evaluate whether the changes wrought by AI are truly seismic and durable—or just the latest blackboards to enter the classroom in a deeply entrenched and decentralized system.

In closing, we can't get there from here if the barriers to an education-innovation ecosystem do not change in a significant way. We will find ourselves ten years hence saying what Cohen and Mehta (2017) wrote almost ten years ago: "Given the depth of the capability problem and the extent of political and cultural divisions over schooling, we suspect that fundamental change, including in the mainstream, is most likely to result from accumulating niche reforms and the capability they bring" (679).

In other words, we will continue to spin our wheels, making an exhausting number of near-constant shifts in practice and policy, while teachers continue to adapt their niche approaches on the fly. Change will occur, but any significant movement will be a result of unintended consequences of local happenstance at the hyperlocal level or of continued regulatory strangulation of the profession at the top. And neither of those scenarios will produce the kinds of positive impact on learning that our students need to thrive.

NOTES

The author wishes to thank Stephen L. Bowen and the team at the Hoover Institution Press for their thoughtful shepherding of this paper. Steve and Margaret (Macke) Raymond also provided substantive feedback that greatly improved earlier drafts.

1. For studies of the outcomes of innovations and reforms and their impact on learners, see, for example, Cohen and Mehta 2017; Dede 2005; Education Futures Council 2024; Fullan 2021; Raymond 2023; and Tyack and Cuban 1997.

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Preferred citation: Rebecca E. Wolfe, "Can't Get There From Here: A Framework for the Start, Spread, and Scale of Bottom-Up Innovation in Education," Hoover Institution, Education Futures Council, January 2026.

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