KnowledgeWorks

Cultivating Interconnections for Vibrant and Equitable Learning Ecosystems

Katherine Prince
Andrea Saveri
Jason Swanson

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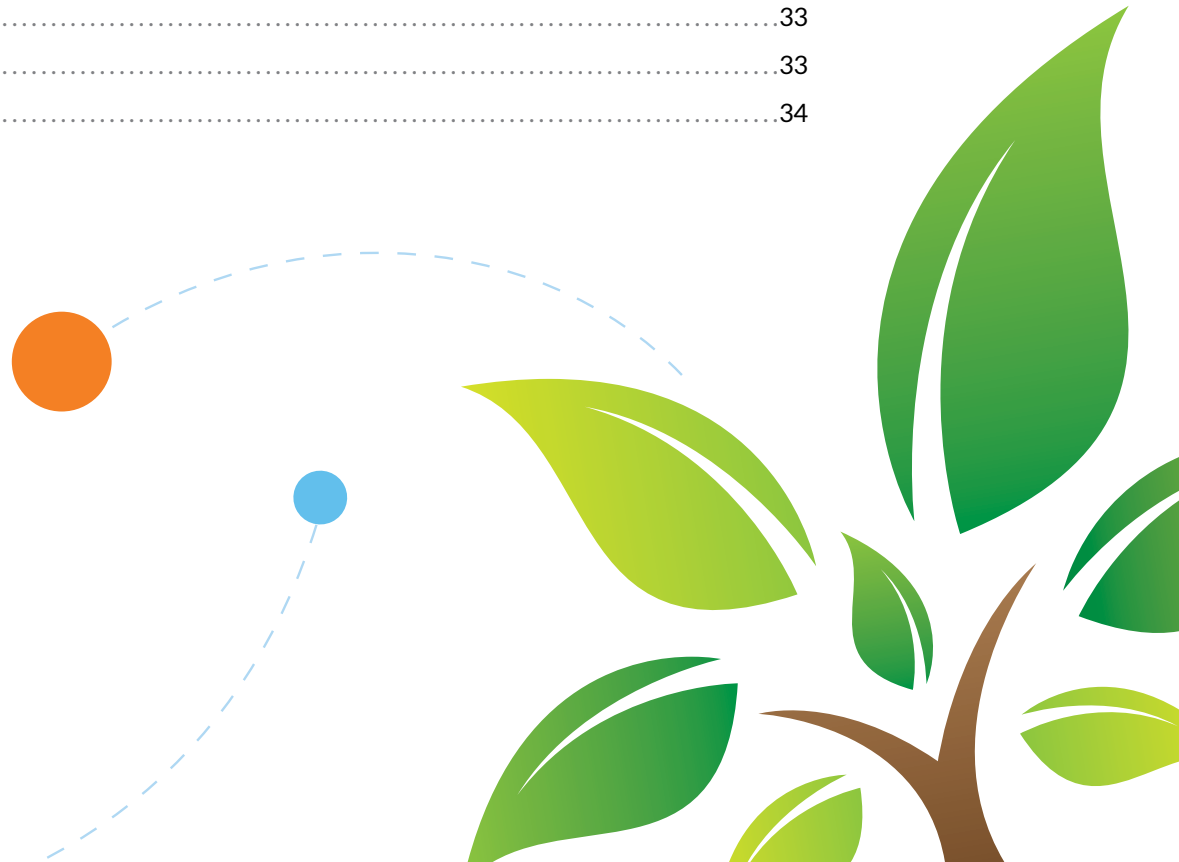


Cultivating Vibrant Learning Ecosystems

As KnowledgeWorks has explored possibilities for the future of learning in light of our current ten-year forecast, *Recombinant Education*,[1] we have increasingly come to question whether the future of learning will be equitable. We see great potential to create flexible and radically personalized learning ecosystems that meet the needs of all learners and have the adaptability to keep evolving with our rapidly changing world. But we worry that education in the United States might be more likely to end up as a fractured landscape in which only those learners whose families have the time, money, and commitment to customize or supplement their learning journeys will have access to high-quality personalized learning that reflects their interests and meets their needs.

Given these profound concerns, this paper explores how education stakeholders might cultivate the connections necessary to make the expanding learning ecosystem vibrant for all learners. As we use the term, *a learning ecosystem is a network of relationships among learning agents,[2] learners, resources, and assets in a specific social, economic, and geographic context.* Ecosystems in nature organize and interact in order to sustain life. Similarly, vibrant learning ecosystems develop effective value webs comprised of interconnected resources and relationships that sustain learning for distinct learning populations over time.

We can think of learning ecosystems as operating at multiple levels, from the entire U.S. education system, or the macro learning ecosystem, all the way down to local networks of relationships serving particular learners in particular geographies, or local learning ecosystems. Like natural ecosystems, local learning ecosystems intersect with, and sometimes overlap, one another. They also exist within the context of, and contribute to the health of, regional, state, and national learning ecosystems.

To be vibrant for all young people, learning ecosystems at any level must reflect four key attributes. They must be:

- **Learner Centered:** Learning adapts to each learner's needs, interests, and goals. Learning flows around individuals, not institutions, providing coherent services and experiences in the context of young people's needs and interests.
- **Equitable:** The learning ecosystem is diverse and flexible, serving all learners well, including self-motivated and self-directed learners, reluctant learners who struggle to engage with learning, high-need learners, and everyone in between.
- **Modular and Interoperable:** Learning providers and opportunities are disaggregated from single, monolithic institutions, yet they are easily connected through customized learning playlists and pathways.
- **Resilient:** Learning ecosystems have the capacity to adapt as the conditions around them and the needs of learning populations change.

The two guiding questions that we explore in the rest of the paper are:

1. What kinds of learning ecosystem interconnections might help participants create vibrant learning ecosystems?
2. What might learning ecosystems look like in different high-need geographies?

Making the Future of Learning Equitable

We worry about the question of equity because our current education system is not equitable, despite judicial and legislative intentions. Indeed, the income achievement gap has been growing for at least fifty years, such that "family income is now nearly as strong as parental education in predicting children's achievement;" at the same time, adults' earning potential has increasingly come to reflect educational attainment.[3] Furthermore, for the first time in recent history, a majority of students in U.S. public schools were from low-income families in 2013.[4]

The expansion of the learning ecosystem that we see coming over the next decade could help education stakeholders find new solutions to this dangerous cycle, but it could also make it easier for vulnerable learners to fall through the cracks or get left behind in learning deserts that have few or ineffective learning resources. Vulnerable learners risk falling farther and farther behind as learning services fail to meet their needs sufficiently and as their families and communities struggle to access expanded learning opportunities. (See Katherine Prince's "Glimpses of the Future of Education"[5] for further exploration of the fractured landscape and vibrant learning grid scenarios.) Our hope is that the expansion of the learning ecosystem will enable new ways of supporting learners within their communities so that every young person has full choice in pursuing his or her educational and life goals.

Examining High-Need Geographies

To help illustrate how learning ecosystems emerge from particular geographies, this section examines four high-need geographies and the challenges and constraints that tend to be especially salient for the learners who inhabit them: poor urban neighborhoods, disrupted suburbs, poor rural communities, and incarcerated settings. We chose these geographies to focus the discussion on cultivating vibrant learning ecosystems in settings in which the question of equity seems particularly pronounced and in which the risk of letting fractured landscapes emerge seems particularly high.

These high-need geographies often reflect conditions that make it difficult for learning ecosystems to become learner centered, equitable, modular and interoperable, and resilient. While the specific conditions vary from one high-need geography to another, they can be traced back to a common set of challenges:

- **Isolation** in various forms and barriers to accessing resources can prevent vibrant learning ecosystems from developing.
- **Instability** of, or extreme constraints to, an area's economic base can undermine effective planning and prevent consistent movement toward solutions that could make local learning ecosystems vibrant.
- **Cultural barriers and stigma** can prevent viable solutions from taking hold in meaningful ways. For example, cultural barriers can include how stakeholders in a particular geography define success, leading to conflicting narratives about what it means to be successful along with resulting variation in attitudes towards education. In another example, people who are incarcerated often face significant stigma, such that the general public might question whether inmates deserve access to high-quality education.

Each of these challenges manifests in the form of unique educational needs and constraints that reflect the particular geography's larger socioeconomic needs and constraints along with the needs, interests, and goals of the learners who reside there.

Poor Urban Neighborhoods

Learners living in poor urban neighborhoods are often marooned on islands of poverty, surrounded by a sea of resources that they have difficulty accessing. Despite living in such close proximity to the city at large and to the resources and institutions that it contains, learners in poor urban neighborhoods typically contend with many deprivations, including the lack of access to essential learning resources, quality teachers, and technology. These learners often experience cultural isolation and may be dealing with complex or misunderstood social narratives associated with poverty and race. In addition, they may be navigating conflicting narratives about what success means, at times placing greater emphasis on short-term gains and survival than on long-term goals. These cultural issues can create the need for educators to develop bridges and foster learning cultures that emphasize the value of education. Furthermore, learners in poor urban neighborhoods can face significant needs stemming from economic uncertainty, including a lack of employment options, concerns regarding safety, limited choices around healthy food and nutrition, and inconsistent access to health care. Such concerns can create the need to monitor whole student health to ensure that learners are not just doing well academically but are also mentally and physically healthy.

Disrupted Suburbs

Disrupted suburbs include suburban communities that are experiencing some manner of disruptive change, such as economic decline or a shift in demographics. For example, the rising cost of living in a city might force some poorer residents to move to nearby suburbs that are unprepared to deal with challenges of poverty. Or anchor businesses might move out of a region, triggering an overflow of workers searching for employment opportunities. Such disruptions can cause growing economic uncertainty, social instability, and income polarization. In fact, from 2000 to 2010 the number of poor people living in suburbs grew at twice the rate of urban areas, increasing by 53 percent to 15.3 million people.[6] Such changes can create a need for creative educational funding measures. Disrupted suburbs might also need strategies and tools for linking and sharing resources throughout the community and with nearby communities so as to ensure that all learners have equitable access to high-quality resources. Often the first generation in the area to deal with poverty and with the resulting stress, isolation, and anxiety, learners in disrupted suburbs can need support in dealing with these challenges. People in disrupted suburbs might also need to address a changing community narrative as their geography, which was once a stronghold for the middle class, shifts. As part of that process, parents and other adults might need help understanding that the old system of education that enabled them to succeed might no longer be sufficient for their children.

While the specific conditions vary from one high-need geography to another, they can be traced back to a common set of challenges.

Poor Rural Communities

Poor rural communities can include farming communities, rural towns, mountain villages, and other locations that are geographically isolated. Such communities often lack social and economic infrastructure, making it difficult to attract educators. Poor rural communities' isolation and lack of infrastructure can also create the need to expand learning environments so as to make up for the limited number of cultural institutions, such as museums and libraries, and the lack of other place-based learning options. In addition to addressing learners' limited choices about where and how they learn, educators might also need to address limited diversity of perspectives and interests through diverse learning content. For many people in poor rural communities, the limited options and resources can lead to defining success simply as meeting basic, immediate needs. This constraint can result in a need to find creative ways of both funding education, as well as a need to motivate students to finish high school and pursue post-secondary education so as to expand career options and the definition of success. Finally, learners in poor rural communities can lack access to basic health services, creating a need to develop strategies, tools, and methods for fostering health.

Incarcerated Settings

Incarcerated settings consist of places where people are confined, such as juvenile detention centers, jails, or prisons. The United States currently has more prisons than colleges,[7] and, with 2.4 million people imprisoned according to the Prison Policy Initiative,[8] inmates constitute a large population of learners with significant needs. Due to the restrictive nature of their surroundings, learners in incarcerated settings require access to learning content and need that content to be customized such that learning can help build a bridge back to society. These learners also need access to technologies and media that are tailored for use in restrictive settings. Learners in incarcerated settings also face pronounced stigma and isolation both during and after incarceration. As a result, there is a need to address the societal narrative that learners in such locations cannot learn and that being incarcerated has little to do with education. In addition, these learners sometimes need help developing new relationships to learning and often need intensive remediation.

Cultivating Vibrant Learning Ecosystems in High-Need Geographies

We need to increase the number of communities with vibrant learning ecosystems that meet the needs of all learners, especially communities in high-need geographies. To do so, education stakeholders must strengthen the structures connecting the elements of, and integrating the activities within and around, learning ecosystems and make those learning ecosystems responsive to the individuals whom they serve. The three structural roles described in the next section, which include concentration, fragmentation, and catalyzation, can help create greater interconnections within learning ecosystems in support of making them learner centered, equitable, modular and interoperable, and resilient.

We need to increase the number of communities with vibrant learning ecosystems that meet the needs of all learners.

Structural Roles for Vibrant Learning Ecosystems: Concentration, Fragmentation, and Catalyzation Build Adaptability.

Industries in many sectors are transforming into ecosystems as they adapt to the shifts brought about by the amplified collaboration and connectivity resulting from the Internet, expanded data capture and computation, and exponential innovation. According to the Deloitte Center for the Edge,[9] successful industries are responding to this shifting landscape by developing flexible ecosystems that make use of interconnected webs of services and experiences to deliver sustained value to highly user-focused markets. The same forces are at play in education. Looking ahead ten years, learning ecosystems will develop their identities and impact as stakeholders take on specific structural roles that shape the dynamics of the ecosystem, including how ecosystem participants relate to one another and how diverse elements of the learning ecosystem interconnect to provide effective learning experiences and supports for all young people.

As suggested by Deloitte, effective structural roles in ecosystems include concentrators, fragmenters, and catalysts.[10] Ecosystem participants that take on concentrator roles will deliver core infrastructure, such as platform, aggregation, and brokering services, which will provide foundational services and efficiencies for other participants in the ecosystem. In contrast, participants that take on fragmenter roles will focus on well-defined niches, differentiating their offerings to deliver high-value user experiences. Participants that take on catalyst roles will mobilize resources and attract diverse participants to forge connections across boundaries. They will also enable policies, provide venues for joint problem-solving, facilitate the articulation of shared goals, and advocate for standards that support cross-organization connection and resource sharing.[11]

When ecosystem participants combine activities associated with each of the structural roles, vibrant learning ecosystems can emerge. In vibrant learning ecosystems, concentrators, fragmenters, and catalysts will coordinate their activities to create webs of services and experiences that can deliver effective and meaningful learning experiences for their geographies and adapt to changing circumstances. While these structural roles are relevant everywhere, the challenges of coordinating them tend to be particularly pronounced in high-need geographies.

The following sub-sections describe the three structural roles in more detail. For each role, we provide a short description of what the role means for learning ecosystems, a list of current and future activities that can contribute to the creation of vibrant learning ecosystems, and signals of change that illustrate how ecosystem participants might develop learning services and supports as they aim to serve all learners well.

Effective structural roles in ecosystems include concentrators, fragmenters, and catalysts.

Concentration:

Providers of core infrastructure, aggregation, and brokering services create process efficiencies through scale.

Some ecosystem participants will use technology platforms to provide core infrastructure services for the learning ecosystem and will leverage scale to create value. These participants will offer aggregation and brokering services that support the rest of the ecosystem, creating a new backbone for diverse kinds of teaching and learning services. Their value will come from being able to consolidate services and leverage efficiencies. Today we see concentrators in areas such as school governance, education resource platforms, learning management systems, and e-portfolio development platforms. Expect concentrators to emerge in areas such as data warehousing, assessment and credentialing, management services, quality assurance, and learning agent and asset brokering services.

Current Points of Concentration

- Management and governance services such as those provided by school districts, charter management organizations, and school networks
- Open learning resource platforms, including content creation, sharing, curation, and navigation sites such as Khan Academy, OER Commons, and Gooru
- E-portfolio platforms, such as FolioSpaces and Mahara, where learners and learning agents can curate and reflect on their achievements and display badges and credentials
- Open learning management systems for teachers to organize and curate teaching and learning activities
- Learning record store systems that store and report information about formal and informal learning experiences
- Collective impact backbone organizations that provide important community infrastructure, such as data management and fundraising

Future Points of Concentration

- Brokering platforms that match expert practitioners, learning agents, and community assets with learning ecosystem needs
- Badge development platforms, such as the Open Badge Platform, which allows anyone to create digital badges that can be displayed, shared, and verified by linking them to descriptive information, credible organizations, and other data
- Quality assurance services that provide verification and validation of micro-assessments and micro-credentials
- Interoperable data warehouse infrastructure that serves large, diverse data sets
- Open innovation platforms, such as OpenIDEO and StartUpWeekendEdu, that provide infrastructure enabling distributed groups to problem solve together

By providing and scaling essential ecosystem infrastructure, concentrators will provide the “growth medium” that allows the rest of the learning ecosystem to generate and proliferate specialized, user-focused services. Their focus on providing backbone or foundational services and platforms in an ecosystem allows other ecosystem participants to create user-focused innovations and interconnections that create value for learners.

Concentration Signals

These signals of change illustrate how some learning ecosystem participants are providing core infrastructure, aggregation, and brokering services today and point toward future opportunities for ecosystem participants to create process efficiencies through scale.*

- **Open Resource Commons Aggregates Teacher-Created Resources**
  The Institute for the Study of Knowledge Management in Education's Open Educational Resource Commons is a free teaching and learning network that aggregates over 50,000 educational resources, creating a platform that educators can use to develop and improve their own teaching practices and curriculum strategies. The platform provides search and filter functions that use a rich set of descriptive data to help educators find useful, relevant, and high-quality materials. It also enables educators, learners, and other users to enrich the metadata when they tag, rate, and review materials and share what works for them. oercommons.org

- **Brokering Service Facilitates Searches for Educator Talent**
  US REAP acts as a one-stop shop for individuals seeking education positions and employers wishing to fill education positions. By connecting educators who are hiring with those who are looking for positions, the platform acts as an efficient brokering service for educator talent management. usreap.net

- **LMS Offers Flexible Infrastructure for Classroom Management**
  Moodle is a free, open-source learning management system (LMS) that acts as a backbone classroom management tool. For those needing functionality beyond the routine tasks that Moodle handles, Moodle Extensions allows educators to configure their own customized learning management toolkits for niche uses while still drawing upon the LMS's core infrastructure. moodle.org

- **Interoperable Data Warehouse Infrastructure Enables Integrated Services**
  Versifit offers end-to-end data warehousing backbone services and analytics reporting, enabling individual schools, school districts, and statewide school systems to become more strategic and target interventions more efficiently through data-driven decision-making. versifit.com

- **Global Open Innovation Forum Supports Collective Problem Solving**
  Open IDEO enables sponsors to host design challenges and distributed groups to solve them in order to promote social good. The platform provides an established framework and process, along with analytics, that contributors can use when collectively creating innovative solutions to big challenges in critical areas such as health, food, energy, education, and transportation. openideo.com

** Throughout this paper, the signals of change represent a range of current developments spanning diverse dimensions of the learning ecosystem and pointing to future possibilities. Using current signals of change as the basis for forecasting the future is a core strategic foresight technique.*

Fragmentation:

Creative niche specialists target user needs and customize services.

Other ecosystem participants will focus on niche markets, leveraging the backbone services provided by concentrators to deliver specialized, high-value products and services. These niche participants will be able to address particular teaching and learning needs by building specialized services on top of the core infrastructure, aggregation, and brokering services provided by concentrators. Creative and productive fragmentation will expand in areas that support personalized experiences and customized services. Look for fragmenters to continue diversifying school formats and learning venues, classroom models, and professional learning communities. New fragmentation activities will emerge in micro-assessment and micro-credentialing approaches, increasingly specialized learning agent roles, data analytic interfaces and reporting tools, and creative uses of education innovation spaces and processes.

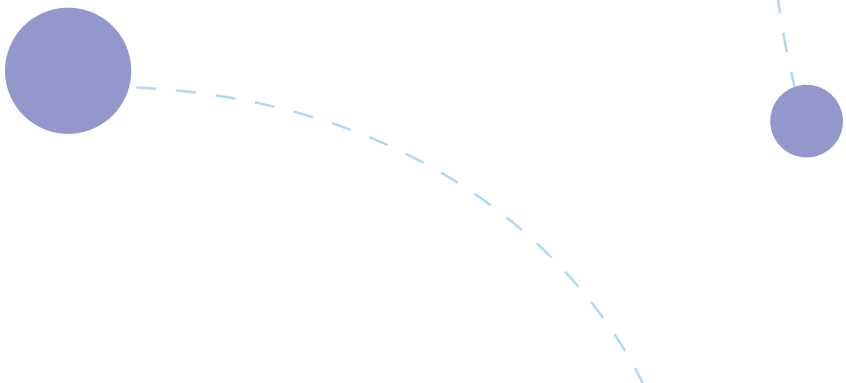
Current Points of Fragmentation

- Classroom formats, including blended, virtual, and project-based learning
- School formats, including cyber schools, home and custom schools, maker and studio school models that emphasize learning by doing and through authentic work, and pilot schools
- Community learning venues and providers, including museums, parks, science centers, maker centers, and other community organizations
- Professional learning communities that support teacher development and networking
- Learning and instructional apps, including educational games and skill-building tools
- Performance-based micro-assessments that provide formative feedback for use in learning
- Stackable micro-credentials that enable learners to demonstrate mastery in relevant and timely ways

Future Points of Fragmentation

- New learning agent roles, such as assessment designers, learning pathway designers, education informatics managers, and community connectors
- Data analysis and reporting interfaces and apps that allow educators to create their own data dashboards and views of student, class, and school performance
- Community-based creation spaces and processes that facilitate local approaches to problem-solving and education innovations that address specific needs

In the context of cultivating vibrant learning ecosystems, fragmentation is a necessary and positive attribute, as it reflects the ability of ecosystem participants to address the distinctive needs and wants of learners and learning agents. By building on the core infrastructure, aggregation, and brokering services provided by concentrators, fragmenters develop the niche specialties and deep user understanding that help learning ecosystems differentiate services and adapt to their particular constituents.



Fragmentation Signals

These signals of change illustrate how some learning ecosystem participants are providing niche services today and point toward future opportunities for ecosystem participants to target user needs and customize services.

- **Customized Learning Environments Tailor Learning to Each Student**
  Fusion Academy offers a one-to-one, standards-based education experience for middle and high school students. With everything from the pace of the instruction to the style of teaching tailored to each student, students can customize their class schedules and begin a new semester at any time of year, even in the summer. Other new approaches to schooling, such as AltSchool's network of micro-schools and Tilden Academy's mastery-based program, also offer highly user-focused programs. fusionacademy.com, altschool.com, tildenprep.com

- **Indianapolis Fellowship Sparks School Innovation**
  Supported by The Mind Trust, a school incubator growing out of the Indianapolis Mayor's office, the Innovation School Fellows program selects stellar education leaders to create and launch school models within the Indianapolis school district. Fellows are paid to devise creative school models that address the needs of Indianapolis students. Their school models will have the flexibility and autonomy of a charter school, will be able to use district buildings at no cost, and will have the same financial support as a district school. themindtrust.org/innovation-school-fellowship

- **Teachers Design Their Own Professional Development**
  The Edcamp is a cross between an unconference and MeetUp that helps teachers address their particular goals and needs. Built on principles of connected and participatory learning, it brings teachers together in various geographic locations to talk about their personal interests, passions, and questions as educators. Edcamp participants can choose to lead sessions on topics that matter most to them, with the expectation that fellow participants will share their knowledge, insights, and support. edcamp.org

- **Network Offers Digital Badges for After-School Employees**
  After-school employees typically lack the certification available to other educators. To address this gap, the Maryland Out of School Time Network offers a set of digital badges to motivate its after-school employees to deepen their skills and develop their para-professional identities. mdoutofschooltime.org

- **Specialized Data Capture Addresses Learners' Trauma**
  Mastery Schools in Philadelphia is piloting a program aimed at helping educators become more trauma sensitive and more able to recognize behaviors and patterns that might be caused by high levels of stress. By expanding student data collection to include information about trauma, the school network plans to develop curricula to help reduce students' stress and improve their emotional lives. thenotebook.org/december-2014/147969/mastery-moves-toward-understanding-trauma

Catalyzation:

Connectors mobilize cross-boundary initiatives, bridge ecosystem gaps, and forge shared goals.

Catalysts promote action in learning ecosystems by creating shared goals, opportunities, standards, policies, and incentives. In so doing, they help mobilize the flow of resources, ideas, and interactions across traditional boundaries, levels, and parts of the learning ecosystem. They also help integrate the learning ecosystem by enabling other participants to form creative partnerships that support deep learning experiences. High-impact catalysts develop, promote, and implement forward-looking policies, including those that remove barriers to innovation, develop open standards to spur the development of new tools, and create legal or programmatic mechanisms that bridge connections across boundaries. Presently, policy, standards, and accountability systems are three areas where catalysts operate in learning ecosystems. Moving forward, expect to see catalysts working to create cross-boundary mechanisms such as universal data permissions and cross-agency data-sharing agreements.

Current Points of Catalyzation

- Innovative policies, such as those that eliminate seat time in favor of mastery or enable funding to follow students
- Open standards, such as those for open badges and data sharing, that catalyze innovation and enable new learning services
- Standards of learning, such as the Common Core State Standards and the International Baccalaureate, that provide common goals for diverse ecosystem participants to address
- Innovation incubators and entrepreneur networks that link educators, startups, and business professionals around common challenges, such as the Open Education Challenge and Investor Club in Europe and the Software and Information Industry Association (SIIA) Innovation Incubator for learning technologies in the U.S.

Future Points of Catalyzation

- Alternative funding structures that enable learners to access the right experiences and supports across the learning ecosystem
- New compensation structures appropriate to an expanded array of learning agent roles
- Social currencies and reputation markers that help demonstrate learning agent and learning provider quality across settings
- Protocols for easily verifying the quality of micro-assessment and micro-credentials
- Data sharing mechanisms, such as cross-agency sharing agreements and universal data permissions, that address privacy issues and facilitate data sharing
- Information trust brokers who serve in the interest of learners and their families

Catalysts stimulate connections among learning ecosystem participants. By removing barriers, providing common working standards and frameworks, and proposing new visions and concepts that trigger experimentation among concentrators and fragmenters, catalysts help to make the learning ecosystem dynamic and responsive.

Catalyzation Signals

These signals of change illustrate how some learning ecosystem participants are catalyzing connections across the learning ecosystem today and point toward future opportunities for ecosystem participants to mobilize cross-boundary initiatives, bridge ecosystem gaps, and foster collaboration and resource sharing.

- **Loosening of Seat-Time Requirements Puts Focus on Learning**
  As reported by the National Governors' Association, thirty-six states have instituted some form of policy loosening or eliminating seat-time requirements. Among them, New Hampshire has gone the farthest, requiring public high schools to base credit attainment on student mastery. Students can earn credits through expanded learning opportunities, community service, online courses, and other means. nga.org/files/live/sites/NGA/files/pdf/1202EDUCREDITBRIEF.PDF

- **Network Fosters Collaboration among Digital Badge Developers**
  The Badge Alliance acts as a network to foster collaboration across organizations developing, issuing, and managing digital badges for learning. It actively supports the development of an open badge system by facilitating work through groups such as Mozilla and the MacArthur Foundation. badgealliance.org

- **Data Standard Unlocks School Information Systems**
  Clever is developing a standard application programming interface (API) for school information systems. By enabling schools and districts to share information across school information systems, Clever is facilitating cross-boundary data access for educators, learning providers, and programmers. edsurge.com/clever

- **Information Fiduciaries Build Trust via Dialogue and Collaboration**
  Information fiduciaries protect students' privacy and inform individual students and their families about their rights related to third-party use of personally identifiable information. In so doing, they help bridge the data-related needs of education decision-makers and the privacy needs of students and their families in support of using data to provide meaningful interventions and services. Information fiduciaries act as trust brokers between institutions that warehouse and analyze data and students, creating transparency around options. educause.edu/ero/article/questions-data-ownership-campus

- **Innovation Challenge Catalyzes Global Learning Solutions**
  The Global Learning XPRIZE is an open innovation challenge that invites project teams from around the world to develop open source software that will enable children from developing countries to teach themselves basic reading, writing and arithmetic. The XPRIZE provides a framework that activates interdisciplinary teams to pursue a shared objective in creating learning solutions for global populations that have not been served by the education enterprise. learning.xprize.org

- **Collective Impact Networks Catalyze Collaboration around Shared Outcomes**
  Collective impact networks such as StriveTogether provide a framework for collaboration by encouraging community-wide stakeholders to develop a shared vision of student success, build relationships, and coordinate resources and programming in support of shared outcomes. In so doing, they bridge the interests and agendas of stakeholder organizations, ignite the desire to collaborate, and provide frameworks to coordinate funding and action. strivetogether.org

Looking across the Structural Roles

Concentrators, fragmenters, and catalysts are all necessary roles for facilitating learning and addressing learners' needs in ecosystems, including those of vulnerable high-need learners. As mentioned above, when ecosystem participants combine activities associated with each of the structural roles, vibrant learning ecosystems can emerge. Ecosystem participants can build concentrating infrastructure and platforms and catalyze cross-boundary connections in support of fragmented, user-focused teaching and learning services. These three structural roles also provide for growth and expansion without pushing ecosystem participants toward scaling one-size-fits-all learning ecosystems as they have been used to doing in the industrial education model.

A learning ecosystem will be successful when participants begin to think strategically about the whole ecosystem and identify their unique organizational strengths and assets in relation to others in it. Success for ecosystem participants will come from understanding which structural role — concentrator, fragmenter, or catalyst — will best leverage their particular strengths. Some organizations might initially find that their offerings overlap across two roles, particularly those of concentrator and catalyst. For example, the Open Badge Alliance provides an open badge API and a shared vision that catalyzes educators, technology developers, and policy makers to work together. At the same time, its open badge platform serves as a form of concentrating infrastructure that enables niche education service providers to develop learning badges for their target learning populations. Over time, however, most ecosystem participants will choose a single structural role that plays to their strengths and allows them to create the most value for the learning ecosystem.

When ecosystem participants combine activities associated with each of the structural roles, vibrant learning ecosystems can emerge.

Learning Ecosystems in 2025: Stories of Breakthrough Change

Using the structural roles of concentrator, fragmenter, and catalyst as building blocks, the fictional stories below imagine what vibrant learning ecosystems might look like in the four high-need geographies in 2025. These stories draw upon the signals of change listed above to imagine how ecosystem participants might connect learning resources and activities to create vibrant learning ecosystems in such locations. Each story of breakthrough change represents just one possible way of addressing specific needs in the geography that it addresses. By drawing upon the three structural roles of concentration, fragmentation, and catalyzation, ecosystem participants could create many kinds of learning environments in response to local needs.

Each story of breakthrough change presents a description of the learning environment that it imagines along with quotes from imagined stakeholders; highlights essential ecosystem components, which are tagged to reflect the structural roles that they represent; and cites current signals showing how ecosystem participants are beginning to develop related approaches today.

Poor Urban Neighborhoods: Dropout Rate Plummets as Urban Learning Crews Thrive

The 5th Annual Urban Learning Crews Assembly of Chicago was gathered in the auditorium of the downtown media and performing arts center. Twenty-three tribes, each averaging about twelve students, were celebrating the passage of their members from middle and high school level programs to the next phase of their learning and personal development. Rising eighth graders were celebrating placements in their high school internships and self-study projects, while graduates were off to community college or university, had been accepted into local work-study programs, or were planning to start their own ventures. In his address to the crew members, Rashidi Jackson, Chicago Learning Crew Assembly Director, said, "You are turning the tide in cities across the country. All of you, and young men and women in other crews, are doing the hard work to fight the stereotypes of inner city youth and are taking charge of your lives. Your next steps will take you to new places and new challenges, but you will always have the support of your crew."

"I just felt angry all the time. I cut school lots and hung out on the subway. That's where I met Marlon, my mentor, catching the train. He gave me a flyer about the crew, and I checked it out. I saw they were guys from the neighborhood, just like me, but talking about personal stuff, feelings, and learning. Now they're my crew. I'm going to apprentice at this custom furniture company next month. My grandmother is so happy. She cries and says how I'm not so angry anymore."

– *Victor Jackson, Learning Crew Graduate*

By drawing upon the three structural roles of concentration, fragmentation, and catalyzation, ecosystem participants could create many kinds of learning environments in response to local needs.

The Urban Learning Crew League (ULCL) is an ecosystem of peer-based learning groups that provide personalized learning and deep social support and relationships to middle and high school aged boys and girls in the largest inner cities in the U.S. Given the great risks that these young people face, the ULCL coordinates their educational programming to leverage the rich digital media, design, fabrication, and social justice projects of Hive learning centers, which have expanded to most major U.S. cities, or whatever learning infrastructure exists in a city. Some crews are gender-specific so as to address the particular challenges that girls and boys face. Learning crews travel together to various learning venues – museums, maker spaces, media labs, parks, and science centers – and engage in hands-on learning within the familiar and supportive social context of their mentor and peers. Visits to city-wide learning locations are integrated with online

curriculum and in-person classes to help students achieve individual learning goals. A unique component of the Urban Learning Crew experience is the social-emotional curriculum and personal growth activities that are interwoven throughout the day and week. Crew members have several in-person check-ins during the week to reflect on personal challenges and engage in emotional intelligence skill-building activities. A mood capture application lets crew students track and reflect on their emotions throughout the day to help them practice self-regulation and develop a healthy inner self.

"The kids come in feeling skeptical and unsure how to behave, like, 'Is this cool?'. When they share that first success and see people from the art or business worlds react to their work, their whole body language changes. They start looking ahead. They start to learn about who they are inside."

– Daria Vazquez, Industrial Arts Educator

"Our goal is to help young urban kids achieve academic and social success through self-discovery, self-love, and a community of deep, caring relationships. When our students feel like they matter and start talking about their dreams, I see the League's success."

– Anton Brooks, Urban Learning Crew Mentor

COMPONENTS KEY Concentration Fragmentation Catalyzation

Urban Learning Crew Ecosystem Components

- **Personal Learning Journey Compass** – This web-based platform uses data and analytic tools to assess student performance and recommend a personal learning playlist for each student that is curated by a learning journey mentor.
- **Visual Roadmap Interface** – The personal learning journey compass platform includes a robust visual display that maps completed courses and learning experiences and shows potential pathways for moving ahead. The interface filters potential learning experiences available in the regional learning Hive based on each student's performance to date. It includes links to learning providers so that students and their mentors can register for experiences directly from the compass platform.
- **Social Media App Suite** – A flexible suite of mobile social media apps, including mobile video chat, photo sharing, push notifications, and alerts, is personally configured by each crew to provide crew peers, mentors, and graduates a way of communicating and coordinating their mutual support and project-based activities as members move through various learning Hive options. This personal media toolkit enables positive social presence for students between their in-person meetings with crew mentors. It also enables graduates from each crew to become influential "lifeline" role models who provide tangible examples of healthy success beyond membership.
- **Home Connection** – Every month, crews have potluck open portfolio celebrations where parents, neighbors, and guardians are invited to see members' work and learn how best to support their kids. These celebrations help foster connections among crew participants and their communities.

Ecosystem Interconnections

The Urban Learning Crew League (ULCL)

is able to provide niche education experiences and tailor support to small groups of urban youth by leveraging two core concentrating platforms, the personal learning journey compass and the visual roadmap interface. These platforms provide infrastructure that enables each ULCL crew to play a fragmenting role by configuring a set of experiences so targeted to the needs of its members that the ways in which crew members experience learning vary from city to city and sometimes even by neighborhood. To help customize these experiences, ULCL also uses a specialized suite of social media apps provided by a niche app developer that is also playing a fragmenting role. Lastly, ULCL's home connection framework for social group process acts as a catalyst to mobilize learners, parents, and learning agents to come together to reflect on learning and related supports.

Current Learning Ecosystem Signals

- **Ever Forward Club:** This community-based club helps young men, particularly underserved and at-risk young men of color, foster emotional maturity and overcome the hyper-masculinity code that can be a barrier to empathy, personal growth, and academic achievement. Ever Forward Club uses conversation, play, and community to support young men's development by expanding their emotional toolboxes so that they can better handle the challenges of school and life now and into the future. everforwardclub.org

- **Hive Learning:** Learning Hives are comprised of many diverse youth-development focused organizations such as museums, libraries, advocacy groups, higher education institutions, after-school programs, and tech start-ups. Together, members, partners, and allies create and connect equitable and accessible opportunities for young people to explore their interests and gain skills that prepare them for lifelong learning and success. hivelearningnetworks.org

- **AltSchool:** This network of micro-schools focuses on building systems that strip the school model to the essential features of what constitutes an outstanding classroom experience and help kids leverage learning outside of school hours. AltSchool has proprietary software that helps teachers put together learning playlists tailored to an individual student's learning style and pace with given subjects. altschool.com

- **Crew Support Structure:** Increasingly, educators are seeing the positive support and reinforcement that peer-based "crews" provide each other for scholastic and social-emotional learning at K-12 schools. Examples such as the crew support structure at Expeditionary Learning schools provide groups of twelve students with a cohort of peers that stay together through several years of schooling, providing a safe community of trusted peers as a source of personal care and emotional support. teachingchannel.org/videos/student-support-structure-exlh

Disrupted Suburbs: FlexCareerWeb Expands Job Mobility in Struggling Suburbs

Jenna Barnes, a junior at Washington High School, reviewed the graphic on her tablet screen. It showed that two of her science classes this year would count towards career credit at the clean energy startup company in her area and that her persuasive writing project would earn her core skills credit at several companies. As she describes it, "I don't obsess about earning career credits, but I pay attention to how my interest and coursework point to different career options in my region. It's motivating to see how my classes relate to work opportunities. Few of my friends are designing their learning pathways just to get into college. Most want to complete FlexCareerWeb certificates so that they can get real-life experience. Some even take a gap year where they can work and study so they can learn, get experience, and make connections. At first my parents didn't feel comfortable with how I am mixing work and school, but now they see that the two parts of my education will overlap in related paths."

Clean energy, small-scale manufacturing, and transportation are the industries in Jenna's area that participate in the FlexCareerWeb consortium. The consortium serves as a catalyst for coordinating learning modules and micro-credentials across education providers and businesses. Consortium member industries arrived to take advantage of low-cost facilities and co-created a strategy with local and regional educators to develop a new way to support school goals and communicate with students about long-term employment prospects, core academic skills, and learning mindsets.

> ***"FlexCareerWeb students are self-aware of their learning and skill development in a way that makes them very reflective, thoughtful employees. We've hired several of them back after they've completed college and have enrolled many of them in our college degree partnership program."***
>
> *– Marsha Green, HR Director, CleanTek Energy*

Through the consortium, the local school districts were able to secure funding to upgrade their data capture and analytics dashboards so that they could provide more relevant and integrated services to a school population that was changing rapidly. When the housing market plummeted and the SuperShopper regional distribution center and the telecomm services headquarters moved out, the population in Jenna's suburban area declined rapidly, ushering a downward economic spiral. Many families left, tax revenues declined, retailers closed, and jobs became scarce. Pockets of abandoned homes attracted vagrants. The number of families qualifying for free and reduced school lunch increased, as did reported incidents of family breakups and stress-related illness. Now, the Community Connections Service Program (CCSP) uses the data dashboard analytics to integrate data from schools, social services, mental health, and juvenile justice agencies in the county to make sure that service interventions are both preventative and relevant. CCSP recently identified a small group of students who were experiencing parental job loss, family separation, and emergency room treatments. School psychologists and teachers were alerted and came together to outline support strategies.

> ***"Our education, workforce development, and employment systems now talk to each other, and we are seeing the benefits. Graduates are transitioning to work or are furthering their education in greater numbers. Our workforce is showing greater flexibility in adapting to new job opportunities as the area's economy shifts to a new composition of industries."***
>
> *– Erika Sorensby, Regional Industry Council and Workforce Development*

> ***"Our families have been pretty stressed out. Two big employers left, and folks are struggling to find work and maintain their lifestyles. CCSP helped us anticipate the types of families who might need extra support in some way like mental health counseling, food bank services, or supplemental tutoring. We want to nip problems early when they are manageable before they become bigger and more costly to solve."***
>
> *– Susan Dixon, Principal, Inspire Middle School*

FlexCareerWeb Learning Ecosystem Components

- **Teacher Intern Exchange Platform:** During the school year, middle and high school educators are eligible to travel to take curriculum design internships at regional employers, museums, and science centers so as to keep project-based activities relevant.
- **Cross-Agency Data Warehouse:** Regional service organizations, including school districts, health agencies, social services agencies, and juvenile justice systems, share data using a common data warehouse platform that provides a rich base for analyses supporting service interventions.
- **Career-Diploma Dashboard:** High school students use this dashboard app to manage their skill credits and decide whether to pursue micro-credentials that are aligned with jobs at regional employers, facilitating job placements after graduation.
- **Local Career Gap Year Service:** Students who wish to do so can add an extra year of work-study between high school and post-secondary education so as to gain exposure to more career options and prepare for further education.
- **FlexCareerWeb Consortium:** This consortium of employers from several key regional industries performs job-task analyses and works with industry-standards organizations to identify and define basic employability and career-specific skill modules that are transferable across employers. The consortium also works with several school districts in the region to issue badges that are recognized by all participating employers.

Ecosystem Interconnections

The FlexCareerWeb Consortium acts as a key learning ecosystem catalyst by working with schools and local employers to articulate a shared long-term vision for learning in the region and to design outcomes that guide contributors' respective initiatives. In turn, the teacher intern exchange program and cross-agency data warehouse provide two critical concentrating platforms that help the learning improve by developing its talent and by creating rich data sets that inform the learning and wellbeing of students. Lastly, the career-diploma dashboard app and the local gap year service are niche offerings developed by fragmenters to serve specific needs of the FlexCareerWeb learning ecosystem.

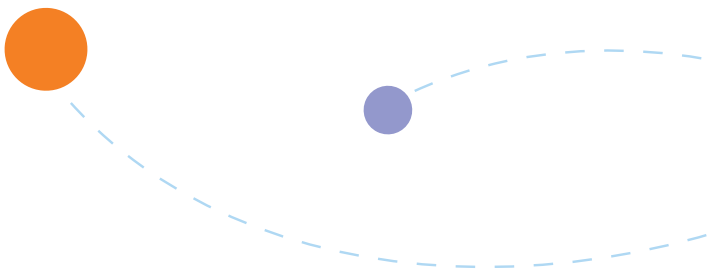
Current Learning Ecosystem Signals

- **Jump Start Program:** Louisiana's statewide Jump Start program prepares high school students for careers via a career-ready diploma. This program uses a unique point system, whereby participants earn graduation index points that correlate directly with the state's Workforce Investment Council, linking local business needs with skills developed in the Jump Start program. louisianabelieves.com/courses/jump-start-career-education

- **The Starbucks College Achievement Plan:** This partnership with Arizona State University creates an opportunity for eligible Starbucks employees to finish a bachelor's degree with full tuition reimbursement through the college's top-ranked online degree program. Juniors and seniors receive full tuition coverage to complete their degrees, while freshmen and sophomores can access a combination of partial-tuition scholarships and need-based financial aid. news.starbucks.com/collegeplan

- **School Link Services:** This integrated services program in Santa Clara County, California, uses a cross-agency data-sharing model and associated infrastructure to identify student support needs at an individual level. Its goal is to deliver coordinated and effective health and social services on school campuses and in neighboring communities so as to meet the needs of students and their families and to facilitate success in school and in life. sccgov.org/sites/mhd/MHSA/Documents/2013/Xtra/SLSPlanFinal.pdf

- **Industry Initiatives for Science and Math Education:** This non-profit industry-education partnership serves as a platform that matches teacher fellows in science and math with host organizations for paid summer internships that allow teachers to deepen their science and math knowledge and to transfer their experiences into creative projects and curriculum for their students. Fellows share their "transfer plans" with other fellows, creating a rich resource repository across the network of participants. iisme.org



Poor Rural Communities: Learning Oases Nurture Learners in Rural America

Jeremiah and MingLi finished reading their "I am" poems and discussing their artwork with the class. They had worked together the past week, capturing details of each other's faces to create charcoal portraits. Scans of the portraits appeared along the side of the wall-sized ShareWall. Mr. Barnes looked around the room and at the ShareWall, taking in the faces of his students. "Thank you MingLi and Jeremiah," he said. "Goodbye for today. We'll see you all again next week, same time, same place."

"Zài jiàn," responded teacher Zhu and his class in unison.

McKeen Elementary School third-grade teacher, Charles Barnes, clicked off the ShareWall. Group time with his partner class in Shanghai was going well. He and Mr. Zhu had jointly developed a curriculum to explore language arts, specifically poetry, synonyms, and metaphors. Sometimes he would leave the ShareWall on to enable spontaneous encounters with Mr. Zhu's class as a way to expand the kids' classroom interactions. That's how Jeremiah and MingLi had come up with the idea of drawing portraits of each other. Next week, the class would be sharing favorite foods and contributing recipes to a joint third-grade cookbook. "Do they have fries in Shanghai?" asked Jeremiah. "Let's do some research and find out," replied Mr. Barnes.

> ***"We've had inquiries from teachers all the way from California and Oregon who want to come to Oklahoma and teach – in rural Oklahoma! The freedom to develop their personal teaching styles, along with the professional support and recognition as innovators, are so attractive to young teachers."***
>
> *– Amanda Choctaw, Co-Director, Oklahoma Learning Commons*

Charles Barnes is in the second year of his residency with the Rural Oklahoma Accelerates Developing educatorS program (ROADS). The program is a core component of the Rural Oklahoma Learning Commons, an infrastructure organization that seeds educator development, hosts a robust open education resource platform, manages an integrated data warehouse for rural school districts, provides training in data analytics for school leaders, and coordinates the quarterly educator Collab MeetUp that rotates across rural communities. Tomorrow, the MeetUp will be about 120 miles away near McKeen, so Charles will be leaving early to drive over and set up for the workshop that he'll be leading. With teachers in three other rural schools, he is a member of a research and design cohort that is creating a project-based language arts curriculum and rubric that will use augmented reality to bring the historic Caddo and Wichita native tribe cultures to life for students. Mr. Barnes recently Skyped with his education outreach mentors from the American Indian Center in Oklahoma City and from the Smithsonian and was excited to share new ideas with his cohort.

> ***"The teachers in our town have gotten so creative. The way these resident teachers collaborate and use technology to bring outside resources and people into our kids' lives is inspiring. Just last week, I was talking to a group of sixth graders about my job at the electric cooperative, and they said they had just interviewed a software engineer at Tesla about electric powered cars. I started asking them questions!"***
>
> *– Ray Jenkins, Manager, Rural Electric Cooperative*

> ***"My sister moved her family to Dallas a few years ago because there just seemed to be no opportunities for kids, especially teens, to get exposure to different ways of thinking. We're still remote, but my fourteen-year-old daughter now has classmates and teachers from different parts of the world and is prouder than she ever was about where she comes from. In her online study-groups, she is the exotic one."***
>
> *– Sandy Sherman, Parent of Teenager*

Rural Oklahoma Learning Ecosystem Components

- **Resident Teaching Program:** This network of itinerant learning agents stations expert teachers, mentors, and specialists in rural communities for periods of time ranging from six-week boot camp sessions to four-year terms. Residents gather at Collab MeetUps to share research, practice, and social support.
- **Co-Presence Technology Platform:** Integrated tools ranging from simple videoconferencing to immersive ShareWalls connect teachers and students to people and places across the world.
- **Global Learning Partners:** This platform matches schools and classrooms with other educators in diverse locations for joint projects and professional collaborations.
- **Learning Landscape Augmented Reality Software:** This suite of apps allows teachers and curriculum designers to create virtual layers of content and media in their physical geography to provide enriched learning experiences.
- **Mentor Cloud:** Remote experts, artists, educators, and entrepreneurs engage with teachers and students in online conversations to spark inspiration, provide professional coaching, share resources, and collaborate on projects.

Ecosystem Interconnections

The Rural Oklahoma Learning Ecosystem

takes advantage of three core concentrator services to assemble an effective infrastructure for teaching and learning: the resident teaching program brings in educators to develop local capacity, while the co-presence technology platform and the global learning partners matchmaking platform enable the ecosystem to configure diverse collaborations with teachers in other locations so as to address a specific classroom's learning objectives. In contrast, the learning landscape augmented reality software plays a fragmenter role in that its boutique apps are designed specifically to help teachers enhance their local learning geographies. Lastly, by supporting shared values of collaboration, diversity, and authentic learning, the mentor cloud plays a catalyst role.

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Current Learning Ecosystem Signals

- **Eagle's View Learning Center:** Located in Seward, Pennsylvania, a rural town of 486, Eagle's View offers a learning environment whose curriculum is diverse and personalized despite scarce local resources. Eagle's View has an onsite staff of three adults but uses online lesson content developed by the 200 teachers at the Pennsylvania Leadership Charter School to bring diverse perspectives and material to its rural learners. palcs.org/brick-and-click-centers/eagles-view-learning-center
- **MentorCloud:** This global mentoring network allows members of organizations such as entrepreneurship networks and accelerators, alumni networks, and professional associations to collaborate with one another and provide one-to-one mentoring support. Its Roundtables, MentorPlaza, and Advanced Search tools help individuals find and engage with potential mentors. mentorcloud.com
- **The Rural Teaching Residency:** This clinical experience offered at Fort Hays State University employs part-time paraprofessionals and other school personnel in rural districts for two full years as practitioners while they complete a comprehensive, online teacher education program. fhsu.edu/teachereducation/clinical-experiences/#residency

Incarcerated Settings: Former Inmates Lead Community Innovation

James Traumen watched as the laser cutter shaped the final piece for his water-saving garden tower. In two days, he would be testing his indoor garden kit prototype in the housing complex where he had lived before serving time in jail. James paused and reflected on his journey. He looked up and locked eyes with his mentor at the SFMakeCenter, saying, "This is a turning point for me. To give back to the people I harmed, to help them grow food to feed their families, it's a blessing."

> ***"I noticed a change in the students when they were able to learn at their own pace and follow personalized pathways through the curriculum. RestorED's adaptive learning platform helped me address the extremely wide range of skill levels and gaps in my learning community."***
>
> *– Damien Jones, RestorED Learning Agent*

James is a member of the RestorED Communities learning ecosystem located in the San Francisco Bay Area and Los Angeles regions. RestorED promotes restorative justice by linking classroom- and community-based learning opportunities for inmates through social entrepreneurship. The network catalyzes flexible learning environments through an interdependent web of educational, workforce, and social service organizations that are available to incarcerated students from their time within correctional institutions to their re-entry into their communities. RestorED changes the cultural narrative around incarceration by linking inmates' learning experiences in jail to productive work and projects in local communities and neighborhoods. Learning pathways that begin during incarceration extend and connect to opportunities afterward.

> ***"Having the RestorED students at our MakeCenter has been a win-win for everyone. RestorED performs all the assessments and management of the students, and we get really motivated makers who want to do their communities good and solve a problem for them. In turn, the students get a fresh start as social entrepreneurs."***
>
> *– Sandy Sherman, Executive Director, SFMakeCenter*

RestorED Communities Learning Ecosystem Components

- **RestorED Learning Commons:** This open educational resource hub leverages a global open educational resource commons to customize a resource collection that enables teachers to share highly modular course designs and teaching strategies to meet inmates' diverse learning needs and to address skill gaps.
- **WeLearnTogether.org:** This project-based learning matchmaker app links RestorED Communities' teachers with local project-based learning groups, enabling students to collaborate from jail with students in their communities.
- **RCLearnSpace:** This offline, web-based learning app is accessible by students within RestorED correctional institutions and simulates an online adaptive learning platform.
- **MyMosaic:** RestorED customized this portfolio app to allow its students and their teachers to co-create a reflective learning narrative that helps each student begin to create a new identity as a learner.
- **RestorED Local Affiliate Network:** Digital media centers, tech shops, maker centers, fabrication labs, hacker spaces, and urban farms serve as re-entry partners and facilitate training, social-emotional support, and mentorship.

Ecosystem Interconnections

RestorED Communities uses two specialized apps, RCLearnSpace and MyMosaic, to help students customize their learning and communicate their achievements. The learning ecosystem also incorporates two concentrating platforms: the global open educational learning resource commons infrastructure that provides its educators with abundant teaching resources and the WeLearnTogether Network that matches incarcerated students with on-the-ground project-based learning activities. RestorED's local affiliate network acts as a catalyst by bringing together distributed educators, professionals, and local agencies in pursuit of practical, authentic learning.

Current Learning Ecosystem Signals

- **Five Keys Charter School:** Operating within the San Francisco County jail, Five Keys is the first comprehensive charter school to operate within a correctional facility. Founded by the Sheriff's department according to the principles of restorative justice, the school is fully accredited and seeks to support the education of inmates during and after incarceration in order to help them rebuild their lives and strengthen communities. Five Keys recently initiated a tablet-based program using cordoned-off online curriculum and resources (including KA Lite) to provide incarcerated students the opportunity to access broader resources and personalize their learning. The school also includes a network of micro-schools embedded in eighteen workforce development agencies across San Francisco so as to follow students post-incarceration and support the re-entry process. fivekeyscharter.org
- **Learning Shelter:** Founded by formerly homeless Marc Roth, the Learning Shelter provides a ninety day live-in training program for homeless individuals that includes mentoring, high-demand skill building (including software development, 3D printing, design, small scale manufacturing, and other technical skills), and job placement. thelearningshelter.org
- **Last Mile Program:** Focusing on reducing the recidivism rate, the Last Mile program creates a bridge between incarceration and a productive life in society. It provides business and technology training for incarcerated men and women so as to prepare them for gainful employment and successful reentry into society. thelastmile.org

Implications and Lessons for Stakeholders

Taking an ecosystem perspective on learning provides a framework for understanding the interconnections across roles and activities that promise to help sustain a responsive and vibrant learning environment for all young people, particularly those in high-need geographies. Reflecting on the fictional stories of how the concentrator, fragmenter, and catalyst roles play out in high-need geographies provides several insights about the promise of those structural roles for learning ecosystems and their implications for learners and other ecosystem participants.

- **Scale Impact through Density of Connections:** Ecosystems in nature grow through access to key nutrients (such as sunlight) and a diversity of connections and life forms. Likewise, learning ecosystems will grow to sustain learning opportunities through the density of their connections and the diversity of participants who can provide targeted services. An ecosystem growth model suggests that impact may achieve scale more through its diversity of relationships and connections within a single geography than through replication of a few strategies and programs across geographies.

  Implications: Education decision-makers, particularly at the district, state, and regional levels, may want to encourage and support catalysts that can provide shared technical and policy standards and align goals and agendas in order to foster connections across organizations. Similarly, creating or strengthening backbone infrastructures and open platforms can provide creative technical and social environments for ecosystem participants to collaborate and innovate toward meeting distinct learner needs.

- **Leverage Productive Fragmentation:** Fragmentation tends to be framed as a negative attribute rather than a positive one. We tend to think of fragmentation as being disconnected, but a beautiful mosaic reflects an artful configuration of colorful tile fragments. Presently the education space is seeing a proliferation of teaching and learning tools, services, classroom and school organizational approaches, and governance models. What is missing is a focus at the larger ecosystem level to decide how best to configure various specific offerings so as to create learning ecosystems that address the needs of particular learners in particular geographies.

  Implications: Schools, teachers, other learning agents, educational service providers, ed tech organizations, and data application developers will need to communicate clearly their unique contributions to learning and how those contributions interconnect with those of other ecosystem participants to add value to learning. In concert with that effort, communities could benefit from identifying and pursuing shared goals and deliberately fostering interconnections across distributed learning solutions, with a focus on complementarity over competition. As learning ecosystems diversify, quality assurance systems will need to evolve to reflect diverse learning environments.

- **Leverage Concentration for Efficient, Open Platforms:** Concentration does not necessarily mean a narrowing of services and options; indeed, some types of platforms and infrastructure are best delivered well by a few providers. By providing these generative platforms and infrastructure, concentrators enable others to create new solutions and specialized services.

  Implications: Schools, districts, technology and data service providers, foundations, and local and regional governance offices will need to identify and support core backbone infrastructure so as to allow fragmenters to innovate specialized and targeted services. Some participants may need to choose whether they want to contribute to the ecosystem through a fragmentation or concentration role. Other participants may need to stop attempting to provide core infrastructure and platforms and find ways of obtaining them from others.

- **Explore the Potential of a Distributed Teaching and Learning Ecosystem:** The dynamics of concentration, fragmentation, and catalyzation will contribute to increased unbundling of teaching and learning from traditional institutions. Vibrant learning ecosystems will include a diversity of interconnected participants whose missions regarding education and supporting youth may overlap.

  Implications: Different ecosystem participants will find unique opportunities to contribute to the creation of vibrant learning ecosystems. For example, employers and other community, cultural, maker, and arts organizations can embed learning in their organizations through work-study assignments, internships, project-based rotations for students and young adult learners. In turn, traditional schools can expand their offerings to include many kinds of student-centered approaches and to make their boundaries more permeable. In creating diverse learning experiences, resources, and supports and in building protocols, networks, policies, and resource flows that foster interconnection across the learning ecosystem, participants can foster learning cultures and structures capable of meeting learners where they are. By better addressing the needs of young people and the realities of the communities in which they live, these learning environments promise to support learners not just in attaining academic mastery but also in gaining the social and emotional skills and awareness needed to thrive in contemporary society. These learning environments could also provide young people with stronger support in developing agency of, and responsibility for, their learning and in integrating learning with other dimensions of their lives in authentic and relevant ways.

- **Consider Possibilities for a New Education Workforce:** The growth of highly connected learning ecosystems will create opportunities for new kinds of learning agents, such as learning pathway designers, learning asset brokers, micro-assessment designers, micro-credential authenticators, and information fiduciaries who help students and their families navigate the increasingly complex data landscape. With a broadening of roles and opportunities for participating in learning ecosystems, new talent may come from diverse sources and institutions beyond the traditional education world.

  Implications: Schools, districts, and other learning organizations that are accustomed to recruiting new hires from traditional sources will need to consider diversifying their learning agent roles and will need to become more open and creative in attracting, retaining, and developing new talent. Learning agent preparation and certification programs will also need to diversify to address the needs of diverse learning ecosystems. Particularly with the opportunities that learning ecosystems present for innovation, experimentation, new partnerships, and collaborative initiatives, new hires from non-traditional sources will expect dynamic environments that allow for personal and professional growth. As new kinds of schools and learning startups come into the education space, they will draw from new talent networks in technology, entrepreneurship, design, and business networks to create new kinds of educational organizations.

Looking across these insights and implications, ecosystem participants can leverage the three structural roles of concentration, fragmentation, and catalyzation to address the needs of particular learners in particular geographies. Strengthening learning ecosystem interconnections promises to revitalize learning ecosystems, enabling them to be learner centered, equitable, modular and interoperable, and resilient. Vibrant learning ecosystems will combine activities and inputs associated with each of the structural roles to address the needs of learners in their geographies.

Strengthening learning ecosystem interconnections promises to revitalize learning ecosystems.

Strengthening Learning Ecosystem Interconnections

This activity provides a beginning way for you to explore possibilities for strengthening interconnections in the local learning ecosystems with which you are involved or for the broader learning ecosystem as a whole. It uses the elements of this paper as the basis for guiding you through a learning ecosystem inventory, with the goal of identifying areas where interconnections might need to be strengthened in order for the learning ecosystem to be vibrant for all the young people whom it aims to serve. As you consider this question, we encourage you to think very broadly about the learning ecosystem in the geography that you are considering. Take into account not just formal education providers but also the many kinds of providers that might support and interact with young people, as well as community characteristics and resources that might not relate directly to education as we typically define it today. You can complete this activity on your own or with a group; in either case, make sure to capture your responses as you go along.

1. What is the name of the geography that you are examining through this activity?

2. How would you describe it?

- ◯ a. Poor urban neighborhood
- ◯ b. Disrupted suburb
- ◯ c. Poor rural community
- ◯ d. Incarcerated setting
- ◯ e. Other (please describe):

3. What needs seem most prominent in this geography? (Check those that apply.)

- ◯ Isolation
- ◯ Resource constraints
- ◯ Economic challenges
- ◯ Cultural barriers and stigma
- ◯ Other (List the specific needs):

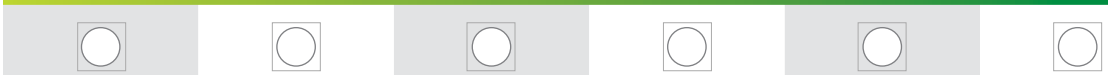
4. In what ways are these needs getting expressed?

5. What specific groups of learners have different or additional needs, and how are those needs getting expressed?

6. **To what degree, if at all, is this geography's learning ecosystem(s):**

Learner Centered: Learning adapts to each learner's needs, interests, and goals. Learning flows around individuals, not institutions, providing coherent services and experiences in the context of young people's needs and interests.

To a Great Extent | Not at All



Supporting Evidence:

Equitable: The learning ecosystem is diverse and flexible, serving all learners well, including self-motivated and self-directed learners, reluctant learners who struggle to engage with learning, high-need learners, and everyone in between.

To a Great Extent | Not at All

Supporting Evidence:

Modular and Interoperable: Learning providers and opportunities are disaggregated from single, monolithic institutions, yet they are easily connected through customized learning playlists and pathways.

To a Great Extent | Not at All

Supporting Evidence:

Resilient: Learning ecosystems have the capacity to adapt as the conditions around them and the needs of learning populations change.

To a Great Extent | Not at All

Supporting Evidence:

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7. **What else is going well today, even if it doesn't directly relate to the characteristics of a vibrant learning ecosystem listed above?**

8. **Currently, how are the three structural roles described in this paper contributing effectively to the geography's learning ecosystem(s) today, contributing sub-optimally, not contributing (and indeed might not be present at all), or detracting? (Write your ideas in the appropriate cells in the table below.)**

Concentration: Providers of core infrastructure, aggregation, and brokering services create process efficiencies through scale.	
Contributing Effectively	
Contributing Sub-Optimally	
Not Contributing	
Detracting	

Fragmentation: Creative niche specialists target user needs and customize services.	
Contributing Effectively	
Contributing Sub-Optimally	
Not Contributing	
Detracting	

Catalyzation: Connectors mobilize cross-boundary initiatives, bridge ecosystem gaps, and foster collaboration and resource sharing around shared goals.	
Contributing Effectively	
Contributing Sub-Optimally	
Not Contributing	
Detracting	

9. **Looking ahead, where do you see possibilities for current or new ecosystem participants to use each of the three structural roles to make this geography's learning ecosystem(s) vibrant? How might those possibilities help address current needs and build off current strengths? (Write your ideas in the appropriate cells in the table below.)**

Concentration: Providers of core infrastructure, aggregation, and brokering services create process efficiencies through scale.	
Possibilities for this geography:	
Would address needs by:	
Would build off current strengths by:	

Fragmentation: Creative niche specialists target user needs and customize services.	
Possibilities for this geography:	
Would address needs by:	
Would build off current strengths by:	

Catalyzation: Connectors mobilize cross-boundary initiatives, bridge ecosystem gaps, and foster collaboration and resource sharing around shared goals.	
Possibilities for this geography:	
Would address needs by:	
Would build off current strengths by:	

10. **How might you or your organization contribute to strengthening the geography's learning ecosystem? What structural role(s) might you best occupy? Consider what you might do directly and where you might partner with others.**

Concentration: Providers of core infrastructure, aggregation, and brokering services create process efficiencies through scale.	
Unique Contribution(s):	
Possible Partnerships:	

Fragmentation: Creative niche specialists target user needs and customize services.	
Unique Contribution(s):	
Possible Partnerships:	

Catalyzation: Connectors mobilize cross-boundary initiatives, bridge ecosystem gaps, and foster collaboration and resource sharing around shared goals.	
Unique Contribution(s):	
Possible Partnerships:	

11. **What first steps towards strengthening this geography's learning ecosystem might you take in the next three months?**

    1.

    2.

    3.

About KnowledgeWorks

KnowledgeWorks is an Ohio-based non-profit social enterprise that works to foster meaningful personalized learning that enables every student to thrive in college, career, and civic life. KnowledgeWorks works on the ground with schools and communities through a portfolio of innovative education approaches, helps state and federal leaders establish the policy conditions necessary to prepare all students for success and provides national thought leadership around the future of learning. To learn more about our strategic foresight work, see knowledgeworks.org/strategic-foresight.

About the Authors

Katherine Prince leads KnowledgeWorks' exploration of the future of learning. As Senior Director, Strategic Foresight, she speaks and writes about the trends shaping education over the next decade and helps education stakeholders strategize about how to become active agents of change in pursuing their ideal visions for the future learning ecosystem. Katherine holds a BA in English from Ohio Wesleyan University, an MA in English from the University of Iowa, and an MBA from The Open University.

Andrea Saveri of Saveri Consulting makes the future actionable for clients through research-based foresight, visual maps, forecast artifacts, and highly creative engagement experiences. She partners with clients to create clear strategic pathways to transformation and resilience in a highly complex world. In her practice at Saveri Consulting, Andrea has worked with diverse education clients in projects focused on bringing long-term futures thinking, emotional intelligence, and a maker mindset to all learners. She recently joined the Institute for the Study of Knowledge Management in Education as Director of Action Collab Services and is developing methodology-based services that enable educators to accelerate their capacity for collaboration, innovation, and design. Andrea is a graduate of Harvard University and the University of California at Berkeley.

Jason Swanson is the Director of Strategic Foresight at KnowledgeWorks, where he helps lead the organization's research into the future of learning. Jason holds a BA in Public Policy from West Chester University and a MA in Foresight from the University of Houston and is an Emerging Fellow with the Association of Professional Futurists.

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End Notes

[1] KnowledgeWorks (2012). *Recombinant education: regenerating the learning ecosystem.* Retrieved from http://www.knowledgeworks.org/sites/default/files/Forecast3_0_0.pdf.

[2] Learning agents are the adults supporting learning in an expanded learning ecosystem. KnowledgeWorks forecasts that many kinds of learning agents could support learning in new settings and ways as well as through more traditional roles.

[3] Reardon, Sean F. (2011). The widening academic achievement gap between the rich and the poor: new evidence and possible explanations. In Greg J. Duncan and Richard J. Murnane (Eds.), *Whither opportunity? Rising inequality, schools, and children's life chances* (p. 2). New York, NY: Russell Sage Foundation.

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[7] Ingraham, Chris. (2015, January 6). The U.S. has more jails than colleges. Here's a map of where those prisoners live. (Wonkblog). Retrieved from http://www.washingtonpost.com/blogs/wonkblog/wp/2015/01/06/the-u-s-has-more-jails-than-colleges-heres-a-map-of-where-those-prisoners-live/.

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[9] Hagel, John, Seely Brown, John, Samoylova, Tamara & Kulasooriya, Duyleesha. (2014, July 24). The hero's journey through the landscape of the future. Retrieved from http://dupress.com/articles/heros-journey-landscape-future/?id=us:em:na:dup826:eng:tmt:121614&elq=4033bcf5cd0e4be08ccee3aa19491dad&elqCampaignId=2606.

[10] Note that Hagel et. al. use the term "mobilizers" instead of "catalysts." We have changed the terminology in adapting the structural roles for an education context.

[11] Hagel, John, et. al. Op cit.