InventEd Ecosystem Mapping and Development

A LANDSCAPE ANALYSIS OF THE INVENTION EDUCATION ECOSYSTEM AND RECOMMENDATIONS FOR NETWORK DEVELOPMENT.

The Lemelson Foundation

inventEd

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EXECUTIVE SUMMARY

Invention Education (IvE) is poised for significant growth, with a clear path to scale and strengthen its impact nationwide. This report, informed by diverse perspectives, offers a roadmap for expanding equitable access and ensuring sustainable growth across the IvE ecosystem.

KEY FINDINGS:

- IvE's student-driven, interdisciplinary model is a key strength, but gaps in awareness and access persist.
- While successful programs exist, more support is needed to equip educators on a broader scale.
- Stronger leadership and targeted advocacy are essential to secure funding and drive broader adoption.
- Collaboration among stakeholders is critical to scale the IvE ecosystem effectively.

STRATEGIC RECOMMENDATIONS:

Shared Purpose

Cultivate a shared sense of purpose among stakeholders to foster alignment, collaboration, and a unified vision for the future of IvE

Hybrid Approach

- **Implement a national "Hub-and-Spoke" model through InventEd to unite central resources with local innovation.**
- Form a unified "Coalition" to drive advocacy and align impact across the ecosystem

Diversified Funding

- Pursue public-private partnerships
- Secure government grants
- Explore regional membership fees

Phased Implementation

PHASE 1: Build a strong national foundation

PHASE 2: Test regional pilots

PHASE 3: Scale successful models

PHASE 4: Secure long-term sustainability

By addressing challenges related to access, policy, and educator support, this strategy aims to empower the next generation of inventors across the country. Through strategic partnerships and a shared commitment to growth, we can unlock vast potential and fuel the innovators of tomorrow.

INTRODUCTION

PURPOSE

This report analyzes the current IvE ecosystem and offers strategic recommendations to drive its future growth. It addresses three key questions for the InventEd community, education leaders, advocates, and policymakers:

- ***What is the current state of the IvE ecosystem?***
- ***What are the key challenges and opportunities across the ecosystem?***
- ***What are effective models for network design and funding to develop the ecosystem?***

By answering these questions, we offer insights to strengthen the IvE landscape and unlock its transformative potential.

PROCESS

In 2023, a group of IvE specialists and practitioners explored models for developing and expanding IvE across the U.S. They identified the key stakeholders across the ecosystem and proposed a hub-and-spoke model with regional networks supported by a national hub providing standards, guidance, and funding. We conducted a landscape study of the IvE ecosystem to evaluate this model and guide next steps.

The Lemelson Foundation engaged Project Invent and Carve Collaborative to build on this work by mapping the current IvE network, conducting interviews with field leaders, and providing recommendations on network design. Participants included:

- Advocacy leaders for IvE and STEM
- Program directors
- Researchers
- Educators
- School leaders
- Government leaders

This report is based on data collected from network mapping efforts, and stakeholder interviews, reflecting a variety of perspectives. Interviewees shared insights on the current state, desired future state, and needs within the ecosystem to inform future investments.

CONTEXT

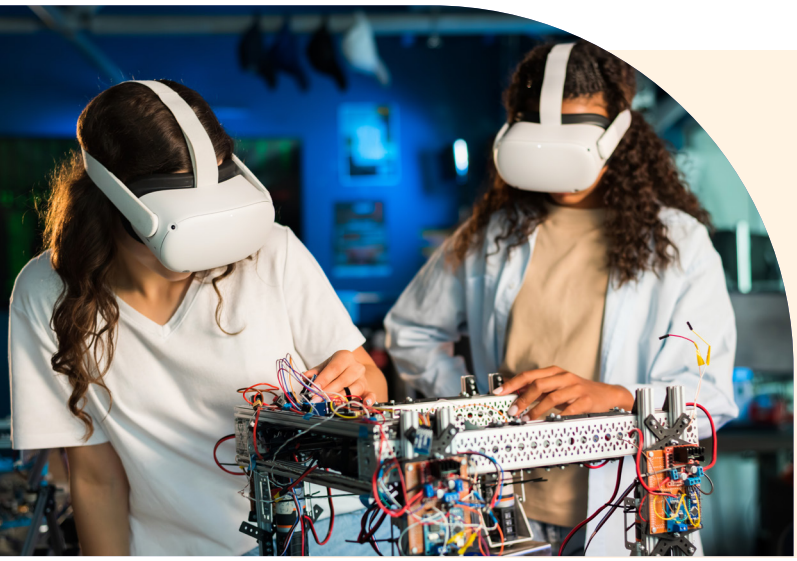
IvE is the cornerstone of preparing students for an unpredictable future. It fosters essential skills in problem identification, innovative problem-solving, and continuous learning. IvE has the opportunity to bridge education with commercialization and economic empowerment, teaching students to protect intellectual property, monetize ideas, and pursue entrepreneurship for real-world impact. By placing learners in the driver's seat, IvE nurtures their identity as inventors and empowers them to become proactive problem-finders and problem-solvers.

A key strength of IvE lies in its interdisciplinary and inclusive nature. It integrates science, technology, engineering, the arts, and business skills into a cohesive learning experience that is adaptable across different ages and cultural backgrounds. This approach not only enhances student engagement and interest in STEM but also develops the mindsets and skills necessary for success in an increasingly complex and interconnected world, demonstrating its wide-ranging value and relevance.

However, not all students have equal access to IvE. Factors like race, wealth, gender, neurodiversity, physical ability, and location create barriers, costing the U.S. millions of potential innovators.[1] Tools like The Henry Ford's Innovation Atlas help target support where it's needed most to drive greater equity.

It's early days, but the ecosystem has a strong foundation. The IvE ecosystem is a diverse, collaborative network promoting innovation from K-12 through higher education and beyond. It encompasses schools, universities, non-profits, businesses, government agencies, and community groups. At its core, the InventEd Network acts as a central hub, offering support and facilitating connections. Complementary networks and programs like STEM Learning Ecosystems, Invention Convention Worldwide, USPTO's Resource Centers, and MESA USA operate within and around this ecosystem, each playing critical roles in developing and nurturing young innovators.

The goal is to enable all students to tackle real-world challenges and prepare them for an ever-evolving future.[2] While the InventEd Network lays the groundwork, achieving true equity and universal access requires the continual expansion and strengthening of support networks. We must build a far-reaching and flexible ecosystem – a complex task, but crucial for ensuring that IvE benefits everyone.



[1] Chetty, R., Bell, A., Jaravel, X., Petkova, N., & Van Reenen, J. "Who Becomes an Inventor in America? The Importance of Exposure to Innovation," December 2017. Available at: http://www.equality-of-opportunity.org/assets/documents/inventors_paper.pdf.

[2] InventEd, "InventEd Field Guide," version 2, October 25, 2022. Available at: https://inventioneducation.org/wp-content/uploads/InventEd-Field-Guide_v2_102522.pdf.

IDEAL STATE

The InventEd Network, a coalition of diverse stakeholders, is guided by the vision to cultivate the inventive mindset in everyone. It focuses on developing resources, raising awareness, fostering collaboration, and expanding IvE programs to build a sustainable ecosystem. As the IvE ecosystem grows, more diverse opinions on its vision will inevitably emerge. Stakeholders offer valuable insights to ensure universal access to IvE. These insights, aligned with InventEd's vision, provide direction for the network's evolution and growth.

1. IvE FOR EVERY LEARNER

All students across diverse backgrounds should access IvE from early education through postsecondary, supported by educators with comprehensive training, resources, and ongoing support.

"Every child has had an experience where they were challenged to solve a problem relevant to them through invention." — Entrepreneur and Funder

2. BROAD PUBLIC AWARENESS

IvE should be widely recognized and understood across urban and rural contexts, much like STEM education today. Advocacy efforts emphasize its benefits and importance to all stakeholders.

"The phrase 'Invention Education' is understood like 'STEM Education'." — Chief Learning Officer, national nonprofit

3. INTEGRATION INTO EDUCATIONAL STANDARDS

IvE should be included in state and national education standards, ensuring consistent and accessible implementation across regions and institutions.

"Standards and expectations are set at the state level to ensure access for all." — Chief Learning Executive Director, national nonprofit

4. LEADERSHIP COMMITMENT

Top administrators and leaders in education and government should be dedicated to implementing and sustaining IvE, advocating for its adoption and securing necessary resources.

"Every school district needs a champion. If the right people want to do it, they'll do it. And kids will benefit from it." — COO, regional STEM center

5. EDUCATOR SUPPORT

Educators and program facilitators should receive comprehensive support, including professional development, training, and ongoing resources.

"Administrators and teachers need tools and resources to know how to integrate IvE into their day-to-day work." — Program Director, national nonprofit

CURRENT STATE

This section outlines the present landscape of IvE, focusing on the interconnected network of stakeholders, the network's reach, and key assets and opportunities. Stakeholders have identified strengths to build upon as well as gaps that can be addressed through strategic network design.

ECOSYSTEM ROLES

The IvE ecosystem thrives on a diverse network of stakeholders, each contributing unique expertise. Direct roles—like program delivery, operations, and competitions—engage students, while intermediary roles—such as funding, industry partnerships, and training—offer essential support. System-level roles—including research, policy, and standards—ensure long-term sustainability and growth.

Survey respondents primarily identified with direct roles, such as program delivery, competitions, and equity and inclusion, reflecting a focus on student engagement. Fewer respondents aligned with system-level roles like research, standards, or outreach. This is typical in early-stage ecosystems, where hands-on program execution takes priority. As the ecosystem matures, expanding participation in system-level roles will be essential for long-term growth and impact.

For example, educators work with business leaders for funding and mentorship, while researchers assess program impact and policymakers secure resources for sustainability. These collaborations foster growth and resilience across the ecosystem.

The InventEd Network serves as a crucial convener, bridging gaps between roles and amplifying the impact of IvE. Nurturing these roles is vital to building a resilient, inclusive ecosystem that cultivates inventive mindsets in students.

IvE ECOSYSTEM ROLES

[3] InventEd, "FAQ," Invention Education, accessed July 2024, https://inventioneducation.org/faq/

Stakeholder	Description	Examples
Program Delivery	Deliver IvE directly to students, fostering creativity and problem-solving.	* After-school invention clubs * Integrated science or technology classes * Summer IvE camps
Program Operations	Manage logistics, materials, and facilities to ensure smooth program execution.	* Sourcing and managing materials * Scheduling classroom space * Coordinating field trips
Competitions	Design and manage invention challenges that spark students' innovative and creative interests.	* National invention competitions * Robotics competitions * Local invention fairs
Industry Partners	Provide real-world expertise, mentorship, and support to students	* Tech companies sponsoring challenges * Engineering firms mentoring students * Entrepreneurs judging competitions
Training	Equip educators with the skills and support to deliver impactful IvE	* Teacher workshops and training * Fellowship programs * Online resources
Content and Curriculum	Create engaging learning materials guiding the invention process	* Invention education modules and lesson plans * Online challenges and interactive tools * Activity books for after-school programs
Program Funding	Provide financial resources to support IvE programs	* Philanthropic grants * Corporate sponsors * Individual donors
System Funders	Invest in initiatives to expand and sustain Invention Education infrastructure	* Ambassador and fellowship programs * Evaluation tools development * Expanding access in underserved communities
Equity & Inclusion	Ensure programs are accessible and welcoming to all students	* Partnerships with community organizations * Programs catering to diverse learning styles * Culturally responsive PD
Awareness and Outreach	Build public awareness and support for Invention Education	* Public awareness campaigns * Partnerships with museums and libraries * Social media campaigns
Convening and Collaboration	Facilitate knowledge sharing and collaboration within the ecosystem	* National IvE conferences * Online communities * Regional Invention Education summits
Policy & Advocacy	Influence policies to prioritize and fund Invention Education	* Lobbying for Invention Education funding * Advocating for curriculum inclusion * Educating policymakers on Invention Education
Standards and Guidance	Develop frameworks and best practices for effective program implementation	* Standards development * Model curriculum frameworks * Publishing research-based best practices
Research and Evaluation	Measure program impact and identify improvement areas	* Program evaluation * Impact studies on engagement and achievement * Research on diversity, equity and inclusion

NETWORK REACH

> ***Solo work can be lonely."***
>
> – Director, national nonprofit

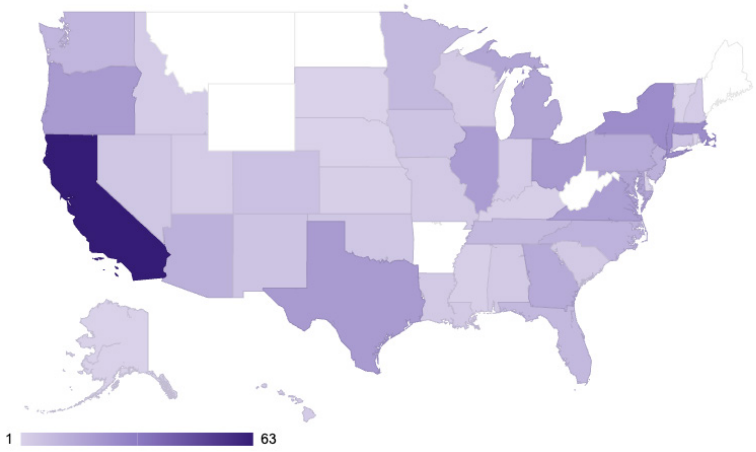
The InventEd Network, while still in its early stages, has already brought together a diverse array of stakeholders across the IvE ecosystem. These stakeholders play various roles, from program delivery to operations, advocacy, and curriculum development. However, network participation has been concentrated in certain geographic and functional areas, leaving room for broader inclusion and engagement.

Network analysis reveals concentration in coastal regions and metropolitan areas with numerous postsecondary institutions, particularly in states like California, New York, Massachusetts, Texas, and Ohio. States like Arkansas, Maine, Montana, and Wyoming remain underrepresented. Survey results reveal the need for targeted outreach. Establishing regional hubs will help close geographic gaps and improve engagement.

This uneven distribution underscores the network's limited visibility and reach. To build on early successes, strengthening connections across geographic and institutional divides is crucial. Stakeholders advocate for both virtual collaboration and regional in-person interactions to integrate participants from underserved areas, fostering growth across all regions.

InventEd COMMUNITY PARTICIPANTS

InventEd Community



The InventEd network spans a diverse array of stakeholders distributed across the country. While programs, nonprofits, and educators form the core of this ecosystem, it also encompasses less visible but crucial participants such as funders, industry partners, institutions of higher education, museums, libraries, and regional STEM ecosystems.

Survey respondents indicated a strong presence in areas like program delivery, competitions, and equity and inclusion, reflecting a focus on student engagement and creating inclusive environments. However, very few identified their roles in critical areas such as research and evaluation, standards development, or awareness and outreach. This distribution makes sense in the early stages of ecosystem development, where hands-on program execution takes precedence. As the ecosystem evolves, expanding roles in evaluation, standards, and outreach will be essential for long-term growth and impact.

MAPPING THE ECOSYSTEM

As the IvE landscape evolves, it is critical to maintain a clear picture of how its diverse roles and stakeholders interact. To this end, InventEd has begun mapping the ecosystem, a vital step toward understanding the current state of the network. This process will help:

- *Identify emerging trends*
- *Uncover gaps in services and support*
- *Facilitate strategic collaborations*
- *Guide adaptive decision-making*

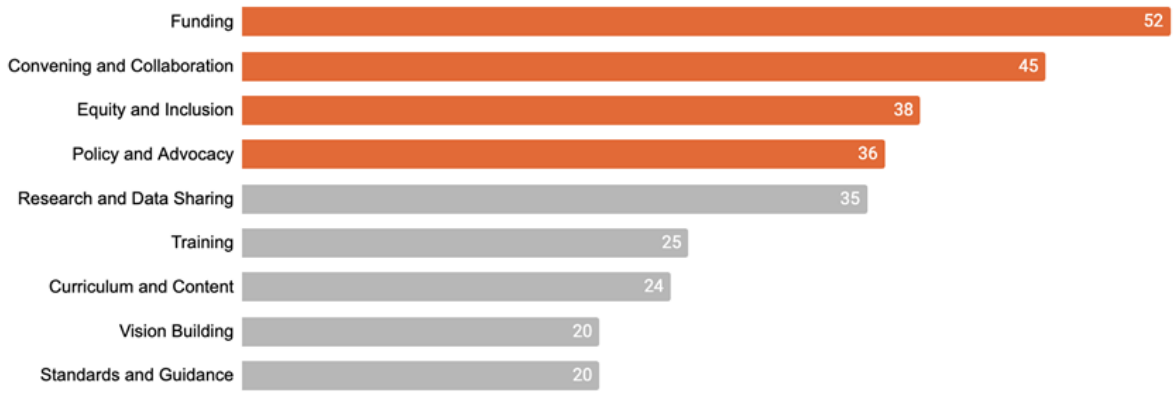
> ***"The IvE ecosystem is a small concentrated group and it's unclear who is a part of it right now."***
>
> – Executive Director, national nonprofit

Ongoing mapping of the ecosystem is essential for building a more inclusive, effective network that can respond to real needs. We invite you to explore the map and join us in supporting ongoing efforts to ensure that IvE reaches its full potential.

PAIN POINTS

Survey respondents, many of whom represent **program delivery** and **competition roles**, highlighted key pain points that directly impact their ability to sustain and scale their efforts. The top challenges—**Funding, Convening and Collaboration**, and **Equity and Inclusion**—reflect the immediate needs of those delivering programs and engaging students.[3] Additionally, concerns around **Policy and Advocacy** and **Research and Data Sharing** underscore the broader support needed to drive systemic growth.

Top Pain Points Impacting the Ecosystem



[3] Source: Survey of InventEd Network members, launched in March 2024. These pain points represent areas marked as "Priority Need" or "High Need" by stakeholders when asked what their organization requires the most.

STRENGTHS AND OPPORTUNITIES

While the current state analysis highlighted gaps and pain points, stakeholder interviews revealed key strengths and opportunities within the IvE ecosystem. Challenges like funding, collaboration, and equity persist, but stakeholders—including students, industry leaders, funders, and educators—identified strengths that can drive equitable growth and sustainable impact. These strengths form the foundation for addressing gaps and expanding the network's reach. The IvE network can transform these strengths and challenges into opportunities, fostering collaboration, improving equity, and expanding national support for inclusive, sustainable growth.

KEY STRENGTHS AND GROWTH OPPORTUNITIES IN THE IvE ECOSYSTEM

S Strengths	Opportunities O
Student-driven, interdisciplinary model	Common vision and language
Pockets of success	Awareness and equitable access
Framework and curriculum	Standards
Educator support programs	Expanded support for adoption
Core champions and diverse coalition	Leadership commitment
InventEd convenings	Differentiated networks

STUDENT-DRIVEN, INTERDISCIPLINARY MODEL

COMMON VISION AND LANGUAGE

Strength

IvE's student-driven, interdisciplinary approach allows students to solve real-world problems at their own pace, integrating skills from STEM, design, and entrepreneurship. By giving students ownership of their learning, this model fosters deeper engagement, creativity, and the resilience to embrace failure as part of the process, breaking free from rigid, traditional education models

> ***Invention Education brings out the best in kids - kids are natural inventors."***
>
> - Executive Director, national onprofit

Opportunity

To build on this strength, IvE needs a common vision and language to ensure coherence across the network. Without clear definitions, such as "inventiveness," IvE risks pursuing too many objectives, which can dilute its impact. The existing Framework for Invention Education[4] provides a solid foundation, but more effort is needed to align stakeholders. For instance, some prefer the broader term Innovation Education, as it better encompasses practices that extend beyond K-12 to higher education and industry. Clearer alignment will help effectively communicate IvE's student-centered approach and support scaling across diverse contexts

POCKETS OF SUCCESS

AWARENESS AND EQUITABLE ACCESS

Strength

Stakeholders highlighted IvE's significant impact on students and educators. Many educators, often working as "solo pioneers," introduce IvE into their schools and build momentum through local partnerships. These collaborations, especially in underserved areas, have been key to expanding access. In some regions, IvE grew from a single classroom to multiple schools by partnering with organizations focused on STEM and providing essential resources like invention kits.

> ***BIPOC communities need to be at the table from the start."***
>
> - Educator and Community Leader

Opportunity

Expanding IvE and ensuring equitable access requires a multi pronged approach. Engaging school and system leaders with data is key to demonstrating IvE's impact. Digital platforms like TikTok and webinars can raise awareness among underserved students and educators. Involving parents through workshops is also crucial, as many are unaware of IvE's opportunities. Strategic partnerships with groups like the Girl Scouts can further extend outreach. Together, these efforts will ensure broader access and equitable participation in inventive learning.

[4] Framework for Invention Education. (2022, October 25). Retrieved from https://inventioneducation.org/framework-for-invention-education/

FRAMEWORK AND CURRICULUM

STANDARDS

Strength

IvE's framework and curriculum were highlighted as key assets. The InventEd network offers curriculum and lesson plans from grades K-12, providing a solid foundation for students and educators alike. Stakeholders noted that the framework's flexibility allows for customization to meet the needs of diverse student populations.

> ***You don't need to reinvent the wheel. If we align to existing standards and benchmarks, we can grab more people."***
>
> – Educator and Teacher Trainer

Opportunity

While the curriculum is a strength, IvE lacks standards aligned with industry and academic benchmarks. Aligning these standards could boost access and adoption, but they should also emphasize commercialization and economic empowerment. By teaching students how to protect intellectual property, commercialize inventions, and explore entrepreneurship, IvE can prepare them for real-world opportunities. Standardization will also streamline curriculum refinement, teacher training, credentialing, and reduce implementation costs, making adoption easier.

EDUCATOR SUPPORT PROGRAMS

EXPANDED SUPPORT FOR ADOPTION

Strength

Support for educators is a key strength of IvE, with programs like fellowships, professional development, and ambassador initiatives providing crucial resources. For instance, The Society for Science's Invention Education Ambassador program leverages veteran educators to share best practices and develop tools that enhance access. These programs offer resources for curriculum alignment, pedagogy, and integration, making it easier for teachers to implement IvE. However, many teachers still struggle to recognize and nurture inventiveness in students, especially in early grades, where traditional methods limit curiosity-driven learning.

> ***We need to develop networks of people who are doing the work and amplify awareness from the top-down and middle-out."***
>
> – Educator and Nonprofit Leader

Opportunity

To drive adoption, IvE must expand support programs to "meet teachers where they are," addressing both content delivery and the challenge of advocating for IvE. Teachers often juggle delivering IvE while convincing peers and administrators of its value. Support should include practical tools, talking points, and strategies for building school-wide buy-in. Training should also focus on helping teachers identify and nurture inventiveness early, breaking free from traditional models that limit curiosity-driven learning. By addressing both instructional needs and barriers to adoption, IvE can accelerate its reach and impact.

CORE CHAMPIONS AND DIVERSE COALITION

LEADERSHIP COMMITMENT

Strength

The IvE network benefits from a dedicated group of core champions, funders, and a small but diverse coalition. These individuals and groups have been crucial in keeping IvE dynamic and responsive to emerging needs. Stakeholders highlighted how this diversity of perspectives drives innovation and enriches the network.

> ***A small [team of leaders] is expected to provide resources to the entire country. They need more support to fund existing and proposed initiatives. More state and national lobbying is needed to increase awareness.***
>
> – Director, Federal Agency

Opportunity

To build on this strength, stakeholders emphasize the need to transition from a loose community of practice to a more structured leadership network. This organized network would harness its collective power to advocate for sustainable funding and policy support, essential for expanding IvE nationwide. By strengthening leadership commitment and engaging school administrators, including principals and superintendents, the IvE network can amplify its impact through increased state and national lobbying, driving greater awareness and support.

InventEd CONVENINGS

DIFFERENTIATED NETWORKS

Strength

The annual InventEd Convening is a cornerstone event for the IvE community, fostering networking, knowledge sharing, and collaboration among a diverse group of stakeholders. Stakeholders consistently emphasize the value of these gatherings, where participants can learn about IvE, exchange ideas, and build communities of practice. For newcomers, it's a gateway to understanding IvE and its applications. For long-time members, it's an opportunity to organize around key issues like raising awareness and advancing equity.

> ***The Invention Education ecosystem is a small concentrated group and it's unclear who is a part of it right now. Ideally, it would be a regional ecosystem with deep involvement from educators and those making invention education training accessible."***
>
> – Executive Director, National Nonprofit

Opportunity

To build on the success of InventEd convenings, stakeholders see an opportunity to broaden participation and deepen impact. Engaging more stakeholders, especially educators who struggle to attend national events, is essential. There's a push for more accessible, regionally focused networks offering tailored support, from IvE basics to advanced curriculum integration. Additionally, addressing long-term issues like advocacy and sustainable funding requires ongoing collaboration. As the IvE community expands, differentiated networks that link regional ecosystems with broader strategic initiatives will be crucial for growth and strength.

FRAMEWORK FOR ECOSYSTEM DEVELOPMENT

We need to find the core of which we unite and how to move forward. It's a collective action problem."

- Executive Director, national nonprofit

A robust ecosystem relies on a clearly defined framework that includes specific goals, principles, and strategies. Based on stakeholder feedback on the strengths and gaps within the current ecosystem, this section presents the guiding principles and strategic objectives that will foster a cohesive and resilient IvE ecosystem, supporting growth, policy alignment, and sustainable development.

GUIDING PRINCIPLES

Principle 1: Student Centered Pathways

Develop integrated routes from primary to postsecondary education to support students in developing innovative mindsets and skills.

Focus Areas:

- Develop programs that span from early childhood through postsecondary education.
- Support students at key transition points (e.g., from elementary to middle school or high school to college).
- Foster partnerships within and between schools, higher education institutions, and industries to create seamless educational experiences.

Insights:

- Need for a continuous pipeline from pre-K through postsecondary education.
- IvE prepares students for the future workforce with critical skills.
- Lack of continuity and gaps exist in the PK-20 pipeline.

Principle 2: Diversity, Equity and Inclusion

Ensure equitable access for all students, with a focus on underrepresented communities.

Focus Areas:

- Improve access to IvE for students in urban, rural, and low-income areas by targeting location-specific challenges.
- Design culturally responsive programs that resonate with diverse populations.
- Provide scholarships, free resources, and outreach to lower barriers to participation for underserved communities.

Insights:

- Inequities are evident in who is inventing and securing funding and patents.
- IvE feels unfamiliar to many communities, with underserved groups not feeling adequately included or impacted.
- Need for intentional outreach to historically underrepresented communities to foster equitable participation.

Principle 3: Interconnection

Leverage IvE's transdisciplinary nature to build diverse partnerships, fostering collaboration and strengthening the network's impact.

Focus Areas:

- Ensure a diverse range of partnerships, including K-12 schools, universities, businesses, and nonprofits, to expand access to resources and support.
- Highlight cross-disciplinary learning examples that integrate STEM, arts, business, and other fields.
- Facilitate cooperation between educators, community leaders, and industry professionals to enrich student learning and real-world connections.

Insights:

- IvE must incorporate diverse fields beyond STEM, including arts and social sciences, to promote holistic learning experiences.
- Need to involve community partners of all kinds and support community projects and partnerships.
- IvE is not limited to STEM; all teachers can incorporate it into their curricula.

STRATEGIC GOALS

Strategic goals ensure measurable progress as the IvE network grows. By focusing on awareness, access, adoption, and advocacy, these shared goals can build a coordinated approach across regions to ensure IvE for every learner.

Goal 1: Awareness

Enhance public understanding of IvE and its unique value to society.

Focus Areas:

- Craft messaging and public relations initiatives that highlight IvE's unique focus on creativity and problem-solving, positioning it as critical for the future.
- Launch storytelling campaigns across the IvE network to share impactful stories and increase understanding of IvE's role in shaping future innovators.
- Host workshops and outreach events in partnership with local organizations, including libraries, museums, and community centers.

Insights:

- Aim for 'Invention Education' to be as widely understood as 'STEM Education'.
- Raising awareness is crucial for expanding IvE's reach and ensuring widespread recognition of its benefits.

Goal 2: Access

Ensure that all students, especially those from underserved communities, have greater access to IvE through expanded programs and resources.

Focus Areas:

- Assess student access by mapping and measuring local programs to identify strengths and gaps in availability.
- Integrate IvE into classroom curricula to make it a core component of daily learning.
- Partner with colleges and universities to offer college credit and placement for IvE courses, increasing demand and broadening access.
- Advocate for IvE inclusion in educational standards at the local and state levels, and work to secure sustainable funding for long-term support.

Insights:

- Survey feedback reinforced the importance of focusing on rural and low-income communities.
- Classroom integration ensures all students, especially inhistorically marginalized communities, benefit from IvE.
- Offering college credit boosts IvE's value and appeal.
- Success depends on policy support and sustainable funding, making it a worthwhile investment.

Goal 3: Adoption

Facilitate seamless integration of Invention Education into school curricula and teaching practices.

Focus Areas:

- Provide curriculum resources that are aligned with state standards to ease the burden on educators and "meet them where they are".
- Develop professional development programs that equip teachers with the skills needed to deliver IvE effectively.
- Create peer networks for educators to share best practices, curriculum ideas, and program success stories.

Insights:

- Administrators and teachers need tools and resources to integrate Invention Education into their day-to-day work.
- IvE adoption is hindered by a lack of standardized resources and support for educators in implementing the curriculum effectively.

Goal 4: Amplification

Advocate for increased funding and resources while promoting broader recognition of IvE.

Focus Areas:

- Advocate for increased funding by building strategic partnerships with corporations, foundations, and government agencies to secure sustainable resources for IvE programs.
- Lobby for IvE's inclusion in educational policies at state and national levels to ensure long-term support and integration into curriculum standards.
- Elevate IvE's profile through media coverage, public recognition, and awards, emphasizing its critical role in developing the next generation of innovators.
- Leverage regional and national networks to unify voices in advocating for IvE, amplifying its importance to key stakeholders, policymakers, and funders.

Insights:

- A collaborative ecosystem enables effective advocacy.
- Success in amplifying IvE depends on sustained advocacy efforts, strong partnerships, and ensuring IvE's role is recognized at all levels of policy and education.
- Building a coalition for IvE advocacy will help secure necessary funding and policy changes.

To ensure this framework succeeds, the next step is to establish clear performance metrics to measure growth, impact, and sustainability. These will provide measurable targets that bring data-driven insights and greater alignment across the IvE network. Defining specific metrics will help the ecosystem assess its growth, impact, and sustainability, ensuring that strategies can be refined and scaled effectively for long-term success.

RECOMMENDATIONS FOR NETWORK DESIGN

"The IvE movement is too young to depend on a more loosely defined organizational structure."

- Educator and Working Group Member

To realize the vision of IvE for every learner, a well-defined network structure is essential. As IvE grows, moving beyond a loosely defined organization is crucial. Various models have been considered, each with its strengths and challenges. Network structures can be understood as existing on a continuum from highly centralized (top-down) to highly distributed (bottom-up) models. Each point on this continuum represents a different balance between centralized control and local autonomy. Below, we assess each model's pros and cons, and how they align with the guiding principles and strategic goals of the IvE ecosystem.

Central Hierarchy

A top-down model where a central authority directs and controls the ecosystem.

Hub and Spoke

A central hub connects to various spokes, facilitating communication and coordination between all parts.

Coalition

A collaborative alliance of diverse stakeholders working together toward shared goals.

Networked Improvement Community

A decentralized network focused on continuous improvement through shared learning and innovation.

Ecosphere

A holistic, interconnected ecosystem connected by geography, audience or other unifying factors where all entities interact symbiotically without a central authority.

Grassroots

A bottom-up approach driven by local, community-based initiatives and participation.

Model	Pros ✓	Cons ✗	Considerations
Central Hierarchy	Consistent quality control, efficient resource allocation, clear chain of command	Less adaptable to local needs, more bureaucratic, may stifle local innovation	Best for strict standardization, requires strong leadership
Hub-and-Spoke	Combines central support with local autonomy, scalable, encourages innovation	Risk of overwhelming hubs, potential for resource inequities	Ideal for balancing national direction with local innovation, requires robust hub support and collaboration
Coalition	Amplifies collective voice, leverages diverse expertise, addresses systemic issues	Competing priorities, difficult to align on a shared vision	Effective for policy advocacy, requires clear governance and goals
Networked Improvement Community	Accelerates innovation, builds collective expertise, adaptable to needs	Requires active participation, hard to scale across regions	Best for fostering continuous improvement, needs strong facilitators and openness
Ecosphere	Holistic, promotes sustainability, diverse collaboration	Complex to manage, risk of focus dilution	Best for leveraging existing ecosystems, requires strong governance and communication
Grassroots	High community engagement, responsive to local needs, fosters ownership	Resource limitations, hard to scale, risk of burnout	Best for local initiatives, needs external support for scalability

STRUCTURE

No single model fully addresses the evolving needs of the IvE ecosystem. A **hybrid approach** that combines the **Hub-and-Spoke** and **Coalition** models offers the most effective strategy for scaling the network while supporting advocacy and policy efforts.

Hub-and-Spoke Model: Establishing National and Regional Coordination

- **National Hub (InventEd):** Acts as the central body providing strategic guidance, resources, and advocacy for IvE. The national hub coordinates efforts across regions, sets the overall vision, and drives partnerships, research, and awareness campaigns.
- **Regional Spokes:** Local ecosystems, or spokes, focus on implementing IvE initiatives tailored to their regional needs. These spokes innovate and address local challenges while maintaining alignment with the national vision and strategic goals set by the hub.
- **Why It Works:** The Hub-and-Spoke model ensures cohesion while empowering regional hubs to adapt and innovate. It provides the structure for centralized coordination and advocacy while allowing flexibility in local implementation.

Coalition Model: Amplifying Advocacy and Policy Work

- **Coalition:** A network of stakeholders from various sectors (education, industry, nonprofits) works collectively to advocate for policy changes, secure funding, and promote IvE at the state and national levels. The coalition leverages the collective expertise and resources of its members to address systemic challenges, amplify the network's voice, and align on shared policy goals.
- **Why It Works:** The Coalition model strengthens the Hub-and-Spoke structure by ensuring a unified voice for advocacy and policy work. This model is essential for driving systemic change, securing long-term funding, and aligning the IvE network with broader educational standards and goals.

While the Hybrid Hub-and-Spoke and Coalition model provides a strong foundation for the IvE network, it is worth noting that other network models, such as Networked Improvement Communities (NICs) and Ecospheres, should also be explored and evaluated as the ecosystem evolves.

FUNDING

Access to funding and resources was the top priority in stakeholder feedback, with respondents stressing the need for sustainable financial support to drive growth. Without sufficient funding, the IvE network risks stagnation and limited expansion. This section outlines key funding models to ensure the ecosystem's long-term sustainability.

Public-Private Partnerships

Public-private partnerships are vital for a robust IvE ecosystem. These collaborations unite corporations, educational institutions, and government entities, each contributing essential elements: funding, expertise, curriculum, infrastructure, grants, and policy support. Together, they create a sustainable ecosystem offering real-world challenges for students.

Key Benefits:

Engages corporations, educational institutions, and government agencies to fund and support IvE initiatives. These partnerships provide financial backing and valuable expertise for long-term sustainability.

Recommendation:

Formalize partnerships with corporations and educational institutions in pilot regions, focusing on aligning workforce development goals with regional needs.

> ***Corporate funding is essential. Philanthropy and corporate can sustain national and regional hubs."***
>
> – Director, national nonprofit

Federal and State Grants

Federal and state grants in educational innovation, STEM, and workforce development offer crucial long-term funding. These programs, such as NSF's "Broader Impacts" initiative, create a network effect that connects IvE with other organizations, enhancing visibility and impact.

Key Benefits:

Taps into educational innovation and STEM-focused grants from federal and state programs to provide sustainable, long-term financial support.

Recommendation:

Pursue targeted grants to fund pilot hubs and national initiatives that boost awareness and policy integration; collaborate with partners to strengthen applications wherever possible.

> ***Recurring revenue and state funding via institutional partnerships and large-scale development grants are crucial."***
>
> – Researcher and Advocate, research university

Membership Model

A membership model for regional hubs could provide sustainable funding. Fees from schools and nonprofits would support local operations, resources, and training, aligning regional activities with the broader IvE vision.

Key Benefits:

Generates revenue by charging member organizations (schools, nonprofits) fees to support regional operations, providing sustainability at the local level.

Recommendation:

Test the feasibility of a membership model in select regions to support regional growth and align local initiatives with the national vision.

> ***I could see regional hubs in the future that are established and are growing might consider a membership model."***
>
> – Director, national nonprofit

Additional Funding Strategies

Additional funding strategies include crowdfunding for educator-led projects and a national IvE program offering standardized practices and bulk-rate licenses. Innovation is essential to ensure that students can access funding promptly, allowing them to experience the immediate benefits of their ideas and innovations. To address fragmentation and missed opportunities, stakeholders emphasize collaboration. As one nonprofit leader noted, "We need all the groups doing this work to collaborate, not compete for recognition and funding." Joint efforts can strengthen applications and create a more cohesive network.

Recommendation:

Map, engage, and convene stakeholders to align goals and streamline funding strategies, building partnerships that advance the IvE vision.

> ***We need all the groups doing this work to collaborate, not compete for recognition and funding."***

IMPLEMENTATION

A phased implementation strategy is recommended to ensure coordinated and strategic development of the IvE network, aligning national and regional efforts:

Phase 1: Foundation Building

- Define and align goals, guiding principles, and strategic priorities for the network.
- Continue ecosystem mapping efforts to build a better understanding of network assets and needs
- Grow InventEd, the national hub for invention education, by expanding staff, upgrading project management, and improving communication platforms.
- Secure initial funding from grants, corporate sponsors, and philanthropic partnerships.

Phase 2: Regional Pilots

- Select and design pilot programs in both ecosystem-rich and underserved regions, tailoring strategies to enhance awareness, access, and adoption.
- Launch pilots with full support from the national hub, implementing monitoring and evaluation systems to gather data and refine approaches.
- Criteria for pilot selection might include: funding potential, educational need, network strength (K-12, academia, industry), USPTO presence, and robust STEM ecosystems.

PILOTING IN DIVERSE MARKETS

To ensure future network strategies are adaptable across various contexts, it is critical to build capacity in diverse markets.

1. High-Opportunity Market

In markets including Boston, DC or the Bay Area, pilots could leverage a strong funding base, established networks, robust STEM ecosystems, and strong industry and USPTO presence to refine scalable models.

2. High-Need Market

In underserved regions and underrepresented communities such as Appalachia, the Mississippi Delta, or the Northern Plains, pilots can focus on building IvE capacity from the ground up, developing partnerships that address educational and economic disparities in resource-limited communities.

Phase 3: Scaling

- Learn from pilot outcomes and adapt the regional and national framework for broader implementation.
- Develop national initiatives like storytelling campaigns and advocacy efforts to build public awareness and secure additional funding.

Phase 4: Sustainability

- Establish durable governance structures to institutionalize the network.
- Focus on securing diversified funding streams and fostering continuous improvement through NIC practices, ensuring the network remains innovative and responsive to emerging needs.

CONCLUSION AND NEXT STEPS

As we look at potential models, do not fall prey to the rigid pedagogical system that has been part of our education system– it's okay to shake things up. Don't forget to get into good trouble."

– Executive Director, national organization celebrating innovators

The future of IvE is bright, with a clear path for scaling and strengthening the ecosystem. Here are four key takeaways to guide its development:

1. **Shared Purpose:** IvE needs a common purpose and shared goals. A framework with unified principles and measurable metrics is essential to ensure the network grows equitably and serves all students.
2. **Hybrid Approach:** A hybrid model—combining a hub-and-spoke structure with coalition-building—offers the best path forward. InventEd can serve as a strong national hub, while regional hubs drive local implementation, supported by collective advocacy efforts.
3. **Sustainable Funding:** A diversified funding strategy is critical. Pursuing public-private partnerships, securing government grants, and exploring regional membership models will provide the necessary financial support to sustain and expand the network.
4. **Phased Implementation:** A phased approach is recommended to roll out the hub-and-spoke model, allowing time to pilot, develop metrics, and continuously refine the network based on learning and data.

NEXT STEPS

Educators and School Leaders:

- **Stay Engaged:** Continue supporting IvE initiatives and advocate within your school and community.
- **Build Connections:** Partner with industry, community groups, and other educators to expand resources and strengthen programs.
- **Explore the Map:** Use the ecosystem map to find collaborators and add your school or program to help grow the network.
- **Seek Support:** Reach out to InventEd and other organizations for resources, mentorship, and funding opportunities.

Educators and School Leaders:

- **Share this Report:** Ensure your team understands IvE's value and potential.
- **Advocate for Funding:** Push for state and local funding to increase IvE access, especially in underserved areas.
- **Connect with InventEd:** Connect with InventEd: Partner with IvE organizations to drive meaningful policy and funding initiatives.

Ecosystem Members:

- **Grow the Network:** Expand the ecosystem by connecting with others and introducing new stakeholders.
- **Use the Map:** Add your organization to the ecosystem map and encourage others to do the same, strengthening connections across the network.

The path ahead for IvE focuses on building a sustainable and inclusive ecosystem that enables students from all backgrounds to become tomorrow's innovators. By working together and aligning our efforts, we can provide the opportunities and support needed for students to reach their full potential. This report is a call to action. By taking these steps now, we can drive meaningful progress in innovation education and unlock the potential of tomorrow's inventors.

APPENDICES

WORKING GROUP

This report was made possible through the collaborative efforts of a dedicated working group. These individuals conducted interviews and contributed their expertise to shape the findings and recommendations presented in this report.

- **Nyssa Buning,** Smithsonian Institution
- **Jax Chaudry,** Project Invent
- **Ethan Eagle,** Innovatrium
- **Falatko Florence,** Master Teacher of Invention and Intellectual Property
- **Melissa Frey,** The Henry Ford
- **Tom Jenkins,** Greenon Local Schools
- **Jim Lynch,** Apple Valley High School
- **Yaritza Ortiz-Carrillo,** Carrollton Farmers Branch ISD

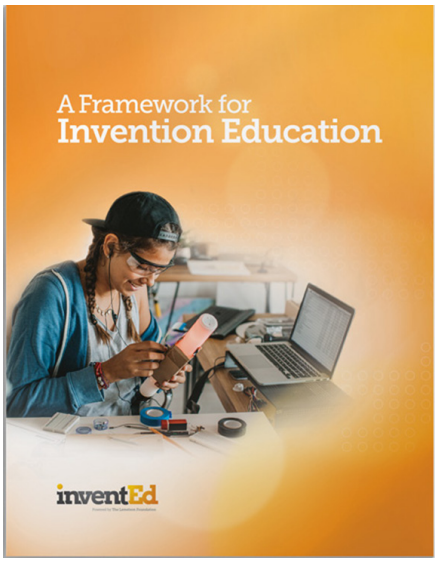
SPONSORS

InventEd is a national network dedicated to expanding Invention Education for all, with a focus on underserved communities. It unites educators, nonprofits, and researchers to build a diverse pipeline of future innovators.

The Lemelson Foundation was established in 1992 to foster future generations of inventors. To date, it has provided over $300 million in support for creating a better world through invention.

RELATED RESOURCES

For additional tools and resources, visit www.inventioneducation.org.



The Invention Education Framework promotes consistency and rigor in the field by identifying the principles and characteristics of both formal and informal best-in-class K-12 Invention Education learning experiences. More than 100 community stakeholders – including in- and out-of-school time educators, business leaders, education researchers, nonprofits, policy makers, inventors and representatives of the philanthropic community – contributed to the development of the document.

Released at InventEd 2019, Researching Invention Education extends the work published in the April 2019 issue of Technology and Innovation Journal focused on the structure, execution and results of local and national invention education programs from primary school through higher education. Researching Invention Education consolidates the current knowledge base that informs the current work by researchers, educators, funders, non-profit organizations and government agencies working to advance the field of Invention Education.

The Lemelson Foundation