VentureCat finalists pose with their awards. Charlotte Oxnam (in red), McCormick ‘23, won the grand prize for her plus-size social shopping app, Cue the Curves. Since its 2014 debut, VentureCat has elevated the entrepreneurial energy at Northwestern University and created impact in and far beyond the Northwestern community.

In his Northwestern-based lab, Evan Scott, PhD, investigates the basic immunological processes contributing to diverse inflammation-driven pathologies and he uses engineering and materials-based strategies to develop targeted therapeutic approaches to combat heart disease, vaccination, and immune dysregulation. Over the past seven years, Scott has worked with INVO to push his enterprising efforts from the lab to the marketplace.

Innovation and entrepreneurship (I&E) is one of the most visible ways Northwestern faculty, students, researchers, and alumni demonstrate the university’s impact on the world. Woven into every part of the Evanston and Chicago campuses, I&E has become an unmistakable component of Northwestern’s identity.

Launched at the end of 2022, InQbation Lab’s FoundHer program put first-time women Northwestern faculty entrepreneurs through an intensive, six-week fellowship that included one-on-one mentoring with an industry professional, a seminar series, pitch presentation coaching, professional development, and a trip to Boston to meet with local venture capitalist firms and network at MIT.
Innovation and entrepreneurship (I&E) is one of the most visible ways our faculty, students, researchers, and alumni demonstrate Northwestern’s impact on the world. Woven into every part of campus, I&E has become an unmistakable component of our University’s identity. The Innovation and New Ventures Office (INVO) is proud to play a central role — home to the technology transfer operations for the University and two thriving hubs for entrepreneurship, The Garage and the newly launched Querrey InQbation Lab.

This year’s Annual Report provides us the opportunity to look both back and towards the future, celebrating milestones and applying the lessons learned to enable the next generation. FY2023 was marked by many highlights, including:

- Ten years of our University-wide startup competition, VentureCat. Over the last decade, VentureCat companies have raised over $1B in follow-on funding and created more than 2,600 jobs.

- The strength of Northwestern research-based startups during this past year’s tough fundraising climate. SIA Health was acquired by Integra LifeSciences and Minute Molecular Diagnostics by Nuclein, and we saw many of our Chicagoland startups raise healthy, often oversubscribed rounds such as COUR Pharmaceuticals ($30M financing), Dimension Inx ($12M Series A), Mattiq ($15M seed), Nanograf ($65M Series B), and Rhaeos ($10.5 Series A) amongst others.

- The official opening in downtown Evanston of the Querrey InQbation Lab, our new hub for research-based entrepreneurship. With support from the state, the University, and a generous gift from Kimberly Querrey, the chair of the Board of Trustees’ Innovation and Entrepreneurship committee, the InQbation Lab is already home to 12 startups and has allowed us to introduce a wide range of programming with partners such as our Research Institutes and Centers, Kellogg, Northwestern Medicine, and many others.

This year is my first as Associate Vice President for Innovation and New Ventures but my seventh year at INVO. It is my privilege to continue to collaborate with talented and dedicated colleagues as we strengthen and expand the support and resources for innovators at Northwestern.

Enjoy the summaries and various snapshots of programs, companies, and people in this year’s Annual Report. As always, do not hesitate to reach out!

Lisa Dhar
Associate Vice President for Innovation and New Ventures
2023 YEAR IN REVIEW

- **151** Patents Issued
- **8.7** Million in Licensing Revenues, Dollars
- **255** All-Time High of Inventions Disclosed
- **257** Agreements Executed
- **10** Startups with Northwestern IP
- **618** Patent Applications

INVENTIONS

INVENTIONS BY SCHOOL

- Weinberg: 56
- Feinberg: 137
- McCormick: 96
- Other: 30

Multiple schools collaborated on 64 — 25% — of 255 inventions processed by INVO in FY23

INVENTIONS BY CATEGORY

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software &amp; Services</td>
<td>7%</td>
</tr>
<tr>
<td>Materials &amp; Industrial Processes</td>
<td>17%</td>
</tr>
<tr>
<td>Engineering &amp; Technology</td>
<td>9%</td>
</tr>
<tr>
<td>Energy &amp; Sustainability</td>
<td>4%</td>
</tr>
<tr>
<td>Therapeutics</td>
<td>37%</td>
</tr>
<tr>
<td>Healthcare Devices, Tools &amp; IT</td>
<td>19%</td>
</tr>
<tr>
<td>Biomarkers &amp; Biomedical Research Tools</td>
<td>14%</td>
</tr>
<tr>
<td>Life Sciences</td>
<td></td>
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<tr>
<td>Physical Sciences</td>
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</tr>
</tbody>
</table>

INVENTIONS BY CATEGORY (Physical Sciences vs. Life Sciences)

- Therapeutics: 37%
- Healthcare Devices, Tools & IT: 19%
- Biomarkers & Biomedical Research Tools: 14%
- Energy & Sustainability: 4%
- Engineering & Technology: 9%
- Materials & Industrial Processes: 17%
- Software & Services: 7%
<table>
<thead>
<tr>
<th>Month</th>
<th>Company</th>
<th>Founder(s)</th>
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<tbody>
<tr>
<td>S</td>
<td>APLEXIS, INC.</td>
<td>PENG JI FSM</td>
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<td>HOLDEN PHARMA, LLC</td>
<td>CHAD MIRKIN WCAS</td>
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<td>N</td>
<td>OPERA BIOSCIENCE, INC.</td>
<td>DANIELLE ERCEK MCC</td>
</tr>
<tr>
<td>D</td>
<td>COSMETEC, INC.</td>
<td>NATHAN GIANNESCHI WCAS</td>
</tr>
<tr>
<td>J</td>
<td>CLEVER CARNIVORE</td>
<td>PAUL BURRIDGE FSM</td>
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<tr>
<td>M</td>
<td>PREDX, INC.</td>
<td>THOMAS MEADE WCAS</td>
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<td>J</td>
<td>ENCUE, LLC</td>
<td>JEFFREY BURGDORF, MCC</td>
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<td>JOSEPH MOSKAL, FSM</td>
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<td>VARCHAS BIOTECHNOLOGIES, INC.</td>
<td>ASHIMA SHUKLA, FSM</td>
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<td>VIPUL SHUKLA, FSM</td>
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<td>A</td>
<td>AFFIX MEDICAL, INC.</td>
<td>RIAD SALEM FSM</td>
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<td>DOLOR THERAPEUTICS, LLC</td>
<td>ANTHONY J. SCHAEFFER, FSM</td>
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<td>PRAVEEN THUMBIKAF, FSM</td>
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Ask Jaehyuk Choi about his research goals and he shares an admittedly audacious two-word reply: “Cure cancer.”

Choi acknowledges simply saying those words aloud seems a bit naive, even irrational. Modern science, after all, has been aggressively chasing new cancer therapeutics, treatments, and protocols for decades, yet the disease refuses to budge, contributing to an estimated 10 million deaths each year and millions more forever-altered lives.

But Choi believes cures are within reach, particularly by shifting immunology from a philosophical problem — “Figuring out a code,” Choi calls it — to an engineering problem.

A physician scientist and member of Northwestern University’s Feinberg School of Medicine faculty since 2015, Choi has devoted recent years to investigating the complexities and idiosyncrasies of T-cell cancers. T-cell therapist, Choi notes, have worked miraculously on blood cancers, but struggled to generate productive results with solid tumors, which represent about 90 percent of all adult cancers. His Northwestern-based lab develops novel genetically engineering T-cell therapies that can address a broader range of cancers. Such approaches, Choi notes, have worked miraculously on blood cancers, but struggled to generate productive results with solid tumors, which represent about 90 percent of all adult cancers.

With an urgent spirit to bring solutions to market, especially since the technology developed in his lab can exist within current products, Choi’s involvement with INVO has intensified over recent years. INVO has helped Choi protect intellectual property (IP) from his lab and determine a robust IP strategy. The office has also provided critical support and counseling, translational guidance, and preparing Choi for interactions with industry and investors.

In 2023, Choi co-founded a startup to take his lab’s foundational IP to market, one that has already completed its initial round of funding to catapult its efforts.

“With its different perspectives and values, INVO is helping us navigate ... the business side of research and innovation. It’s a lofty ambition to think there’s a chance we can cure cancer, but we believe in the technology and are grateful for Northwestern’s translational resources helping us pursue that goal.”

Jaehyuk Choi, MD, PhD
Jack W. Graffin Professor, Feinberg School of Medicine
In 2012, Benjamin Hernandez was a JD/MBA student at Northwestern University with grand visions of launching his own company. It was then Hernandez encountered a chemical engineering PhD student named Chris Wilmer. Wilmer was using computational tools to design and discover materials for industrial sustainability – materials then crafted and tested in the lab of Northwestern chemistry professor Omar Farha. With the cost of computing power falling and unlocking profound opportunities for science, Hernandez was intrigued. He believed the workflows being tested in Northwestern’s labs had compelling industrial applications.

Within months, Hernandez co-founded Numat Technologies with Farha and, with an interdisciplinary team, entered the company into various business plan competitions. Numat netted more than $1 million in winnings, including capturing top honors at the first-ever U.S. Department of Energy National Clean Energy Business Plan competition.

Numat also began working with INVO to structure licensing agreements with Northwestern to bring the novel technology to market. It was one of the earliest examples of a student-led company working to commercialize a Northwestern-developed technology.

With licensing in hand, Numat pitched investors, completed its first round of funding, and built momentum that continues into the present day, where Numat is a fast-growing company with global operations and an unapologetic mission to reduce the negative impacts of chemical products and processes on human health and the environment.

The market leader in metal-organic frameworks – a transformative chemistry platform compatible with existing products and processes to capture hazardous chemicals with incredible precision – Numat is building the world’s first industrial-scale manufacturing campus dedicated to these precision chemistries in Chicago.

“(INVO) took the risk with us and helped structure enabling licensing agreements that made sure we had a win-win start.”

Benjamin Hernandez
McC ’06, KSM ’13, PSL ’13
CEO, Numat
Arjan Quist: The Commercialization Advocate
INVO Champions Research and Translation as a Vital Social Good

With Northwestern University innovators disclosing some 250 inventions to INVO each year, Arjan Quist is a busy man.

Frequently an aspiring entrepreneur’s first point of contact with INVO, Quist provides an earnest, unfettered look at the commercialization journey ahead. He outlines the translational process and provides candid perspective on a long, often strenuous adventure – albeit one in which he and his INVO colleagues assist.

For many inventors, translation is an eye-opening odyssey. For Quist, it’s a personal mission.

The commercialization process first captivated Quist, a physicist and materials scientist by training, during his post-graduate work at the University of California, Santa Barbara, when he worked with the school’s tech transfer office on government capital. Quist began to view commercialization not as a distant byproduct of research, but rather an earnest responsibility to the taxpayers and society at large.

Embracing that mindset, Quist has devoted the last two decades of his professional life to promoting translation as a social good and helping inventors bring their science from the bench to the marketplace with an unrelenting spirit and resolute energy, which includes serving as a mentor in the National Science Foundation's Innovation Corps program.

After learning the ins and outs of business formation and commercialization pathways at a Chicago-based small business, Quist joined INVO in 2013. Initially an invention associate, he rose INVO's ranks to become an invention manager, then senior director of invention management, largely handling project-based work with multiple Northwestern-based inventors.

In spring 2023, Quist was named INVO’s executive director of innovation management. He now guides a 13-member team charged to push Northwestern inventions to market, from executing the initial commercialization assessments and protecting intellectual property to filing patents and securing licensing deals.

“The ultimate mission is to make inventions available to the public and we’re going to educate our inventors every step of the way about what’s necessary to bring science from the bench to a store near you.”

Arjan Quist, PhD
Executive Director of Innovation Management, INVO
NanoGraf started simply enough. In 2012, a team of six business and engineering graduate students enrolled in NUvention: Energy and began investigating potential clean tech ventures. The group quickly focused its attention on the work of Northwestern Engineering professor Harold Kung, who was developing a battery anode technology to maximize energy density and enable longer device run times. The students embraced Kung’s spirited research and developed a comprehensive business plan to commercialize the tech as the capstone project to their NUvention: Energy course. Only the team — then called SiNode Systems — didn’t stop there. From consumer electronics to electric vehicles to national defense, the students saw intriguing market applications to Kung’s research. With INVO’s support, the team incorporated their business, protected the intellectual property, and licensed Kung’s technology from the University. They then entered and won multiple business plan competitions, including the 2012 Cleantech Open Global Forum, the 2013 Rice Business Plan Competition, and the 2013 U.S. Department of Energy National Clean Energy Business Plan Competition.

Powered by those victories and Northwestern’s credibility, NanoGraf gained traction with investors and commercial interest, including earning contracts with the U.S. Department of Defense and the U.S. Advanced Battery Consortium led by America’s big three automakers. A decade later, NanoGraf claims the world’s most energy dense battery — one boasting a run time up to 30 percent longer than its peers. Scalable and cost efficient as it drops into existing manufacturing processes, NanoGraf’s technology is poised to change the battery marketplace and increase the United States’ presence in the global battery supply chain.

In early 2023, the Chicago-based company closed its Series B funding round, a $65 million effort among the year’s largest clean tech venture capital rounds. And in 2024, NanoGraf will open a 20,000-square foot production facility on Chicago’s West Side that will scale North American production of its silicon anode products.

“\textit{We’re crossing the chasm and at a place few lithium-ion startups ever reach, and those early days with INVO were critical to setting a foundation we could build upon.}”

Francis Wang, PhD
NanoGraf CEO

Creating Foundation for Transformative Enterprise
NanoGraf Prepares to Transform the Battery Market
Once a pre-med biomedical engineering undergraduate with clinical ambitions, Evan Scott became intrigued by the potential of basic science to help larger populations lead healthier lives — so much so he shifted his postgraduate plans from medical school to translational research.

Since joining Northwestern’s faculty in 2013, Scott has been pursuing that work in earnest.

In his Northwestern-based lab, Scott investigates the basic immunological processes contributing to diverse inflammation-driven pathologies and he uses engineering and materials-based strategies to develop targeted therapeutic approaches to combat heart disease, vaccination, and immune dysregulation.

Over the last seven years, Scott has worked with INVO to push his enterprising efforts from the lab to the marketplace.

Beginning in 2016, INVO helped Scott protect intellectual property (IP), specifically his development of a novel synthetic drug carrier platform for subcutaneous nanotherapy. In the years since, INVO has continued supporting Scott and his intensifying entrepreneurial ambitions.

For example, INVO’s therapeutic bootcamp, INVOForward, allowed Scott to formulate his ideas and prepared for the launch of SNC Therapeutics with his cofounder, Dr. Jacqueline Burke. With its broad gene and drug delivery platform, SNC taps into surging interest in nonviral synthetic nanocarrier (SNC) systems to addresses issues with toxicity, scalability, and payload stability inherent to current viral and lipid nanoparticle vehicles.

INVO also helped Scott cultivate relationships within the Chicago startup ecosystem. These introductions to the broader investment community, administrative support, and battle-tested counsel culminated in SNC capturing the highly competitive AbbVie Innovation Midwest (AIM) Award in 2022. The award provided investment from AbbVie Ventures and support from AbbVie Research and Development, which contributed to SNC’s smooth launch in December 2023.

SNC closer to commercialization of its key technologies, including a cancer gene therapy currently in animal testing. SNC will soon join the Querrey InQbation Lab, where access to additional resources, support, and space promises to catalyze SNC’s growth and position Scott to accomplish his goal of achieving global patient impact.
Unlocking Doors to Entrepreneurial Opportunity

In Licensing Northwestern-developed Tech to a Motivated Team of Graduate Students, INVO Helped Launch a Market-leading Business

Blending humility and careful reflection, Alexei Mlodinow begins retracing his journey with Surgical Innovation Associates (SIA).

Back in 2016, Mlodinow, then enrolled in Northwestern University’s joint MD-MBA program, co-founded SIA alongside his Kellogg MBA pal Todd Cruikshank and his clinical mentor at the Feinberg School of Medicine, plastic surgeon Dr. John Kim.

Years earlier, Kim had invented an absorbable mesh product designed to help mastectomy patients with implant-based breast reconstruction. Kim’s solution represented a compelling alternative to the prevailing surgical treatment: an internal bra constructed of another individual’s biological tissue. While providing the same technical and mechanical benefits to the procedure, Kim’s invention shed costs and avoided the inflammation and infection concerns dogging the human tissue products. With INVO’s guidance, Kim received a patent on his prosthetic breast support technology in 2014.

In Kim’s novel innovation, Mlodinow saw an opportunity to apply his entrepreneurial instincts to a dynamic product category, help breast cancer patients, and create value. He teamed with Kim and Cruikshank to launch SIA and push the technology to market.

Thereafter, Mlodinow and his SIA colleagues leaned on INVO’s expertise to inform its negotiations and fundraising, which included an introduction to investors who would contribute approximately $1 million to SIA over two different funding rounds. The capital, combined with SIA’s enterprising energy, propelled the company’s 2020 commercial launch of DuraSorb, its absorbable monofilament mesh for plastic and reconstructive surgery. DuraSorb’s debut sparked a three-year wave of 80-100 percent annual revenue growth and generated substantial marketplace attention.

In December 2022, Integra LifeSciences acquired SIA for $140 million in total deal value. The New Jersey-based company is now facilitating the continued adoption of DuraSorb in the U.S. while broadening the technology’s availability around the world.

“Along this entire lesson-filled journey, I always felt supported by INVO – both personally and professionally,” said Mlodinow. “INVO is the entrepreneur’s friend: an ally who brings expertise to the table regarding intellectual property, fundraising, and strategic partnership.”
Driving Entrepreneurial Energy with VentureCat
Program Inspires Student Entrepreneurs, Propels Businesses

Since its 2014 debut, VentureCat has elevated the entrepreneurial energy at Northwestern University and created impact in and far beyond the Northwestern community.

Northwestern’s annual student startup competition, VentureCat, inspires students to develop ideas they believe will make a difference in the world and spawns upstart ventures to success beyond the pitch.

Over the last nine years, 165 student-founded startups have competed. Participants represent every school and college at Northwestern and their startups touch a range of industries, from energy to education, manufacturing to media, healthcare to hospitality.

While pursuing $325,000 in awards — a non-dilutive prize fund greater than any peer institution — students also receive professional counsel as they prepare their pitches. In fact, more than 75 investors, entrepreneurs, and industry experts support VentureCat each year. Their engagement helps students professionalize the ways in which they discuss their businesses and fosters valuable, growth-generating connections.

With its established national profile, VentureCat has propelled Northwestern startups to accelerators, awards, national media coverage, and follow-up funding, powering commercialization and marketplace success. VentureCat businesses have collectively raised more than $1 billion in capital and created more than 2,600 jobs. Eleven VentureCat businesses, meanwhile, have been acquired, while 55 percent of the 165 participating ventures remain active.

For as much as VentureCat has uplifted participants, it continues elevating Northwestern’s entire entrepreneurial ecosystem as well. It fuels enrollment of entrepreneurial-minded students and spurs activity at The Garage, Northwestern’s on-campus hub for student entrepreneurship and innovation.

It serves as a unifying force for innovation around Northwestern, sparking interdisciplinary, inter-campus collaborations and novel ideas that bring licensing and revenue to the University.

It delivers inspired stories advancing Northwestern’s reputation as an innovative institution and generates affinity among alumni who tout VentureCat and Northwestern as significant forces behind their entrepreneurial endeavors.
For many academic researchers, the gulf between a lab discovery and a product hitting the public’s hands appears vast, even insurmountable. After all, the intricacies of the entrepreneur’s journey are often viewed as foreign and daunting.

Northwestern innovators, however, have a capable ally in Sonia Kim.

An INVO team member since 2011 and now the senior director of new ventures at the Querrey InQbation Lab, Kim helps the University’s entrepreneurial-minded souls navigate the commercialization process.

Leveraging her own background as an entrepreneur as well as graduate degrees in education and cell biology from Harvard University and a four-year run at Stanford University’s Office of Technology Licensing, Kim crafts outcomes-oriented programming so Northwestern innovators can travel the translational timeline with passion and poise.

Eight years ago, for instance, Kim introduced the INVO Practicum, an internship program training research scientists to assess technologies for patentability and commercialization.

Within the familiar confines of the University, the Practicum has enabled more than 70 Northwestern PhDs and postdocs to explore alternative, innovation-oriented careers outside academia.

In spring 2023, meanwhile, Kim spearheaded the debut of the Q Entrepreneurial Fellows program. The fellowship supports the next generation of scientific entrepreneurs while advancing Northwestern innovations toward commercialization. In the 2023-2024 academic year, four entrepreneurial fellows are being supported with salary, mentorship, and programming.

And this past fall, Kim steered the pilot of the Q Executives-in-Residence (EIR), a novel program allowing executives to embed at the University for one week. The EIR provides an infusion of business acumen and insight into actionable recommendations for both faculty and startups.

Kim’s rich background emboldens her to cross-fertilize research and technology with business, overcome perceived barriers, and create bridges for Northwestern innovators to thrive and see their discoveries impact the public at large.
In 2022, Pitchbook found that venture capital funds given to women-founded startups made up just 1.9% of the total; women of color received 0.05% and less.

The InQbation Lab’s FoundHer program seeks to change this narrative. Starting at the end of 2022, FoundHer put three first-time women Northwestern faculty entrepreneurs through an intensive, six-week fellowship that included one-on-one mentoring with an industry professional, a seminar series, pitch presentation coaching, professional development, and a trip to Boston to meet with local venture capitalist firms and network with the Cambridge/Boston investment community.

The inaugural FoundHer cohort included Feinberg School of Medicine faculty Ruchi Gupta, founder of Yobee Care, which focuses on balancing the microbiome of the scalp and skin; and Julie Kim, founder of NUVitro, which is developing a multi-well microfluidic platform for studying organ physiology in vitro; and Weinberg College of Arts and Sciences faculty member Yevgenia Kozorovitskiy, founder of Neuroplastica, a high-throughput drug discovery platform that measures neuroplasticity.

Only 11% of university startups have women founders, meaning that the ability to network with other underrepresented entrepreneurs is vital.

Among the seminar speakers were serial entrepreneurs Dr. Shana Kelley, Northwestern faculty member and President of the Chan Zuckerberg Biohub in Chicago; Harvard’s Pam Silver, co-founder of the institution’s Department of Systems Biology; entrepreneur Laura Schewel, whose company StreetLight Data spun out from her work at UC Berkeley; and Cigall Kadoch, a biochemist and cancer biologist at the Dana-Farber Cancer Institute, Howard Hughes Medical Center, and Harvard.

The second cohort launched in early 2024 and is focused on first-time graduate student and postdoctoral founders.
Learning What Works to Optimize Youth Programming

Nichole Pinkard and Cities are Helping Communities Deliver

Possessing an undeniable entrepreneurial spirit, Nichole Pinkard is an education researcher looking to maximize impact.

Building learning systems to scale has been a longstanding personal mission for Pinkard, something she traces back to her days as a Northwestern doctoral student.

The Alice Hamilton Professor of Learning Sciences at Northwestern’s School of Education and Social Policy, Pinkard founded the Digital Youth Network (DYN), a groundbreaking program teaching digital media skills to youth, as well as L3, a social platform connecting youth to learning opportunities in and beyond the schoolhouse doors. She also co-founded YOUmedia, a digital literacy program in which high school students and mentors create new media from traditional media.

But Cities Learn represents Pinkard’s grandest, most ambitious venture to date.

Cities Learn democratizes access to after-school activities by offering a unified data system to track youth participation, achievement, and activity outside the classroom. Cities such as Chicago and Dallas have used the platform’s targeted analytics tools to develop data-driven, equity-focused youth programming with greater intention and purpose.

With the assistance of INVO, Pinkard is working to extend the reach of Cities Learn.

As an inaugural recipient of INVO’s N.XT EdTech award in 2021, Cities Learn received gap funding from INVO as well as individualized resources and mentorship tied to the upstart venture’s specific goals and needs. INVO has also supplied Pinkard guidance on solidifying business operations as well as strategic connections capable of generating sustainable success.

“We get cities all the time asking us to engage with them,” said Dr. Pinkard, “but we need to build our team and our infrastructure to take Cities Learn to a larger audience. That’s where INVO’s N.XT Fund has been an invaluable [resource] to us: giving us structure and support so that we can build a business that has financial and community impact.”