

InventEd Field Guide

A Guide for Accelerating the Adoption
of Invention Education

Presenting Partners



Lemelson Foundation

The **Lemelson Foundation** was established by Jerome and Dorothy Lemelson in 1992 with the vision of cultivating future generations of inventors to create a better world. After 25 years of giving, the foundation continues to be led by the Lemelson family. To date, they have provided more than \$290 million to support their mission.

KID Museum

At **KID Museum**, we empower the next generation with the skills to invent the future. We foster the “Mind of a Maker” in kids and youth by providing hands-on, high-impact maker learning experiences through visits to our experiential museum and educational makerspace, school programs, professional development for teachers, and community partnerships. We are part of a growing movement to remake education for all children, putting young people in the driver’s seat, and trusting them to be agents of change.

Nation of Makers

Nation of Makers is a national nonprofit dedicated to helping support America’s maker organizations through advocacy, resource sharing, and the building of community within the maker movement and beyond. Nation of Makers envisions a society where everyone has access to the tools, technologies, experiences and knowledge to make anything, and works to create a thriving, connected, and inclusive community of practice where collaboration fosters a culture of abundance.



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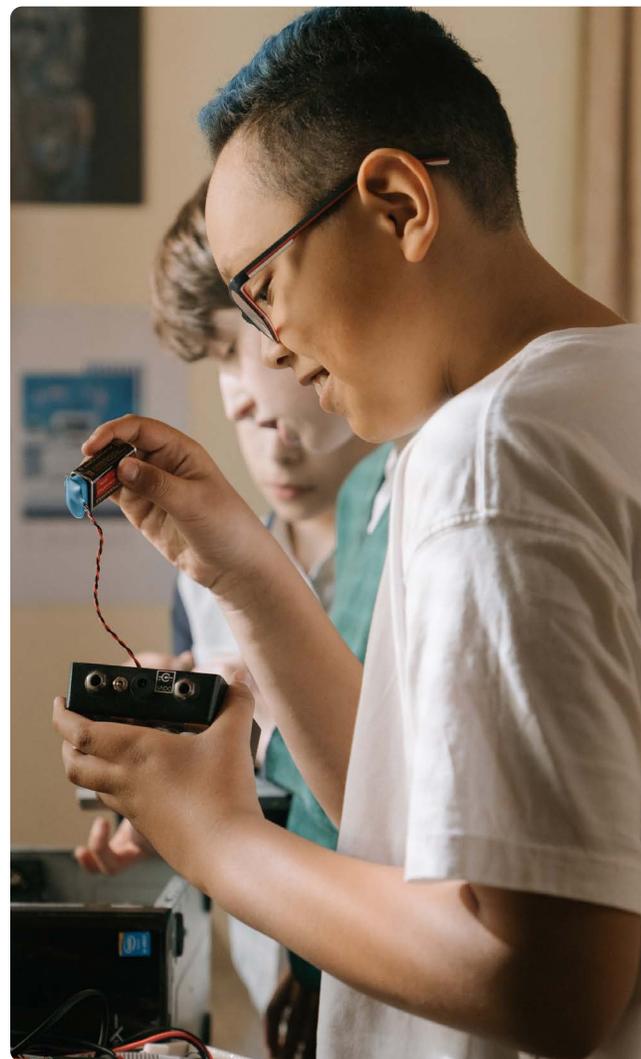
Preface:

About this Guide & How to Use It

The Invention Education community is committed to enabling *all learners* to tackle real-world challenges and prepare them for an ever-evolving future. This Field Guide was developed to increase awareness of and access to Invention Education by helping you – and everyone across this community – advocate effectively, build momentum and promote opportunities for all learners.

The case studies, strategies, data and key messages included here are rooted in quantitative research by leading experts as well as dedicated qualitative research among students, families, teachers, education leaders, Invention Education thought leaders and other key stakeholders, to ensure we are delivering relevant, meaningful and effective stories to the audiences with the power to remake education and deliver effective and meaningful learning experiences to learners today.

We hope this Field Guide helps you strengthen your ability to share the story of your work, with special attention to diversity, equity, and inclusion, as we work together to increase access to Invention Education for all.



Section I:



The Case for Invention Education to Bridge Opportunity Gaps and Promote Equity

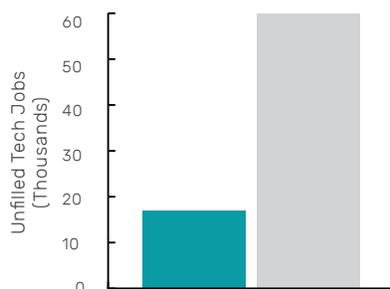
Current Tech Workers in the DC Area

- Black or African-American
- Hispanic or Latinx



Estimated Unfilled Tech Jobs by 2025 in the DC Area

- 2025
- Current



Our recent experience with a global pandemic has vividly reinforced the importance of science and invention.

The American public has never been so engaged in tracking CDC guidance, investing in the rapid development of vaccines, and generating innovations to protect personal health and safety. Within months, the COVID-19 crisis dramatically accelerated the digitization of the economy, making quantum leaps forward in how companies conduct their business and deploy digital technologies and products.¹

Yet these seismic shifts collide with longstanding structural gaps in the US economy that severely constrain our capacity to respond. Even prior to COVID-19, it was well established that there is a vast gap in the talent pipeline to meet changing economic imperatives. For instance, the [National Association of Manufacturing and Deloitte](#) estimated that by the year 2025, there will be 3.5 million STEM jobs – and as many as 2 million of these jobs could go unfilled. In specific markets, the gap is even more pronounced. The greater Washington DC metropolitan region, for example, currently has more than 17,000 unfilled digital tech jobs, and by 2025, an estimated 60,000 digital tech jobs annually will go unfilled. This amounts to a tech supply gap of almost 50%, a gap significantly larger than for other major metropolitan regions nationally.²

Furthermore, populations of color remain significantly under-represented in these jobs. In the DC region, only 17% of tech

1. <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever>
2. <https://gw-partnership.medium.com/how-can-we-equitably-grow-the-capital-regions-tech-talent-pipeline-211465ebd3c2>

workers are Black or African-American and only 5% are Hispanic or Latinx, most of whom are disproportionately concentrated in lower level positions that are at greater risk of displacement due to automation.³ These disparities perpetuate income and wealth differentials and limit economic prosperity – both for individuals and for society as a whole.

Leading economists today recognize that these gaps and disparities must be understood through the lens of longstanding racial, class, age and gender dynamics that stunt access to opportunity on many fronts. From bias in hiring practices to limited professional networks and mentoring, there are real barriers to competing for key jobs in the emerging economy.⁴ These dynamics are set in motion well before candidates hit the job market. Stark disparities in educational experiences lay the groundwork for the longstanding opportunity gaps that plague the US economy. Indeed, in 2018, Raj Chetty and his colleagues coined the term “Lost Einsteins” to describe the millions of potential inventors – women, people of color, and individuals from low-income families – who are left behind in the US economy. This lost potential not only perpetuates inequities, it stifles innovation and economic growth. Chetty and colleagues estimate that we could quadruple the rate of innovation in the US economy if we invest more equitably in educational opportunities for these key populations.⁵

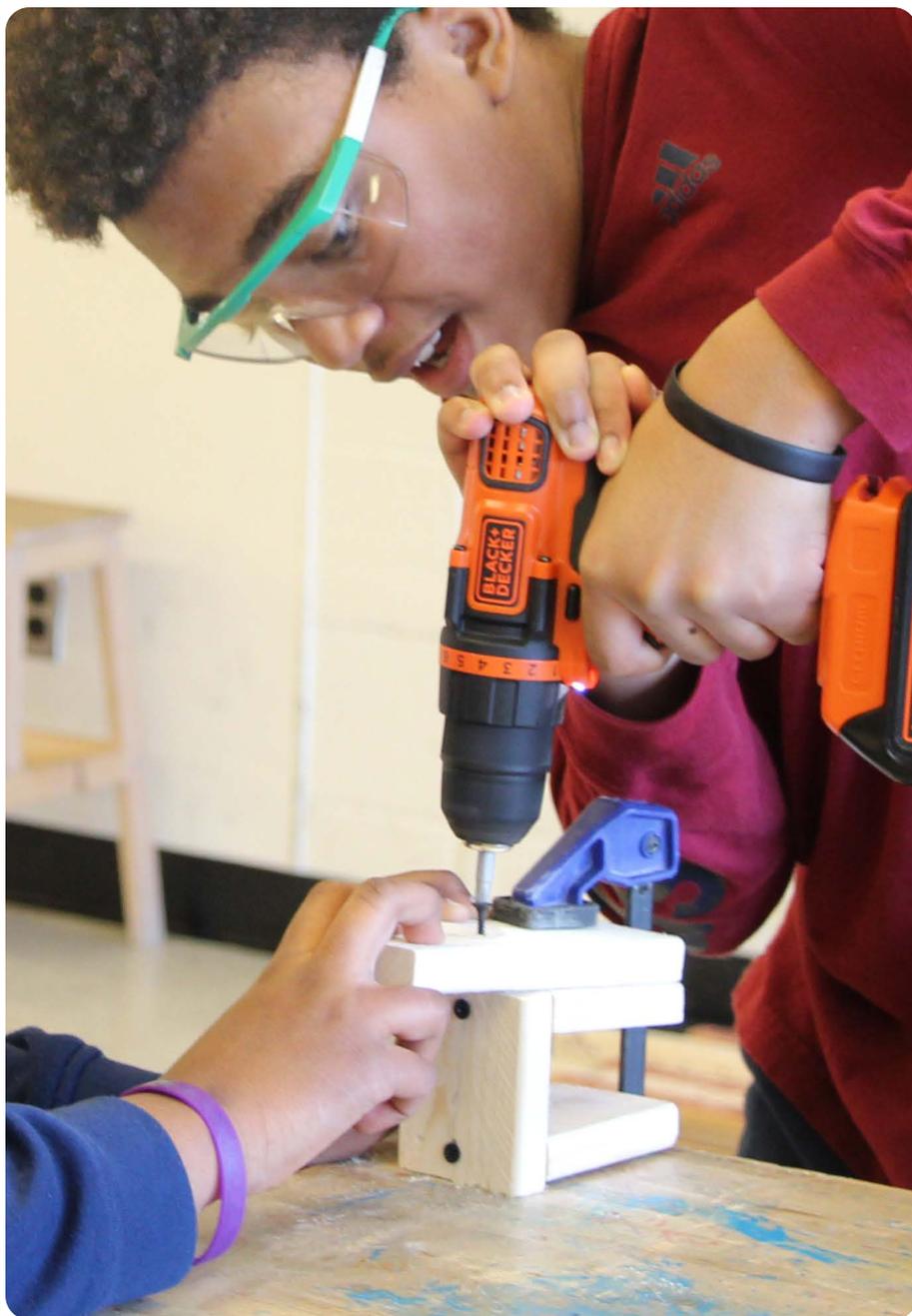
Of course, one of the cruel ripple effects of COVID-19 is that a year of disrupted learning only further widened these gaps. Overall, the pandemic has disproportionately impacted communities of color, and youth have borne the brunt of the fallout, including food insecurity, homelessness, caring for younger siblings, and a lack of necessary technology for



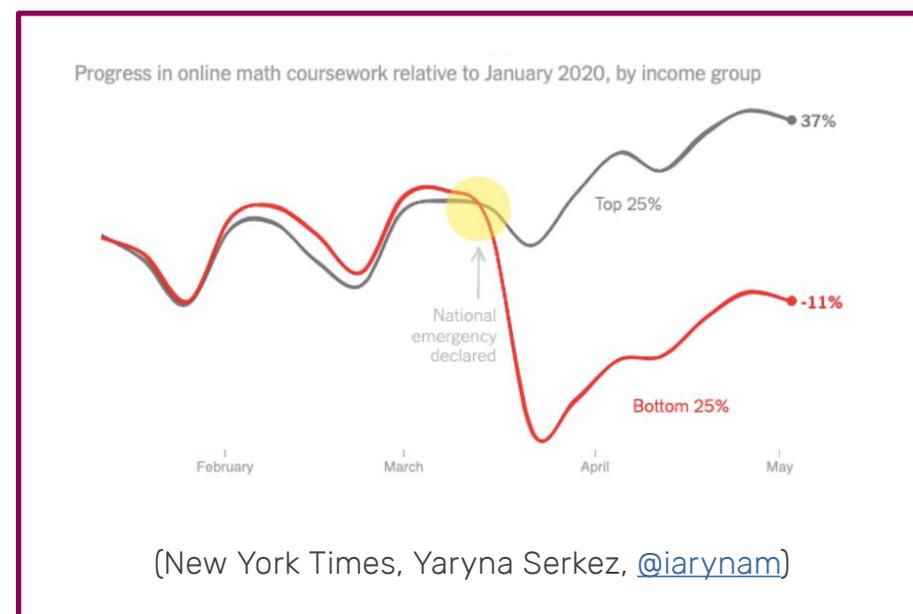
3. *ibid.*

4. <https://www.brookings.edu/blog/the-avenue/2020/09/09/the-labor-market-doesnt-have-a-skills-gap-it-has-an-opportunity-gap/>

5. http://www.equality-of-opportunity.org/assets/documents/inventors_summary.pdf



schooling, in addition to COVID-19-related illness and loss. An estimated 3 million students (most of whom are students from underserved neighborhoods, English-language learners, and those who are experiencing homelessness) did not participate in learning at all during the pandemic. Youth in low-income communities experienced steep declines with remote learning, and the gap relative to higher-income peers widened dramatically, as the graph below illustrates.



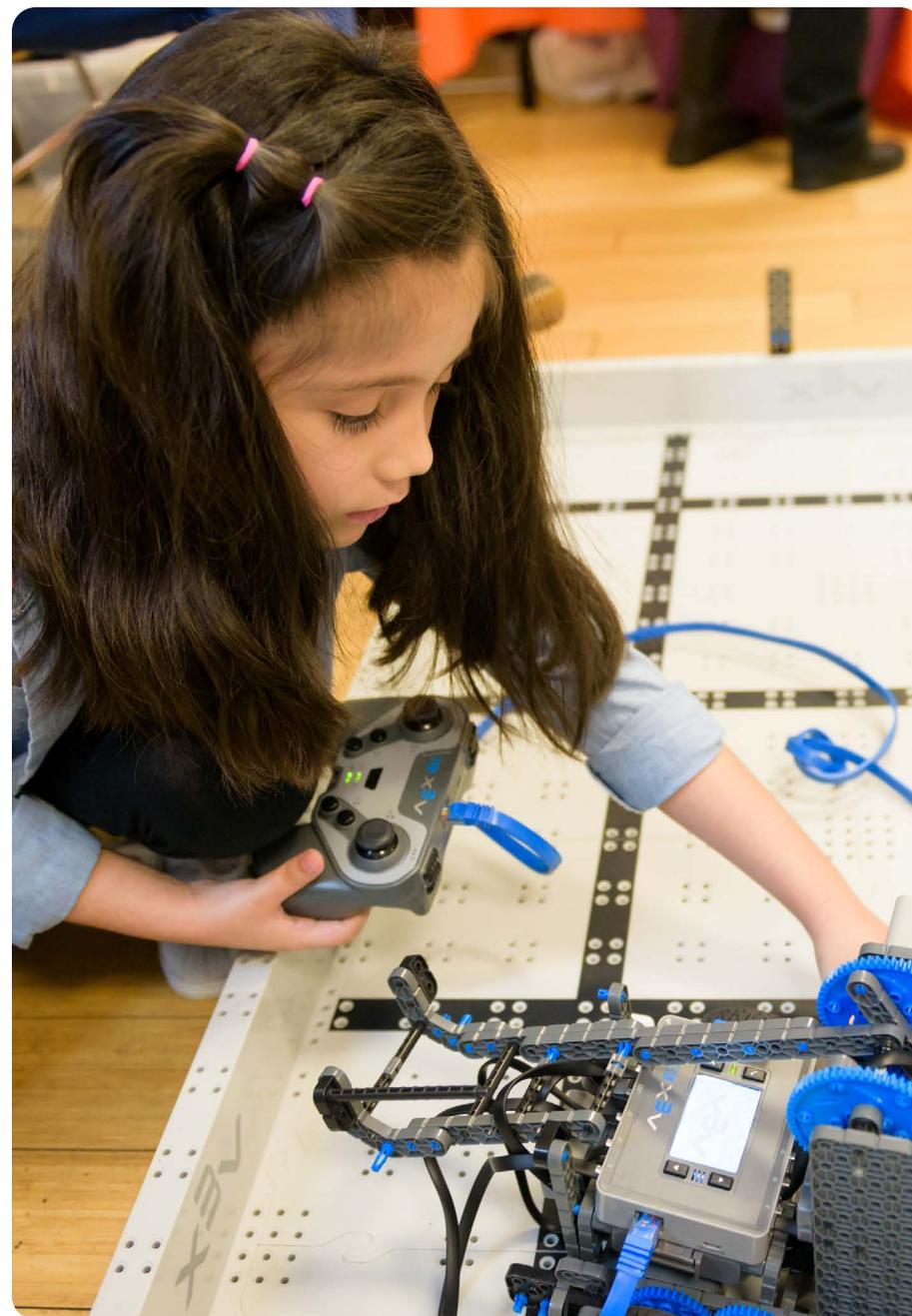
In aggregate, recent reports suggest that students on average were likely to lose five to nine months of learning during the 2020-21 school year. This learning loss is felt most intensely by students of color. In particular, students of color could be six to 12 months behind, compared to four to eight months for white students.⁶ The reverberating effects will be with our students and society for years to come.

6. <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-learning-loss-disparities-grow-and-students-need-help>



Looking ahead, it is clear that there is an urgent need to step up opportunities to accelerate learning and close the widening opportunity gap. Research points to a number of priorities for investment, including expanded learning time with culturally relevant, small group instruction that reinforces core academics, builds skills for the fast-changing economy, and integrates social-emotional learning alongside academic development.⁷ Best practices suggest a focus on acceleration, not remediation, with teacher professional development to support a shift to student-centered, “just-in-time” scaffolding to ensure student mastery of core content.⁸ A series of recent studies reinforce the value of rigorous project-based learning as a strategy to increase student engagement in learning as well as significant outcomes in performance in key subjects such as science, reading and math.⁹

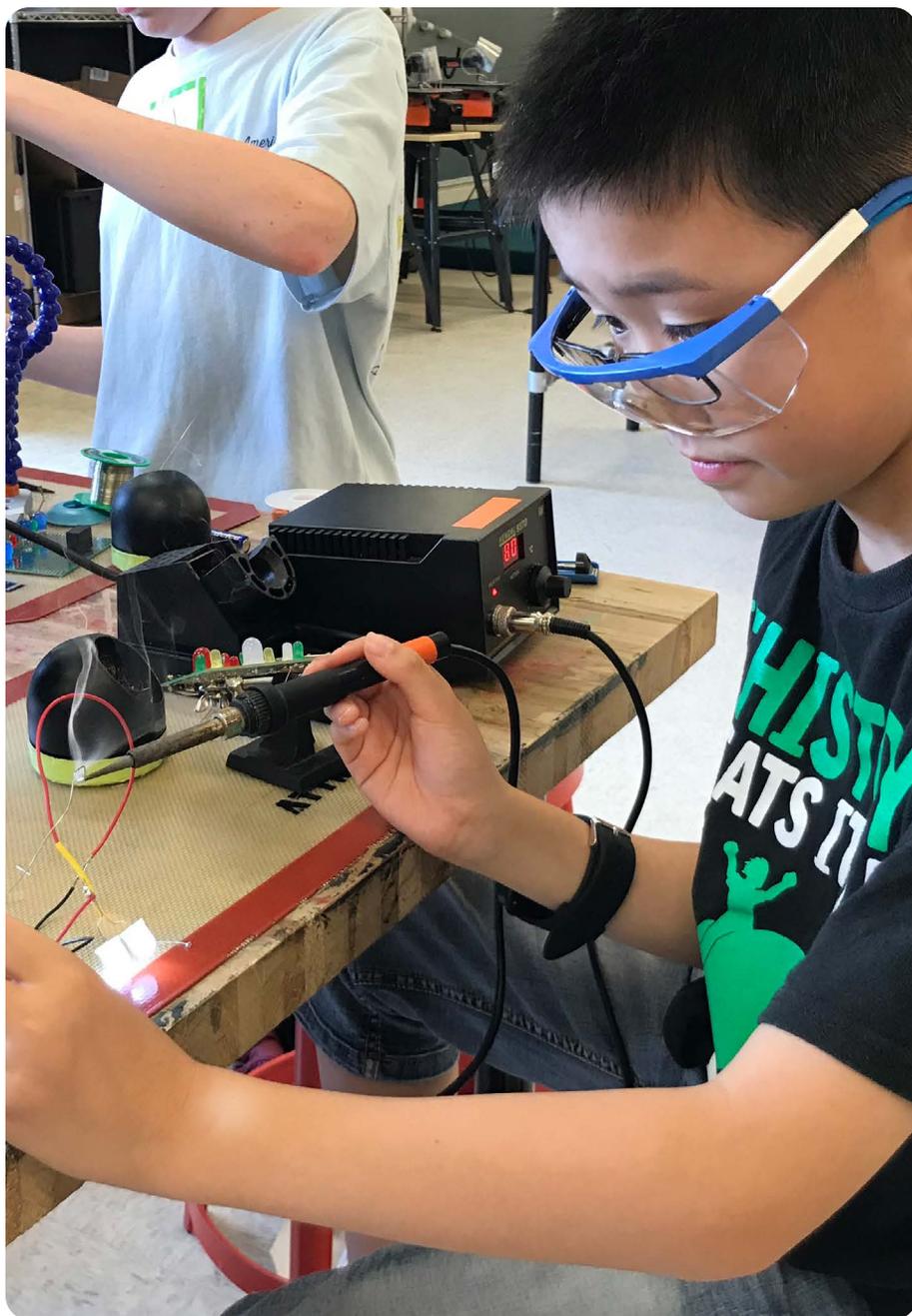
Taken together, the research on effective practices to turn the tide on COVID-19-related learning loss and support students to leapfrog forward presents a compelling case for Invention Education. **Invention Education builds the core competencies that drive innovation: creativity, resourcefulness, and agility combined with an ability to dissect a problem, prototype, experiment and iterate.** It intentionally integrates socioemotional development with STEM skills, such as coding and engineering design. Leveraging project-based learning, it puts students in the driver’s seat of their own learning, making it more relevant, fun, and impactful. Perhaps most importantly, these experiences build student confidence, identity, and agency – fundamental skills that students carry with them into future academic and career opportunities.



7. https://restart-reinvent.learningpolicyinstitute.org/sites/default/files/product-files/Restart_Reinvent_Schools_COVID_REPORT.pdf

8. *ibid.*

9. <https://www.lucasedresearch.org/research/research-briefs/>



As the Invention Education community prepares to expand access to transformative learning experiences that accelerate student outcomes, it is critical that these offerings are **intentionally designed to address equity and engage diverse populations that have traditionally been overlooked or left behind**. Equity-centered Invention Education is not color-blind or simply “open to all.” According to research by Ebony McGee, Associate Professor of Diversity and STEM Education at Vanderbilt University, when *intentionally designed*, equity-centered education can overcome systemic biases (internal and external) for youth to meaningfully engage in and benefit from these experiences. This is accomplished by developing a learning approach that values and sees cultural differences as assets, and welcomes diverse perspectives in a way that is both inclusive and empowering.

As we emerge from our COVID-19 pandemic year, our society faces a watershed moment to reinvent learning and reset our foundation for inclusive growth and prosperity. The Invention Education community is poised to play an important role in shaping the path forward. Through our collective leadership, we can engage our communities at the local, regional and national levels to confront this moment with a spirit of innovation and optimism – and together, close the opportunity gaps that have long plagued our economy.

In this report, we offer a framework for engaging stakeholders in this work, identifying key messages that resonate from different vantage points. We also offer a case study of KID Museum’s experience advancing adoption of equity-centered Invention Education as an illustrative example of one ecosystem’s success to date. We invite others in the Invention Education community to add your own stories, so together we continue to build this resource and support the work ahead.



Invention Education...

Prepares students
to succeed in
tomorrow's
workforce.

Fosters an
inventor's
mindset.

Reinforces the
value of embracing
diverse
perspectives.

Prioritizes
collaboration and
teamwork.

Helps students
recognize and solve
problems.

Develops
the skills* that
employers value in
future leaders.

Develops mindsets
and skills students
can use to create
new industries
yet to be imagined.

*Empathy, curiosity, resourcefulness, and collaboration.

Section II:

■ Advocacy for Invention Education

Invention Education programs are most likely to achieve scale for impact when they receive endorsement, support and investment from the entire community.

Experience shows that a variety of stakeholders hold the power to build passion and engagement for invention education through their individual and collective advocacy efforts.

In order to identify the approaches that promise to be most effective in launching, promoting and sustaining Invention Education programs, we conducted a series of in-depth, individual interviews with those who know and understand Invention Education from a variety of perspectives.

Participants included:

- a program director at one of the leading federal agencies that funds educational research
- the executive director of a major regional foundation that supports innovative learning
- the head of a national corporate educational initiative to improve computer science learning for K-12 youth from underserved and underrepresented communities
- the former school superintendent of one of the nation's largest school districts

- executive directors of two leading organizations that train and support educators to deliver Invention Education in the classroom and help introduce and sustain maker learning programs in the community
- a senior staff member for a U.S. Congressman who supports Invention Education
- districtwide program specialists, classroom educators, regional and state invention education program leaders, education writers and consultants, and more

After reviewing the interviews and analyzing the responses in detail, we are pleased to present findings and recommendations for each of the following stakeholder audiences:

1. Corporate and Foundation Funders
2. Policymakers
3. District Leaders
4. Educators
5. Parents and Caregivers
6. Students



1. Engaging Corporate and Foundation Funders to Support Invention Education

“ These are foundational skills that have the power to create freedom, opportunity and equality. The world around us demands technical literacy, and we are committed to expanding equitable access for communities not historically represented in the tech space.

CORPORATE FUNDER

What we heard in the interviews:

Corporate and foundation funders said they appreciate how IVE encourages creativity, collaboration, critical thinking and communication skills alongside STEM literacy and competence – and said that these are the essential skills we want students to have upon graduation. They noted that IVE helps to cultivate not only a *problem-solving* orientation, but also, importantly, a *problem-identification* mindset, which gives students the confidence to address challenges. Funders discussed how IVE can play a democratizing role, inspiring and engaging students who may not otherwise see themselves as high performers in the classroom, and expanding access to advanced classes and other enrichment opportunities to groups who have been historically excluded.

Funders identified a number of barriers to IVE, including lack of knowledge or misunderstanding about IVE, which can result in its being relegated to a lower status, and doubts about its value due to a paucity of formal evaluation data. Funders told us that while quantitative data would be useful, personal testimonials about IVE from students and teachers are highly persuasive. Finally, corporate funders suggested that employers can be natural partners in supporting IVE but need greater guidance on how to do so.



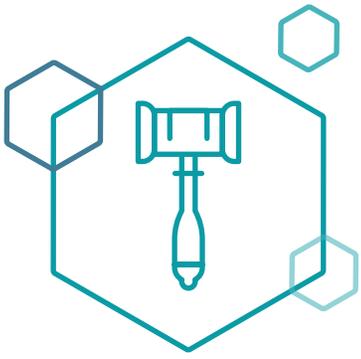
Key Points of Interest

- IVE is not universally well-known or understood. Unfortunately, a funder's unfamiliarity with or misconceptions about IVE may stop them from understanding how it aligns with their organization's mission.
- Many corporate and foundation funders are looking for ways to level the playing field for students academically and professionally. It is worth pointing out how IVE programs do so.
- Funders are best convinced through personal observation of IVE in action. Take advantage of opportunities to bring them into spaces where they can talk to teachers and students and experience the power of IVE first-hand.
- Employers are interested in supporting teachers and schools to help students gain the skills they will need, but need clear ideas on how to do so.



Ideas for Engagement

- Funders can offer grants to provide critical support for IVE, including funding for facilities, equipment, materials, tools, student scholarships and prizes, and even educator salary and training.
- Funders often have the staffing, financial resources, and expertise to help IVE programs in the community achieve higher visibility through digital marketing, media partnerships, and outreach.
- Funders can be invited onto the advisory board of a school or district implementing Invention Education, which would allow them to have a place at the table in vision, planning, and implementation.
- Businesses can offer volunteer and/or professional mentoring opportunities for their employees to engage with teachers and students. Businesses can also create training and summer externship programs for educators, as well as internship programs and paid job opportunities for students to gain professional experience.



2. Engaging Policymakers to Support Invention Education

“ Take legislators on tours so they can see programs first-hand and hear personal stories. Elected officials are moved by real people in their districts, real stories, showing real impact.

CONGRESSIONAL STAFFER

What we heard in the interviews:

Policymakers told us they see a link between IvE and global competitiveness. They recognize that IvE can prepare students with the critical thinking skills, technical know-how, and confidence that are needed to drive our future economy. They pointed to ways in which IvE provides access and opportunity to students from less advantaged communities, so as to develop a more desirable, diverse pipeline into the technical fields. Yet, policymakers also believe that IvE offers benefits beyond technical workforce readiness by teaching students design thinking, problem-solving, and resilience skills that can help them achieve success no matter what career track they pursue.

Barriers to supporting IvE include all of the following: 1) the belief that IvE is a luxury that communities cannot afford when so many students are lacking in basic skills; 2) the assumption that IvE would require a major outlay of resources that communities cannot afford; 3) lack of faith that IvE will lead to measurable outcomes by which school boards, superintendents, principals and teachers are assessed; and 4) a general human tendency to resist change.



Key Points of Interest

- Emphasize that IvE prepares students with the skills to tackle the increasingly complex challenges we are likely to face as a society and can help our country bridge its skills gap.
- Policy goals need to be patient and realistic. While securing budget funding represents the ultimate achievement, it is important to consider that support for IvE needs to build gradually, starting with increasing awareness and understanding.
- Policymakers, especially elected officials, are most responsive to their own constituents.
- The best way to convince a policymaker about the value of IvE is to have them observe it first-hand. Create opportunities for policymakers to interact with teachers and students as they take part in IvE – and allow policymakers to participate personally, if possible.



Ideas for Engagement

- Policymakers can learn more about Invention Education by touring local maker and innovation spaces and engaging with students and educators about their experiences.
- Policymakers can be encouraged to support IvE infrastructure within their communities, for example by spearheading strategic partnerships involving school districts, libraries, museums, universities, and employers.
- Policymakers can connect with schools in their local jurisdiction and help them establish potential partnership opportunities for student jobs/ internships.
- Policymakers can advocate for the importance of research studies to demonstrate the short- and long-term benefits of Invention Education and look for ways to support and advance research initiatives.



3. Engaging District Leaders to Support Invention Education

“ For 20+ years, we've organized around the belief that if students do ok on standardized exams, we've done our job. That's a false assumption. The real question we should be asking is, how do we teach kids to embrace an increasingly complex world on their own terms?

FORMER SCHOOL SUPERINTENDENT

What we heard in the interviews:

District leaders described IvE in positive terms as an approach to education that engages students, taps into their natural creativity, and supports authentic learning linked to real-world problems. They applauded IvE for breaking down artificial lines between the academic disciplines and for supporting the knowledge, skills and habits we want to see in our high school graduates. Note that district leaders said they are more comfortable talking in terms of “maker-centered,” “problem-based,” or “inquiry-based” learning, as they see the term “IvE” as more limiting.

District leaders said that formal and informal obstacles make it difficult for school systems to implement IvE on a large scale. First, there is competition for scarce resources and an assumption that introducing a new program like IvE will require major spending. In general, lack of familiarity with IvE, including by those who fund education budgets and who write the curriculum is a problem. Interviewees said that school districts are regularly approached by new programs and find it difficult to pilot test and sort them out. Moreover, the prevailing emphasis on standards, metrics, and Common Core creates an environment that disfavors new approaches and supports the status quo. Because school districts, administrators, teachers, and students are tracked by their test scores, school systems may be reluctant to adopt a model that promises long-term benefits but does not produce short-term, quantitative improvements.



Key Points of Interest

- District leaders need more support for introducing IvE programs in their school systems. It is important to make a connection between IvE and the key challenges they are facing.
- Emphasize that IvE is not solely focused on STEM, but is interdisciplinary by nature and can be comfortably integrated into the math, science, and language arts curriculum at different grade levels.
- Provide evidence (see Section 1) that demonstrates how Invention Education supports student achievement across the board, including in the core subjects of reading, writing, math, and science.
- IvE programs can be introduced gradually in a school district and do not require an enormous outlay of resources.



Ideas for Engagement

- Share profiles and case studies of school systems, educators and students and teachers who have been profoundly affected by their experience with IvE. Stories of youth whose in-class and out-of-class performance improves with IvE are especially powerful.
- District leaders tend to be responsive to their teachers. Create opportunities for passionate IvE educators in the community to share their enthusiasm with school system officials.
- In conversation with a district leader, ask them to identify the skills that are most important for their graduates to have, and encourage them to consider whether an IvE program might not be an effective way to encourage those skills – especially process skills, such as critical thinking, problem solving, collaboration, and communication.
- Create low-threshold opportunities to bring district leaders on board. Provide step-by-step guidance on introducing an Invention Education initiative, including a sample budget that includes materials, professional development, and any other needed resources. Recommend starting on a small scale to facilitate the introduction.



4. Engaging Educators to Support Invention Education

“Change usually comes from the bottom up. It’s much easier to find an individual teacher who’s willing to try something new than to flip an entire system from the top down. An individual can be the spark.”

DISTRICT DIRECTOR OF INNOVATION &

FORMER CLASSROOM TEACHER

What we heard in the interviews:

We interviewed educators who are fervent IvE supporters, who described how IvE ignites their students’ passion for learning by imbuing lessons with purpose and real world context. Students also gain a sense of efficacy and self worth as they come to understand that one can be an inventor at any age—and that their ideas can have genuine impact and value. Educators told us they have seen how IvE is the one approach that reaches all kids, across different talents and ability levels. In addition, IvE engenders acceptance, empathy, and respect in the classroom.

Our interviewees also shared that many of their peers are not so comfortable with IvE. Generally speaking, they said, educators feel burdened by standards, requirements, and testing, and often cannot see how to integrate IvE into the curriculum. Those who are not trained in STEM and entrepreneurship can find IvE intimidating. Moreover, the scarcity of professional development opportunities in IvE and the absence of an organized invention educator peer community limit wider adoption. Other barriers include the lack of common standards, assessment tools, and accessible curriculum resources in IvE. Interviewees said that more support is needed to lower the threshold to entry and bring new educators “on board.”



Key Points of Interest

- Educators prize how IvE engages students and ignites their love of learning, yet many feel insecure about introducing IvE in their classrooms and need training and support to feel confident. Hands-on professional development programs and peer support communities can provide educators with what they need to feel confident and enthusiastic about integrating this approach into their curriculum.
- IvE addresses the difficult challenge of educator burnout. At a time when more than half of teachers nationwide have reported a decline in their sense of success due to the pandemic (according to a recent Annenberg Brown University Study), Invention Education can help educators feel more engaged in their own learning and growth.
- IvE can be effectively translated to virtual and hybrid learning. Because of the project-based, hands-on nature of this type of learning, IvE enables kids to engage in meaningful work and tap into their creativity, whether in-person or remote.
- Teachers are the best champions for IvE, and a single teacher can be a powerful voice. When teachers speak about the value and impact of IvE, district leaders and parents find it persuasive.



Ideas for Engagement

- Educators who have no experience with IvE can be introduced to other educators and students who have been impacted by the IvE experience so they can share their enthusiasm.
- Educators can be offered low-cost or no-cost Invention Education training, offered mentorship, and connected to peer-learning communities.
- Educators can be given open access to a library of IvE lesson plans and other resources for different grade levels, to facilitate introducing invention education into their classrooms.
- Educators can be encouraged to introduce invention education as an out-of-school time program, then work to incorporate it into the school day.



5. Engaging Parents & Caregivers to Support Invention Education

“ Parent culture can actually drive a lot of what happens in education. Parents can be a powerful lever for demanding Invention Education in their schools, but they first need to understand what their kids are missing.

FOUNDATION FUNDER

What we heard in the interviews:

Although we did not directly interview parents for this project, other stakeholders frequently alluded to parents in their comments. Funders, policymakers, and district leaders all told us that parents and caregivers can and do exert considerable influence and power when it comes to supporting (or not supporting) programs in their districts. Often, they said, a parent will hear about an IvE program that is offered in another school system and then choose to lobby for it in their own school. On the other hand, if parents do not fully understand a program like IvE, they may regard it as experimental or untested, and oppose it for their child. Various interviewees mentioned that parents can be highly focused on qualifications leading to college admission.

Stakeholders said that educating parents about IvE is key to winning them over. Toward this end, parents should be invited to local learning festivals, showcases, and open houses where they can watch their children engage in IvE and, ideally, participate themselves. The goal is to expose parents to the IvE experience so that they will become advocates.



Key Points of Interest

- Parents may look at IvE as something new and experimental and be initially wary about accepting it. Help parents to better understand IvE, including how it is consistent with well-established, student-centered pedagogical practices that are supported by years of research.
- Point to data that shows how IvE engages students and supports a love of life-long learning. Let parents know that the skills gained through Invention Education – creativity, perseverance, critical thinking – will serve their children throughout their schooling and into their future careers.
- Highlight the role of Invention Education in carving out a stronger career path. Invention Education offers students the opportunity to develop skills in critical and innovative thinking, expands a growth mindset, and builds technical skills that have the potential to lead students to more promising career opportunities in the future.



Ideas for Engagement

- Provide opportunities for parents and caregivers to see the benefits of Invention Education first-hand. Invite them to attend classroom showcases, learning festivals, invention conventions, and makerspaces, so they can observe IvE in action and see what exciting, engaged learning looks like.
- Share stories about IvE programs in other schools and communities to help parents learn about this learning approach and become interested in making such a program available for their child.
- Once parents come to know about Invention Education, encourage them to actively request that it be made available to their children in the classroom and in the community.
- Encourage parents and caregivers to practice their own invention skills. Provide them with no- or low-cost ideas they can do together at home with their children.



6. Engaging Students to Support Invention Education

“ Thank you very much for choosing me for Invention Studio because that is where I found my love for engineering. This program has raised my confidence and now I feel that I can do anything! Thank you for believing in me!

7TH GRADE PARTICIPANT IN KID MUSEUM'S

INVENT THE FUTURE CHALLENGE

What we heard in the interviews:

Although this project did not include student interviews, we heard about the impact of IvE on students secondhand from other stakeholder communities. Essentially all of our interviewees talked about how IvE cultivates inquiry, critical thinking, and problem-solving abilities in learners of all ages, how students learn to collaborate and communicate as part of the IvE process, and how they acquire agency, resilience, confidence, and the ability to work through failure as part of the experience.

Interviewees also said that IvE can be especially transformative for kids from marginalized and underrepresented communities, allowing them to see themselves as change agents, innovators, and leaders. By offering a different kind of learning experience, IvE can help overcome implicit bias in the education system, giving students the confidence to pursue advanced classes, ultimately opening doors to greater opportunity in high school, college, and beyond.



Key Points of Interest

- IvE is not only for students who love math and science, but for students across all interests. IvE encourages students to discover and pursue their passions.
- IvE helps even the academic playing field, giving all students a chance to express their unique strengths.
- IvE allows students to take charge of their educational careers and to pursue interests that can extend beyond graduation. IvE fosters self direction and exploration, encouraging students to pursue what they are most interested in.
- Students can be highly effective advocates for IvE.



Ideas for Engagement

- Provide students in IvE programs with creative opportunities to share their enthusiasm with their parents and peers.
- Establish community festivals and local showcases so that students can share their IvE experience with the broader community.
- Provide opportunities for IvE students to connect with the professional world through internships and field trips. Students can be matched with inventors who can serve as role models for potential future opportunities.
- Look for opportunities for IvE students to offer testimonials about the value of IvE to policymakers and district leaders.

Section III:



A Community Approach to Accelerating Equity-Focused Invention Education, A Case Study: KID Museum

KID Museum is a pioneering experiential museum and educational makerspace in the greater Washington, D.C. metropolitan area. Its mission is to foster the “Mind of a Maker” in kids and youth, empowering the next generation with the skills to invent the future. With a focus on serving youth from under-resourced communities, the organization cultivates technical and 21st century skills that last a lifetime. Through deep partnerships and meaningful engagement, including evolving programs to continue serving kids through the pandemic, KID Museum has served tens of thousands of kids each year over the past six years.

Launching a Movement, Engaging Stakeholders

When KID Museum was first envisioned, the concepts of “maker” and “invention learning” were largely unknown in the community. From its inception, the organization’s founders engaged with district leaders, elected officials, school leaders, and community members to earn support for this new concept. As a jumping off point, the organization produced the region’s first Maker Faire, a free hands-on festival for families. 12,000 people attended and participated in interactive activities, demonstrating community interest and prompting the Superintendent of Schools to announce, “Isn’t this what school should look like every day?”

The success of Maker Faire paved the way for a partnership with Montgomery County. Local legislators championed KID Museum’s vision by helping secure a physical space to serve as proof of concept. They connected the museum with County-based organizations like Excel Beyond the

““ Isn’t this what school should look like every day?”

MONTGOMERY COUNTY PUBLIC SCHOOLS SUPERINTENDENT

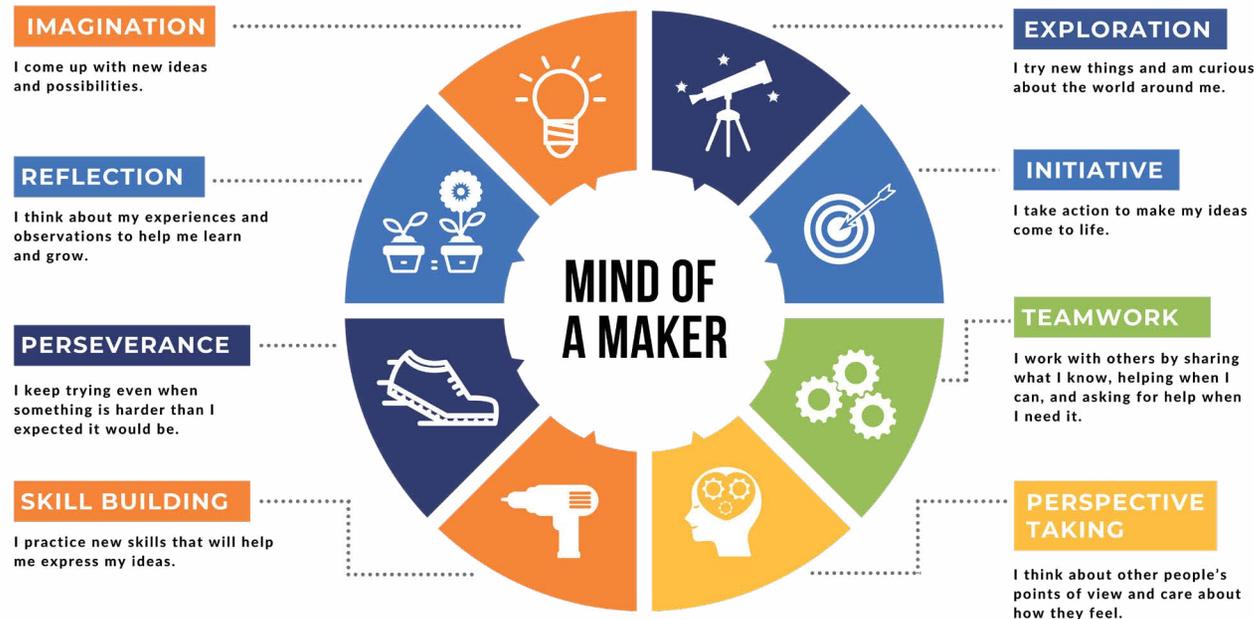
Bell to create long-term partnerships that would reach underserved populations. Montgomery County Public Libraries (MCPL) stepped up to provide KID Museum a home in the lower level of a local library, and the museum went on to

partner with MCPL to provide free coding camps in libraries throughout the region. The museum also established relationships with other organizations, including Identity, which serves Latinx youth from high-poverty areas, establishing a long-running partnership that provides another way to deliver hands-on programming to the larger community.

With a commitment to equitable access for all children, KID Museum established a learning model that integrated technical skill-building – kids could learn to code, solder,

use power tools and 3D printers – with the development of social emotional competencies like perseverance and collaboration. Families attended workshops and open explore activities on the weekends and after-school, staffed by trained educators and a cadre of High School Apprentices, local teens who were trained in facilitating hands-on activities and working with kids. The museum teamed up with the Montgomery County Recreation Department’s Teenworks program to provide paid apprenticeships to high schoolers from low-income families. Along with volunteer apprentices, KID Museum’s Apprenticeship Program provides training and work experience to over 100 students each year.

With its learning model established, KID Museum set out to provide high-impact programming to students who need it most. Museum educators developed Invention Studio, a program which immersed students in the process of design and invention over multiple weeks or months. They collaborated with the local school district, Montgomery County Public Schools (MCPS), to identify a school with high-need populations to pilot Invention Studio. Parkland Middle School became the first school to take part in a program that would grow to include 41 middle schools over the next five years.



(From KID Museum, Mind of a Maker)



Invention Studio Program

KID Museum's pilot *Invention Studio* program began with one school, Parkland Middle School, in the first month it opened its doors. Parkland is a magnet school in a neighborhood with a high concentration of low and moderate income families, where most of the local students weren't choosing the more challenging courses. The administration teamed up with KID Museum to leverage the experiential, maker learning in Invention Studio as a strategy to increase student engagement in STEM and spur them to take advantage of the school's aerospace technology magnet program.

Most of the local students in the Parkland cohort were in lower level math classes and many were struggling academically, as was one boy, Juan Carlos. Juan Carlos's mother and teachers were worried about how engaged he was in his classes and feared he might eventually drop out of school. His experience at KID Museum was transformational. As he started learning new skills and designing his own invention, he gained confidence in his abilities and got excited about learning. He became increasingly engaged at school, developing a strong interest in science and engineering. At a KID Museum showcase event, Juan Carlos's mother stood up to praise the program, calling it "game-changing" for her son. The following year, Juan Carlos applied and was accepted into a highly competitive STEM program run by the Army Corps of Engineers.



Deepening Engagement, Embedding Hands-on Learning Experiences in Schools

In its second year, KID Museum's Invention Studio expanded to two schools. One of the principals, after observing students at the museum, exclaimed, "ten times the amount of learning

“Ten times the amount of learning takes place on these field trips than in a typical classroom.”

takes place on these field trips than in a typical classroom." She then went on to organize a district-wide meeting held at KID Museum so that other principals could experience the program first-hand.

ALISON SERINO, PRINCIPAL
OF WESTLAND MIDDLE SCHOOL

The following year, the partnership between KID Museum and Montgomery County expanded to support five more schools,

bringing the total to seven. This included increasing access to the program for schools with high rates of students experiencing poverty. KID Museum collaborated closely with MCPS on this expansion to ensure the program met

district standards. A grant from the Jim and Carol Trawick Foundation allowed KID Museum and Parkland Middle School educators to expand the Invention Studio program by co-designing a new curriculum that integrates maker and Invention Education into the classroom. KID Museum's partnership with the Trawick Foundation also provided an opportunity to further evaluate the program and demonstrate measurable impact.

“ Students get so much more out of two hours in KID Museum's Invention Studio than they do in a whole quarter of me trying to teach them one subject at school.

STEPHANIE SEO GOULD, PARKLAND MIDDLE SCHOOL TEACHER

based learning, with a focus on those traditionally underrepresented in STEM fields. That first year, the program served 600 students from 26 schools.

The collaboration between KID Museum and MCPS was championed by key school administrators, including the

Expanding Reach, Inspiring Kids and Growing Impact

In 2017, MCPS released a call for proposals for innovative programs to engage students in STEM through a district-wide challenge. KID Museum won the competitive bid process, and the result was the Invent the Future Challenge. Built upon the museum's Invention Studio program, the Invent the Future Challenge was designed to significantly broaden student access to hands-on, project-

Proof of Impact

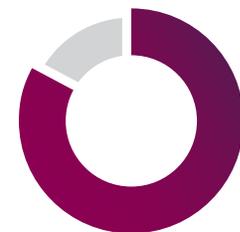
Multi-year assessments conducted by the Partnerships in Education and Resilience (PEAR) Institute at Harvard Medical School and McLean Hospital showed that students in the Invention Studio program made big gains in STEM and 21st century skills.



92.8%
Increased
Interest in STEM



90%
Increased
Critical Thinking Skills



83%
Increased
Perseverance



Director of the Department of Secondary Curriculum and Districtwide Programs, the Director of Pre-K – 12 Curriculum, the Chief Academic Officer and the Superintendent of Schools, who helped pave the way for significant expansion by building support internally amongst principals and teachers, and advocating for KID Museum programming in their budgets. In addition, they collaborated with KID Museum to shape programs to reach students at scale and have the most impact.

“At school, it’s a structured curriculum. At KID Museum, it’s like Choose Your Own Adventure. You get to decide what interests you. And from there on, you use your creativity.”

7TH GRADE STUDENT AND
INVENTION STUDIO PARTICIPANT

To bring critical skills to students at a younger age, KID Museum and MCPS piloted a new Invention Studio program for elementary students. In 2018, all third grade students from two Title I elementary schools designed, coded, and constructed their own robots – with an in-school showcase at the end. While attending the showcase, students in other grades asked if they, too, could be a part of the program.

In 2018-19, the middle school-based *Invent the Future Challenge* had 189 teams from 41 area schools. “We had to anticipate

different problems and come up with solutions when we hit walls,” said one 7th grade student, describing how her team designed a “smart” fire detector to stop forest fires. She went on to explain, “At school, it’s a structured curriculum. At KID

Museum, it's like Choose Your Own Adventure. You get to decide what interests you. And from there on, you use your creativity.”

““ Schools cannot do it alone. Our partnership with KID Museum allows us to work together to prepare our children for the future workforce, where success increasingly depends upon creative problem-solving and innovative thinking.

**JACK SMITH, MCPS
SUPERINTENDENT OF SCHOOLS**

in the early pandemic days with a unique blend of off-screen guidance and on-screen collaboration that opened the door to student engagement and creativity. KID Museum also joined a coalition of community organizations to provide programming to the students most impacted by the pandemic through Educational Enrichment and Equity Hubs.

Adapting in a Pandemic, Innovating for the Future

When the pandemic hit, the KID Museum team set to work re-imagining what learning could look like at a time when no one could be together in person, developing new hands-on experiences that could occur safely in students' homes. Thanks to the long-standing partnership with MCPS, the KID Museum team was able to provide virtual summer school to more students from Title I schools than ever before – over 4,000 students – filling the void

Invention Studio and the corresponding Invent the Future Challenge were moved online, providing live virtual field trips and sending thousands of materials kits out to students throughout the county. To deepen the program, KID Museum

““ Every time I walk away from a KID Museum professional development session, I have something that I can take into my classroom and use.

**JO BELYEA-DOERRMAN, SHADY GROVE
MIDDLE SCHOOL TEACHER**

of Columbia Public Schools (DCPS) and MCPS to deliver high-impact, maker-based learning curriculum to over 2,000 students. Intended to fuel a passion for maker-based learning modules while also building teacher capacity for the future, this professional development program will be instrumental in vastly growing project-based learning across the region.

With long-standing relationships in place, KID Museum and its partners continue to deliver essential hands-on learning experiences to students who need it most. The skills kids develop address pandemic-related learning loss and empower them to become the innovators and changemakers of the future.

piloted an in-class invention curriculum (adapted for virtual) and established a cohort of MCPS “Champion Teachers” to deliver the curriculum, participate in teacher training, and provide feedback to KID Museum.

And despite the pandemic, the museum launched an ambitious new professional development initiative. The pilot trained 50 teachers from District

Section IV:

■ Looking Forward

The COVID-19 pandemic has provided us with a unique opportunity to re-imagine what learning looks like – to reinvent what learning can be for our kids. Too many young people have been devastated by COVID-19-related learning loss, with a ripple effect on schools, the workforce, and our community that could be felt for years to come. If we are to empower the next generation to invent the future, we need to act now to leapfrog learning, and set them up for success.

Invention Education will not only leapfrog students forward in learning, it will prepare them to tackle any challenges life may throw their way – including a global pandemic.

It is imperative that we seize the day to re-imagine education as we rebuild. Let's focus on the skills that we know really matter. Let's partner to create an integrated and well-rounded educational experience for all our children. And let's lead with equity, putting first in line the students at greatest risk of being left behind.

Now is the time to collaborate and innovate.

We hope this Field Guide is just the start of renewed and expansive advocacy for Invention Education. And we hope you will join with all of us to seek, surface and share more stories of impact so we can demonstrate the fullest potential of Invention Education.

Here are a few examples of questions you can ask to uncover meaningful stories to share in your advocacy:

- **(For students/teachers)** What did you learn from this hands-on classroom (or after school) experience that you haven't experienced anywhere else?
- **(For students/teachers)** What did you learn *about yourself* from this experience?
- **(For education/district leaders)** What kind of changes have you seen across your school (district) as a result of students participating in this kind of learning? In what ways does Invention Education help you achieve your goals?
- **(For funders)** What is the most valuable difference you notice when seeing kids learn this way? How might these types of learning experiences contribute to the success of our future workforce? How can you help to support this positive change?
- **(For all audiences)** What does Invention Education offer that is not available in any other way? In what ways does this kind of experiential learning empower kids?



Sometimes, asking the questions of these stakeholders is a great way to engage.

The conversation inspires them to reflect on the value of Invention Education in ways they may not have taken time to consider before.

Please share stories of impact you discover along the way. Email Ms. Erin Tochen at erint@inventioneducation.org. Together, we can shape the inventive, innovative and collaborative future we want to see.

Section V:

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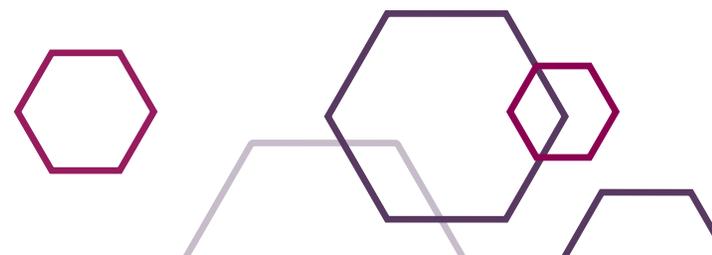
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Nation of Makers

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