

Towards Greater Equity in Science, Technology, Engineering and Math (STEM)

GREATER CLEVELAND AND LORAIN COUNTY LANDSCAPE ANALYSIS

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COMMISSIONED BY

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Executive Summary

This report represents the results of a landscape analysis of the key science, technology, engineering and math (STEM) providers in the Greater Cleveland area, including Lorain County, commissioned by the Cleveland Foundation and the Nordson Corporation. The goals of the landscape analysis are to begin identifying and addressing equity in STEM issues in the context of getting more Black and Brown and other traditionally marginalized students and young adults of color exposed to, excited about and working in STEM professions. (For the purposes of this report, the term “Black and Brown” will be used to include traditionally marginalized populations of color.)

The data gathered during this process involved talking with over 150 people representing leaders

in STEM and STEAM organizations, youth, stakeholders and funders who have invested significant dollars and time in this space. While this analysis focuses on equity in STEM, we recognize that arts exposure and programming enhance the STEM learning experience. Two youth focus groups were conducted in Cuyahoga and Lorain counties and a STEM Advisory Team was convened three times to offer additional insight and thinking to the analysis. It is clear that there are wonderful and numerous STEM enrichment opportunities taking place in school and out of school in Northeast Ohio. The in-school and out-of-school time (OST) opportunities each serve a critical role in nurturing and exciting young people. There is no shortage of activities that can spark natural curiosity and cultivate a love of wonder and joy in STEM learning.



BARRIERS AND SYSTEMS-LEVEL CHALLENGES

At the same time, there were some clear, consistent issues that emerged in terms of barriers and systems-level challenges preventing the maximization of these STEM learning opportunities for Black and Brown populations. The barriers most commonly mentioned were:

- not knowing that a STEM enrichment opportunity existed;
- transportation;
- not feeling welcome in STEM spaces, both in school and on STEM organization grounds; and
- the fact that many students come from low-income homes, which has direct impacts on their ability to regularly access STEM experiences.

COMMON INSTITUTIONAL SYSTEMS ISSUES INCLUDED:

- the lack of racial and ethnic diversity in the executive and programming leadership of the largest STEM providers;
- a general unawareness among the STEM organizations of how to attract and engage Black and Brown youth and their families impactfully and over the long term;
- dots not being connected among the STEM learning community on how to leverage resources to engage Black and Brown youth meaningfully; and
- a lack of urgency by the STEM learning and workforce community to develop tangible, measurable outcomes to ensure greater success of Black and Brown students in STEM.

EXEMPLAR CHARACTERISTICS

To counteract the many systemic and life barriers in place, there are specific organizational exemplar characteristics that result in positive outcomes for Black and Brown youth and their STEM success. These characteristics include:

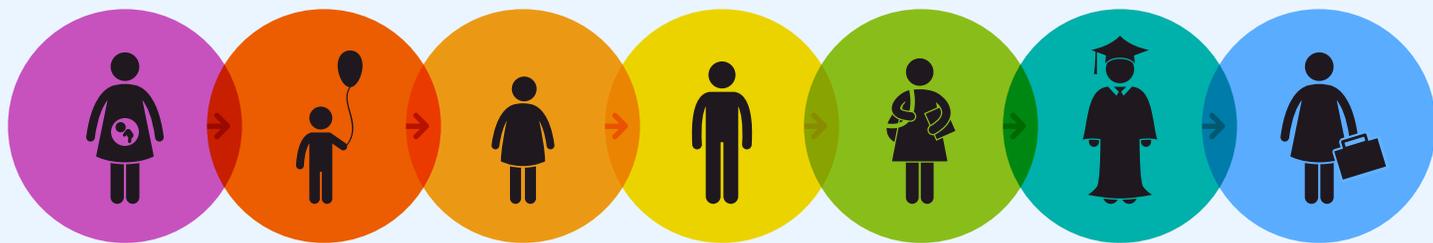
- dedicated leaders who are deeply committed to the individual student and their life circumstances;
- engagement with youth on an on-going basis over time;
- student engagement with organizational leaders and staff who are representative of their racial and ethnic origin;
- opportunities to stay connected with the youth after the program period traditionally ends;
- resources maximized to support the youths' intended outcomes;
- program activities that are directly correlated to clearly defined outcomes; and
- the recording and analysis of data to enhance the student experience and inform future efforts.

RECOMMENDATIONS FOR ACTION

The report highlights many recommendations for ways to address the very complicated and long-standing dilemma of getting more Black and Brown students and young adults excited and trained to be successful in a STEM profession. Some of the key recommendations include:

- Create an infrastructure of champions who continually connect the resource and contextual dots with a racial justice and racial equity lens.
- View STEM programming efforts as a continuum that begins at the pre-natal stage and continues through early career.
- Find ways for STEM to be accessible by every Black and Brown young person.
- Develop various learning communities that support and learn from one another in order to achieve measurable outcomes for youth.
- Ensure more professionals of color are employed in STEM organizations and directly engage with Black and Brown students and families.
- Encourage all STEM providers to relentlessly pursue clearly defined, measurable outcomes for Black and Brown student and family access and engagement, backed by accountability of funders.
- Maximize the use of technology to excite young people about STEM; make them aware of enriching opportunities and foster a life-long love of learning and discovery.

Moving forward. In order to truly tackle equity in STEM issues, we have to be flexible, creative and innovative in our thinking; strategic in our actions; and goal-oriented and uncompromising in our expectations on outcomes. There is urgent work and actions for each of us to undertake and everyone has a role to play in building the confidence of our young people, creating environments where they are encouraged and welcomed to explore, facilitating a natural love of learning and translating it into a promise of hope.



Introduction

This report represents an initial phase by the Cleveland Foundation and the Nordson Corporation Foundation in jointly and strategically addressing equity in science, technology, engineering and math (STEM) issues in Northeast Ohio. The main goal of the work involved doing a landscape analysis of the key STEM providers in the region. In performing the analysis, over 150 people were interviewed and engaged to gain perspectives on their lived experiences, organizational work, the populations they serve, intended program outcomes, the barriers Black and Brown students face in accessing the STEM opportunities and the tracking and evaluation systems in place to inform their work. The process was incredibly informative and illustrated the vast institutional and organizational resources that exist in the region, the exciting work being done in the STEM space and the great opportunity to increase engagement of Black and Brown youth and their families. (Appendix A: List of Organizations Interviewed)

While the Nordson Corporation Foundation focuses its resources on Lorain County, Ohio, and the Cleveland Foundation focuses its resources on the Greater Cleveland area (Cuyahoga, Lake and Geauga counties), there were common themes that emerged from conversations with key STEM actors in both areas, and there exist many opportunities for collaboration.

This report lays out the myriad of complex issues at play in addressing equity in STEM in the region. *Existing contextual realities* are highlighted, *barriers* faced by Black and Brown students are lifted up, *exemplar characteristics* are articulated, and *recommendations for action* are suggested.



The below quote articulates the relevancy of this work and highlights the need for us to aggressively tackle and solve the persistent dilemma of low STEM access and achievement by communities of color.

“As someone who works in the tech sector, I see day in and day out that diversity of workforce leads to better products and better organization,

SHAINA HOROWITZ, VICE PRESIDENT OF PRODUCT AND PROGRAMS AT NEWLAB, SAID.

What we build represents and reflects our biases and constraints, so making sure there’s a real diversity of individuals contributing to the STEM fields just makes for better business all around.”

**THE HECHINGER REPORT NEWSLETTER
BY OLIVIA SANCHEZ, NOV. 12, 2021**



Existing Contextual Realities

The issues surrounding equity in STEM are complex and multilayered. There are numerous factors and considerations that need to be taken into account when assessing the landscape and determining how to disrupt the ingrained systems and circumstances that prevent Black and Brown students from accessing and succeeding in STEM areas. On face value, the complexity of factors may seem too overwhelming to make a difference, but I believe a careful analysis of the challenges, assets and points of leverage can offer great hope in making inroads on getting a greater number of Black and Brown youth excited by the wonders of art, science and technology. The following represents some issues that came up in my investigation process and should be taken into account when developing a strategy to address equity in STEM.

CHALLENGES WITH BASIC NEEDS

- **Basic needs of children are often not being met.** This reality was reinforced by my conversations with most of the Lorain County providers, stakeholders and funders. Students are being confronted daily with food and shelter insecurities, clothing needs, social and emotional needs and unsafe home and community environments. Programming efforts must determine how best to mitigate these realities and offer the best chance for students' academic and personal growth and success while making STEM opportunities accessible.

- **Many of the Black and Brown communities are transient.** It is hard for programming to build off each other when students may transition out of the community due to housing instability and other social factors.

STRATEGIC CHALLENGES

- **Missed opportunities to connect.** Many dots are not being connected between organizations, which is leaving opportunities unrealized. There are countless ways in which organizations could be working together to maximize their outcomes and more completely impact the youth and adults they serve.
- **Lack of strategic use of data.** Many schools and organizations are not as strategic as they could be about using their student participation data to proactively engage students who show an interest in STEM activities over time.
- **Lack of evaluation.** There is overwhelming under-evaluation of program activities, and robust evaluations are not common. People are doing the work, but the real impact on youth is not known in most cases. Most robust evaluations are done on a grant-basis. Several organizations do their own surveys and evaluations, but they are mostly informal, anecdotal and not rigorous. Impact and success are not clearly defined in the majority of cases. Many organizations don't have the capacity to track students over time.

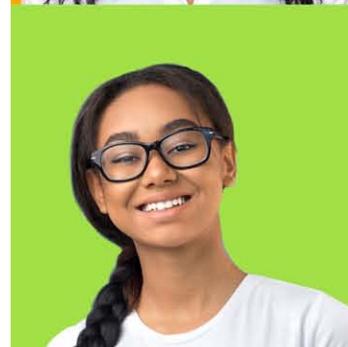
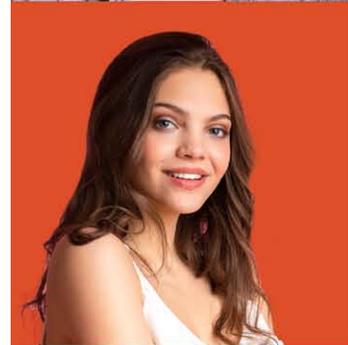


- **Underutilized STEM professionals.** There are many organizations with high numbers of STEM professionals, representing opportunities for engagement with youth.
- **Youth aging out of programming.** Many organizations have specific age targets. We must consider how to support youth once they age out of an organization. How can organizations support their alumni? How do you ensure the investment poured into youth during the pre-K-18 years transfers to positive adult outcomes?
- **Lower male participation.** A lack of male program participants was found in some programs. We must figure out how to engage males in the middle to high-school years.

ISSUES OF RACE AND DIVERSITY

- **Lack of racial equity lens.** Many of the white STEM providers do not have a racial equity lens and are not viewing their work from the lens of a disparate and unequal society.
- **Lack of leadership diversity.** Most of the education heads and/or leaders of STEM institutions are white. Given the non-diversity of the education leadership and staff, this only compounds the challenges of getting authentic Black and Brown voices and perspectives in the programming.

- **Lack of focus on Black and Brown outreach.** Many of the white-led organizations have just recently begun to think critically about ways to engage a broader and more diverse audience. Of the big STEM-based organizations, no one talked authoritatively about how to include students of color in their organization.
- **Most organizations don't track racial/ethnic data.** Most record their Black and Brown engagement by the schools they serve and base percentages off school and district-wide percentages, or by full class rosters.
- **Exclusionary practices.** Organization policies and rules are not always friendly towards Black and Brown youth (e.g., one STEM provider said they don't offer monetary compensation because it goes against the traditional model of "volunteering" – illustrating an old mindset that serves as an institutional and systemic barrier for Black and Brown teens to work in the internship program.)



Barriers in Accessing and Participating in STEM Activities

The barriers Black and Brown youth face in accessing and participating in STEM activities are complicated, institutionally grounded, and not easily solvable. They are also not isolated to one area of Cleveland, but cut across geographic lines. Many of the barriers faced by Lorain County youth are also faced by Greater Cleveland youth.

The general categories of barriers fell into:

- 1 CROSS-CUTTING BARRIERS**
- 2 GENERAL SYSTEM BARRIERS**
- 3 INSTITUTIONAL BARRIERS**
- 4 INDIVIDUAL AND MENTAL BARRIERS**
- 5 GEOGRAPHIC BARRIERS**



CROSS-CUTTING BARRIERS

- **Mindset shift needed.** There needs to be a complete overhaul in what we think Black and Brown youth deserve and what we think is possible for them. A pervasive mindset, explicit or implicit among adult STEM facilitators, the adults in young people's lives and in the minds of young people themselves is that STEM is not really for them. We need families, the youth, the adults in their lives and anyone affiliated or having a connection with STEM opportunities to change their mindset about the transformative value of engaging these under-tapped youth.

GENERAL SYSTEM BARRIERS

- **Lack of awareness.** Black and Brown students, their parents and educators often don't know that a STEM activity exists. This is one of the largest barriers to fully accessing STEM opportunities. Many organizations agreed that widely spreading the word about their offerings was challenging.
- **Adults are often the intermediary between youth and a STEM opportunity.** Adults are the primary advocates and facilitators bringing STEM opportunities to Black and Brown youth. If a caring adult is not there to facilitate the enriching experience, the youth will be less likely to be exposed to the experience.
- **Limited transportation.** Transportation is a pervasive and overwhelming barrier that keeps Black and Brown youth from accessing STEM opportunities. There are not consistent and funded transportation options for many Black and Brown youth and their communities. (Lorain County's lack of a comprehensive busing system is a major barrier.)
- **Undervaluing of STEM.** Black and Brown communities often do not understand the value of science, technology, engineering and math — and the economically and socially viable future opportunities that exist in those areas.
- **Limited access to technology and internet access.** Students may not have access to a computer device, may not have access to the internet at home and may have to share their computers with other family members.
- **Lack of social connections.** Students and families from under-resourced areas may not have the social capital or connections to people or organizations that may inform them and advocate for their participation in STEM opportunities.



INSTITUTIONAL BARRIERS

- **Institutional and structural racism.**

Racism, both institutional and structural, is a barrier that shows up in a number of different ways:

- > There is no sense of real urgency to solve the issue of engaging greater numbers of Black and Brown youth nor concrete solutions to tackle the challenge.
- > No uniform strategy exists among organizational leaders to address Black and Brown youth engagement.
- > There is a lack of diversity of educators, program staff and organization leaders, and staff often lack the skills to connect with and attract Black and Brown students on a consistent basis.
- > Often, school, classroom and STEM organizational spaces and environments may not be welcoming and inclusive of Black and Brown students and their families.
- > Curriculum materials are often not relatable to Black and Brown youth and often enforce stereotypes; these materials could help change the narrative of contributions of Black and Brown STEM professionals by highlighting their contributions.
- > Organizations often misunderstand the life experiences of Black and Brown students, including the reality that teens often need to earn money to contribute to their family in the summer. Several organizations did not believe that any barriers existed to Black and

Brown students because their activities were brought to the student. Program requirements like aptitude tests and full-time participation requirements may deter Black and Brown participation and program entrance.

- **Family resource constraints.**

Families and students might not have the money to participate in fee-based activities or cover costs associated with those activities, including supplies, the right types of clothes or tools to do the activity, etc. *Middle-income families are being left out of programs because they don't qualify for free- and reduced-lunch-targeted programs yet they can't afford costly enrichment programs.*

- **School constraints.** Many public schools don't offer higher level math, science, computer science and technology classes, so students do not have access to these content areas like more well-resourced schools.

- **School and organizational leadership turnover.** Changes in leadership often disrupt meaningful and carefully built relationships and can impact an initiative's future.

- **Limited community presence by STEM organizations.** Organizations are often not known in Black and Brown communities.

- **Lack of quality control of STEM programs.** Pop-up programs exist, but the accuracy of content is not always clear.



INDIVIDUAL AND MENTAL BARRIERS

- **Lack of confidence.** Black and Brown students are more likely to have a lack of optimism about their futures as compared to their white peers. Black and Brown youth often have lower self-confidence in their abilities to pursue a STEM career.
- **Misperceptions.** There is widespread misunderstanding and misperception of STEM organizations' missions, goals, audiences served, activities and relevance to their lives.
- **Stigma.** Youth face the dilemma of not wanting to be different from their neighborhood peers, which may prevent them from taking advantage of enriching STEM opportunities. In the case of the Youth Rockwell Automation Internship, student interns sometimes feel like "the other," or feel inferior and drop out because they don't feel like they measure up or belong at the internship. Some students from public schools feel inferior to students from other schools that are perceived to be "better."
- **Exclusion.** In Lorain, sometimes students don't do extracurriculars due to language barriers and don't feel welcomed by coaches and teachers.
- **Pandemic-induced stresses.** Death of loved ones, job loss and insecurity, shift to virtual academics and isolation impact students' ability and willingness to engage in STEM activities.

LIFE AND FAMILY BARRIERS

- **Lack of family support.** There is a general misunderstanding of the importance or relevance of STEM opportunities among many families.
- **Lack of trust.** Parents are more likely to put their student into a STEM experience if they trust the sponsoring organization or staff.

- **Home life stresses.** Financial insecurity, housing insecurity, food insecurity, family members with substance use disorders, parents who take their money, care responsibilities for ill family members, physical abuse, peer pressure, pressure to care for younger siblings, pressure to work to contribute to the household, etc. can make it harder for youth to participate in STEM activities.

GEOGRAPHIC BARRIERS

Geography of the physical location of STEM opportunities plays a big role in students' ability to take part in an enriching experience; geography is especially salient in Lorain County because the bus system does not cover a wide area in the county, thus making it extremely difficult for those without vehicles or personal transportation options. In the Greater Cleveland area, geography of the STEM opportunities is also a barrier, but less so than for Lorain County youth.

Lorain-specific barriers. The following were barriers raised by a conversation with people in Lorain City and are issues specific to the Latinx community context.

- Parental lack of trust in schools, coupled with lack of welcoming reception by the schools.
- School system is different from what they may be used to from their home countries.
- The power dynamics shift for Latinx families when they come to America; parents are often dependent on their children to interface with the world outside their family unit, whereas in Mexico and Puerto Rico, parents are the dominant figures
 - > Undocumented status adds complexity to the relationship dynamics and introduces hesitancy of parents to advocate for their children.

Characteristics of Exemplar STEM Organizations

Several organizational characteristics emerged as having the greatest impact on young people's academic, social and emotional success. The challenge continues to be how to ensure that programs and efforts incorporate as many of the below characteristics as possible. (See Appendix B for a list of exemplar STEM organizations identified in this landscape analysis process.)

The characteristics found in exemplar organizations include:

- **Dedicated adult leaders.** Adults are deeply committed to the youth they engage and go above and beyond the call of duty to make sure their youth are cared for and their needs are met; they show vision in their work and are creative in their support of the youth under their care. There are highly personalized experiences where students build relationships with organization leaders or someone in the organization.
- **Duration and consistency.** Organizations engage with youth over time and on an ongoing basis during the program period.
- **Diverse staff and volunteers.** Students engage with adults and organizational leaders who look like them and are racially and ethnically representative of the student participants. The organizations recognize the value of having Black and Brown youth see and interface with Black and Brown individuals and professionals, and they ensure that these people are directly engaged with the students.
- **Post-program engagement.** There exists an opportunity to stay connected with youth after the formal program activity ends, and efforts are put in place to continue communication with the youth after high school graduation.
- **Strategic resource leverage.** Organizations leverage available resources to maximize the mission of their work.
- **Explicit program outcomes.** There are clear intended outcomes, and the program activities directly relate to those outcomes.
- **Strong data collection.** Good data is recorded on student participants that may include racial, ethnic background, educational status, programs participated in, high school attendance and grade data, high school graduation status, college or post-high school status and graduation, professional status, etc.





Recommendations for Action

In order to tackle the persistent challenge of engaging and supporting all Black and Brown youth in STEM, we need to have an innovative mindset in all that we do and expect from the *funding community, the public and private sector, the educational and STEM institutions and from the youth and their families*. The issues preventing engagement and success have to be met with a fierceness and sense of urgency with the explicit goals of clear and measurable change and impact. The

challenges are complex, and as a result, the recommendations cover a wide array of suggestions, from big-picture systems-level thinking to specific programmatic improvements.

I believe that, with strategic thought and creative execution, we will be able to see notable impact on Black and Brown STEM access, engagement and the development of a more robust STEM workforce pipeline.

FUNDAMENTAL ISSUES AND EDUCATIONAL SUPPORT

- **Guiding principles.** We must develop some guiding principles for this equity in STEM work on which all activities and decisions will be based; we must be laser-focused in the goal of each activity, relentless in the pursuit of reaching the goals, and focused on building young people's self-confidence. We must promote self-love, encourage independence and grit, nurture the love of learning and instill a sense of hope in the present and the future.
- **Transportation.** We have to figure out how to tackle the transportation issue! A short-term solution could be to provide programming in closer proximity to where the youth live and spend most of their time (e.g., housing complexes, libraries, recreation centers, etc.).
- **Virtual and hybrid delivery.** All programming should have a virtual option. Virtual instruction has been challenging, and getting program participants to show up has been really tough. By the same token, many people said that going virtual allowed them to reach more people.
- **Teacher professional development.** We must provide opportunities for educators to learn and practice evidence-based STEM teaching methods for all grades.

- **Diversity and inclusion training.** We must provide ongoing opportunities for educators and STEM program leaders to intimately understand the barriers facing students of color in accessing STEM.

STRATEGIC INNOVATIONS

- **STEM champions.** Develop an infrastructure of STEM champions who are relentless in their pursuit of exposing Black and Brown youth to the wonders of STEM. They can serve as the global and big-picture thinkers who strategically and analytically connect the dots with a racial justice and racial equity lens. They will ensure that appropriate big goals are being set and executed.
- **Age-specific strategies.** Create a STEM engagement and outreach strategy for specified age groups with intended goals and outcomes for each age/grade band. I am suggesting we think about equity in STEM as beginning in the womb and continuing throughout early career. I believe that to have truly different outcomes in the levels of Black and Brown children getting excited about and excelling in STEM fields, we have to consider the full spectrum of a young person's life through early career.



The following are life stages that I am suggesting for consideration:



- **Universal access to STEM materials at home.** Ensure that **every** Black and Brown family has access to STEM materials at birth and over the course of a young person's life; provide home materials, books and activity supplies during the various stages of childhood, adolescent and teenage life. Make these resources available to every Black and Brown household.
- **Creative use of technology.** Use technology to maximize access to Black and Brown communities — be creative and innovate new ways to excite Black and Brown students around STEM. Think about how the Internet of Things can be a part of the solution to provide greater access.
- **STEM incentives.** Create a system where students earn points for doing various STEM activities and can "purchase" things using their points — much like deals with magazine subscriptions, etc.
- **Shared youth support infrastructure.** Create an infrastructure of support to young adults who grow up in organizations. Instead of each organization being separately responsible for figuring out how they will support these young adults, create a shared infrastructure that will support the youth by providing financial literacy, professional and leadership development, social and emotional wellness support, etc. Create new youth boards (many already exist: MyCom, Twelve Literary Arts, Organic Connects, Rainey Institute, etc.) and create opportunities to bring youth boards together as a collective.
- **Discovery mobile.** Create a discovery mobile that visits neighborhoods regularly and brings a region's assets to the block level, focusing on engaging STEM content and experiences with the youth and adults of a community.
- **STEM challenge markers.** Put markers around the region with STEM facts and problems where youth can find the challenges and earn points/rewards for solving the problem, making STEM accessible, building in excitement around discovery, introducing incentives and encouraging lifelong learning. Ensure there is a way for students to input their answers to log their participation.

STEM INFRASTRUCTURE DEVELOPMENT

- **Assessment assistance.** Many organizations are struggling with how to assess their activities. Offer evaluation assistance to these organizations from a collective standpoint; think about identifying evaluators who can help with assessments across programs; identify some uniform common metrics.
- **Black and Brown student pipeline into STEM jobs.** For organizations that are struggling to find Black and Brown staff, one solution is cultivating a pipeline of high-school students; provide internship opportunities, stay connected with them post-graduation, through college or their vocational training, and provide viable options for hiring them upon graduation.
- **Teacher recruitment.** Create a recruitment campaign to attract Black and Brown teachers, offer housing benefits and other financial and incentives to work in schools.

SUPPORTIVE LEARNING COMMUNITIES

Create various learning communities that will bring together people so that they can share best practices, thoughts and ideas about tackling equity in STEM issues.

- **Create a learning community of educators** who teach and facilitate instruction in STEM. Create opportunities for educators to share best practices in a) STEM programming, b) successfully engaging Black and Brown students, c) best teaching aids, d) evaluation insight, etc. Many districts have great fab-lab resources; make them available to a wider audience beyond the students attending the respective schools and train students to engage the younger kids in the community. ImaginEering Hub in Elyria High School and flight simulators at CMSD Davis A&M High School are good examples. Lift up and highlight possible replicable activities: Tinker Train, Discovery on the Go bus, Little Library on the Lake, etc.
- **Create a learning community of funders** who have an interest in and support STEM programs; provide a forum to strategically think about their program investments.
- **Create a learning community of Black and Brown students** where students can network and find space to collectively explore the wonders of STEM. Create cohorts of youth to engage in shared experiences — encourage the building of supports and confidence as a group (i.e., NSBE Jr., IndeedWeCode, ACE Mentor Program, CWRU Envoys Program, etc.).





RECOMMENDATIONS

- Create a learning community of parents and family members** to promote the values of STEM and continually think about ways to engage youth and families more deeply. When parents become familiar with STEM activities, attitudes and pressure on students have been known to change. Be on a mission to build healthy parents and curate healing environments. There should be a particular focus on Black and Brown families who have experienced centuries of trauma and discrimination, so that they can be supportive and healthy for their children. Create opportunities for parents to come together on a monthly basis for workshops, family STEM events, networking opportunities, etc.
- Create a learning community of industry partners and stakeholders** who have resources to give towards the equity in STEM effort. Leverage corporate and stakeholder relationships — can businesses support more than one school? Build off Rockwell Automation’s efforts (e.g., Manufacturing Day). Encourage more companies to participate and offer opportunities to more schools. Create a mechanism where STEM providers can easily find out what other providers do (i.e., program scope, target students, grades, location, etc.). Too many providers don’t know what the other providers are doing. Ensure that enrichment opportunities are known across organizations so that camp scholarship slots do not go unfilled.

ENHANCING EXISTING STRATEGIES

- Provide technical assistance.** Create opportunities for organizations to get technical assistance with strategic planning and development needs, on call and by appointment. Equip neighborhood organizations and regional institutions to run high-quality STEM programming. Provide guidance and standardize measurable outcomes for organizations. Provide resources for activities.
- Expand ambition.** In all outreach activities, think about how to maximize outcomes for youth and their communities and how actions can help to dismantle structural and institutional racism.
- Create a STEM depository.** Create a depository of STEM learning ideas on one site and ensure wide use by all targeted audiences.
- Grow the audience.** Identify organizations that have robust STEM enriching opportunities and resources, and find ways to open them up to a wider audience who cannot pay for organizational experiences.

- **Improve tracking.** Student tracking is not done well in most organizations. Help organizations develop a tracking system within and across organizations (e.g., create badges or incentives for student participation in extracurricular activities, including STEM, athletics, leadership, social emotional learning, etc.) The ACES Program in Lorain provides the best tracking among the organizations interviewed; it involves hyper-vigilance and hyper-staff dedication to stay connected to the students. This level of commitment is difficult to scale in most organizations.
- **Include student voice and feedback.** Create mechanisms for students to give continuous feedback on activities and programming to ensure continuous evaluation and improvement and encourage accountability and voice. Be intentional about including student voice in the ideation, implementation and evaluation phases.
- **Expand definitions of STEM.** We have to push our thinking around what can be classified as STEM; too often there exists a narrow view of the field. We must constantly look for linkages to STEM concepts and ideas.
- **Broaden student recruitment.** Consider establishing a student recruitment mechanism that goes beyond CMSD to ensure STEM resources are being fully accessed and slots are being filled.
- **Incentivize STEM activities.** Consider providing incentives for adults (teachers, program managers, etc.) to expose their students to STEM opportunities.
- **Engage Black and Brown STEM professional organizations.** Determine how to maximize the connections between local professional organizations and pre-college youth. Create ways to partner with national organizations like the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), etc.
- **Broaden partnerships.** Identify and think about how to leverage the local and statewide assets (STEM serving organizations, community-based organizations, faith-based organizations, libraries, recreation centers, businesses, governmental agencies, etc.), and tap into all possible partners (some may be non-traditional). Think about ways to partner with existing private and public schools that offer STEM enrichment during the school year and summertime; see how they can be a part of the equity in STEM solution. Think about how to leverage institutions outside of Northeast Ohio like the Center of Science and Industry (COSI) Museum in Columbus. Some of their resources can be marketed to our region (e.g., COSI lunch boxes). Find ways to leverage organizations and programs that have well-structured and standards-based curriculum materials. Find ways to incorporate state and local resources and state and local government in an equity in STEM strategy.
- **Engage Volunteers.** Create the infrastructure and opportunities for volunteers who are motivated by the mission of STEM equity work.



STEM OUTREACH INITIATIVES

- **Use public spaces as laboratories for learning.** Find ways to make public spaces learning and teaching laboratories where residents have an opportunity to engage interactively with STEM concepts and ideas.
- **Leverage the power of history.** Consider the importance of history in shoring up the internal strength of Black and Brown students and their communities — there is much power and strength to gain from knowing our history and drawing upon the strength of the ancestors to provide inspiration and motivation. Identify creative ways to infuse Black and Brown history into everything that is done; build up confidence in being Black and Brown, and build upon the resiliency and strength of people of color (e.g. Boys and Girls Clubs of Northeast Ohio has created a traveling exhibit that will focus on topics such as human rights, disability inclusion, gender equality, identity and cultural heritage. Curriculum is being developed to accompany the exhibits.) Consider installing interactive history exhibits in any place possible to encourage a thirst of learning about the past. Exhibits could be installed in libraries, recreation centers, daycare centers, etc. Consider partnering with the Smithsonian Museum of African American History.
- **Create a professional speaker's bureau.** Create a STEM professional speakers bureau including Black and Brown and other professionals; have them engage on a regular basis with students in the school buildings and community-based organization facilities.

- **Develop traveling exhibits.** Have companies create traveling exhibits about their companies, to be placed in schools, libraries, community-based organizations, churches, etc.

INCREASE STEM PARTICIPATION

- **Promote universal access.** Consider ways to ensure that every youth is connected to at least one STEM enriching experience.
- **Take a tiered approach.** Think about ways to offer *tiered* experiences for students:
 - > For those *strong in STEM* – offer carefully designed engaging experiences for them (i.e., job shadowing, internships, mentoring, competitions, etc.).
 - > For those with *little exposure* – increase exposure experiences and connect them with other students who are strong in STEM.
 - > For those who have *no exposure or interest* – create exposure opportunities – **start early and often!**
- **Invest in math instruction and activities early.** Math is the foundation for all things STEM and having early fluency will contribute to greater future success in STEM. Identify creative ways to expose Black and Brown youth to STEM early and often — find ways to introduce STEM vocabulary, create games and facilitate activities.



- **Harness youth mentorship abilities.** Facilitate the ability of youth to mentor younger students; create opportunities for older youth to excite and engage younger students in structured STEM learning environments.
- **Use technology strategically.** Creatively and innovatively use technology to reach youth directly, in addition to reaching parents and adult youth advocates. Use the youths' obsession with their electronic devices to engage them and get information to them.
- **Help students attend professional conferences.** Create opportunities for students to attend STEM professional and technical conferences (e.g., NSBE National Conference, SHPE National Conference, SWE National Conference, etc.).
- **Create big opportunities.** Create big thinking solicitation opportunities like the Gates Foundation does around solving big world problems. Offer tiered prizes to the team with the best ideas but acknowledge all participants; offer to target school districts with large numbers of students of color.
- **Engage the MyCom network.** Fund VEX robotics teams in MyCom communities and recreation centers; identify community high-school students as teen leaders.
- **Connect directly to youth.** Identify ways to get information into the hands of youth directly so they do not have to depend on adults so much.
- **Encourage entrepreneurship.** Provide entrepreneurship training and create a space for young entrepreneurs to sell their products; explore relationships with local entrepreneur development programs.



STEM PROMOTION AND MARKETING

- **Create a shared vision and statement.** Consider creating a shared statement among STEM providers, stakeholders and funders to acknowledge the STEM access and career matriculation disparities of Black and Brown populations as well as a statement of joint pursuit of working to eliminate these disparities, with clear articulation of intended measurable outcomes.
- **Shift mindsets.** Develop strategic methods to shift the mindset of everyone — youth, parents, educators, industry, higher ed, etc. — that STEM is attainable by *all Black and Brown youth*. Help students to see themselves in STEM; make it personal and relatable. Use more descriptive and exciting terms to describe STEM — language and presentation matters.
- **Offer public recognition.** Publicly recognize students, stakeholders and organizations for their efforts in addressing equity in STEM issues.



Conclusion

The overarching goal of the equity in STEM work is to ensure that every single young person, regardless of their racial or ethnic background or their socioeconomic status, has the chance to explore the wonders of science, technology engineering and math. The intention is for all youth — and specifically Black and Brown youth — to be given opportunities to engage in learning that is fun, relevant to their lives and potentially life-transforming for themselves, their communities and for the world.

This landscape analysis shows clearly that there is an abundance of wonderful science, technology engineering and math institutional assets, resources and activities in the region that foster a love of learning and greatly enrich the lives of residents. It is equally clear that a large sector of the population, namely Black and Brown people, are not fully welcomed nor taking advantage of the wonderful opportunities available to them — in the school environment, in public spaces and within STEM institutions. We *must* do better, and we *can* do better.

We must start by changing the mindset of everyone: Black and Brown students, their families, educators, STEM institutional leaders and staff, industry leaders and workers, stakeholders and funders. We must believe that Black and Brown youth and young adults will be transformed by the wonders

that science, technology, engineering and math can provide, and that they can be successful in pursuing STEM careers if they desire. We must have a long-term perspective and think of tackling these challenges from pre-natal to career. And we must employ an *all-hands-on-deck* strategy that is urgent and involves thoughtful and strategic analysis and execution. We must be relentless in our pursuit of making sure that Black and Brown youth and their families are fully engaged and exposed to these opportunities, with concrete measurements of success articulated.

If we do not do these things, we will not see the kind of transformative outcomes that are needed to change our current state of chronic non-access, non-belief and underachievement by a huge portion of our residents. If we do not do these things, we are not allowing our region to reach its fullest social, economic and political potential. We all stand to gain when every single individual knows their essential life needs are met, that they can indulge their natural curiosity and be free to dream and hope, and that they have the confidence and supports to pursue their passions.

Investing and working towards this goal is a game-changer for our region.

LET'S GET TO WORK!

ORGANIZATIONS INTERVIEWED

(multiple people within an organization may have been interviewed)

4-H Youth Development, Cuyahoga County	College Now Greater Cleveland	Horizon Education Centers, Lorain Collaborative	Recess Cleveland
99 Treasures	Community Foundation of Lorain County	IndeedWeCode	Refresh Collective
ACE Mentor Program of Cleveland (Architecture, Construction and Engineering)	Conservancy for Cuyahoga Valley National Park	Jumpstart	Rising Titans Collaborative
ACES (Achievement through Community Education & Support) Program, Lorain	CSforCLE, Cleveland State University	Leaders of Today	RITE/Greater Cleveland Partnership
ACES Youth Group, Lorain	Cuyahoga County Public Library	Lorain City Schools	Rockwell Automation
Advantage Cleveland Tennis and Education	Cuyahoga Soil & Water Conservation District	Lorain County Community College	Save Our Children
Arts Impact - formerly Progressive Arts Alliance	Cuyahoga Valley National Park	Lorain Historical Society	Success Pathways
ASM Materials Education Foundation	Case Western Reserve University Veale Entrepreneurial Institute	Lorain Public Library	Tech Corps
Assembly for the Arts	Davis Aerospace and Maritime High School, CMSD	Manufacturing Advocacy and Growth Network (MAGNET)	Tech Elevator
Baldwin Wallace University	El Centro De Servicios Sociales	MetroHealth	The Cleveland Clinic
Black Environmental Leaders Group (BEL)	Elyria City Schools	Motogo	The Cleveland Foundation
Boys and Girls Clubs of Northeast Ohio	Esperanza, Inc.	MyCom Cleveland	The George Gund Foundation
Camp Invention	Fund for Our Economic Future	MyCom Youth Workforce Advisory Board	The Meeting Place Learning Center
Campana Center for Ideation and Invention of Lorain County Community College	Get With the Program	NASA	The Stocker Foundation
Center for Arts-Inspired Learning	Gilmore Girls	National Society of Black Engineers (NSBE) Jr. Cleveland Chapter	Thrive Scholars
Children's Learning Center, Lorain County Community College	Girl Scouts of North East Ohio	Nature Center at Shaker Lakes	Tri-C Manufacturing Technology Center
Cleveland Metroparks	Great Lakes Science Center	NEOSTEM Ecosystem	Tri-C Youth Technology Academy
Cleveland Metroparks Zoo	Greater Cleveland Aquarium	Nord Family Foundation	Twelve Literary Arts
Cleveland Metropolitan School District (CMSD)	Greater Cleveland Partnership	Nordson Corporation Foundation	United Way of Lorain County
Cleveland Museum of Natural History	Hands-on Health	Nordson Tech Time, Fusion Marketing	University Circle Inc.
	HIT in the CLE	Northeast Ohio Regional Sewer District	University Hospitals
	Holden Arboretum and Botanical Gardens	O.U.R. Family	Urban City Codes
		Oberlin City Schools	Urban League of Lorain County
		Ohio Invention League	Urban Squash Cleveland
		Organic Connects, Inc.	Verizon
			VEX Robotics Inc.
			Youth Entrepreneur Institute at University School

The following are the standout program exemplars that show high impact and influence on the youth they engage. They do not represent an exhaustive listing of all the STEM exemplar organizations in the region, but organizations that stood out during this landscape analysis process. These organizations represent industry, small non-profits, school-based programs and institutional initiatives. It must be acknowledged that there is no one STEM effort highlighted below that has all of the exemplar characteristics. It is also worth noting that most of the activities target high-school students and involve a relatively small group of students (*with the exception of the CMSD initiative with MetroHealth*). More thoughtful reflections are required to think about scalable options.

National Society of Black Engineers (NSBE) Jr. Cleveland Chapter

Convenes group of high school students monthly during the school year; exposes them to STEM professionals and takes students to national NSBE conference

ACES (Achievement through Community Education & Support) Program – Lorain County

Supports students in after-school and summer programs; highly personalized; offers career exposure, community service activities, college prep, job skill development and internships; offers 24-hour access to staff

IndeedWeCode

Summer coding camp for Black and Brown girls; exposure to STEM professionals; does activities throughout the year and hires Black and Brown female instructors

O.U.R. Family – Elyria, Lorain County

In-school STEM programming, summer camps and various community service activities; Taylor family history of decades-long dedication to City of Elyria; food distribution, STEM kit distribution, reading program; family donated funds to create maker-space in Elyria library; facilitated baseball field construction, and looking to build empowerment zone

Rockwell Automation, Global Academic Organization

Big company investment in advanced manufacturing program in schools; clear outcome is training people to work on Rockwell equipment and build advanced manufacturing skill set; personalized attention on students, builds labs and offers summer internships

MetroHealth - Lincoln West School of Science and Health Partnership

Program involves full student engagement from the 9th grade to 12th grade with MetroHealth; program model is highly personalized and long term in nature

Case Western Reserve University Envoys Program

Provides high-school students with paid summer and school-year lab research experience working alongside a STEM graduate student; Envoys participate in program for multiple years and get test prep and math and science instruction



About the Author



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Me'lani Labat Joseph has been designing and advising youth programming and STEM initiatives for over 20 years. Before launching her consulting firm Transformative Innovations, LLC in 2020, Me'lani was the Director of Engineering at the Leonard Gelfand STEM Center at Case Western Reserve University. Trained as a mechanical engineer at MIT, and with a public policy graduate degree from the University of Chicago, she is on a lifelong mission to expand horizons for Black and Brown youth. Her pride and joy are the thousands of youth whose creativity and aspiration she has helped spark over the years, including her own three children who have chosen careers in medicine, communications and engineering.

