Examining the Research Landscape: What Existing Studies Reveal—and Omit—About Youth-Driven Afterschool STEM and Communities

CYESS
Collective for Youth Empowerment in STEM & Society

January 2026

ABSTRACT

Substantial research documents the benefits of afterschool and other out-of-school time (OST) STEM programs on young people's confidence, sense of agency, and interest in science, technology, engineering, and math (STEM). This is to be expected, as afterschool programs offer an ideal informal learning environment for youth to engage with hands-on projects and apply STEM knowledge and skills to tackle real-world problems in their communities. While these individual benefits to youth are extremely valuable, there is less research measuring the systems-level changes youth are enacting in their communities and on the specific issues they tackle. The few available examples are extremely promising and offer important practice-based insights into the broader impacts of community-centered and youth-led afterschool STEM programming. This paper explores this gap by reviewing emerging research on youth-led STEM initiatives, focusing on projects addressing real-world problems that youth care about in their communities. We also present key themes from qualitative interviews conducted with two OST STEM programs, Technovation and trubel&co, to illuminate the practical strategies and challenges associated with fostering youth-led community change through STEM. Synthesizing the available research and these examples, we offer recommendations for designing and documenting the impacts of afterschool STEM programs that foster both individual growth and lead to meaningful community benefits. Describing these impacts will offer clear pathways for youth involvement and intergenerational approaches to solving local, national, and global challenges.

INTRODUCTION

Young people bring both optimism for the future and innovative ideas to address today's problems. However, their voices are too often missing from the very conversations that will shape their lives, their communities, and their futures (Taylor & Hall, 2013). When young people are empowered to share their thoughts and experiences, it fosters their development, builds confidence, and ensures that decisions shaping their futures are informed by their realities. There is growing recognition that youth have unique perspectives and a different lived experience from adults that can lead to more relevant and effective solutions for issues that impact us all. This recognition of the importance of actively including young people in meaningful ways is a central theme within the research on youth participation and the power of youth voice (Brown & Gabriel, 2018; Hart, 1992; Zeldin, Gurtner, & Chapa, 2018).

Scholarly discourse on authentic youth participation has a rich history, notably exemplified by Hart's (1992) "Ladder of Young People's Participation," which delineates varying degrees of youth involvement in decision-making processes. Hart's Ladder presents eight rungs, ranging from non-participation to genuine participation, where young people share decision-making with adults or initiate their own projects. The higher rungs signify increasing levels of youth agency and power in shaping outcomes. This model continues to serve as a valuable framework for analyzing and enhancing the quality of youth involvement in educational and community settings, advocating for a move beyond superficial engagement towards meaningful intergenerational partnerships. Concurrently, young people themselves are increasingly vocal in their desire for increased civic engagement and opportunities to contribute meaningfully to the betterment of their communities and work towards the resolution of pressing issues that matter to them (Flanagan et al., 2018).

This recognition of varying levels of youth involvement has significant implications for how youth are engaged in various settings today. Increasingly, afterschool programs and other out-of-school-time (OST) programs (any programs that run outside the typical school day) rooted in positive youth development (PYD) principles (Lerner et al., 2005) are centering youth voices in their programming. This intentional inclusion recognizes the valuable perspectives and potential contributions of young people in shaping their own experiences and the broader community. At the same time, science,

technology, engineering, and mathematics (STEM) programming in afterschool is now widespread, with three-quarters of parents reporting that their child participates in a STEM program at least once a week (Afterschool Alliance, 2025). We also know that three-quarters of parents agree that children gain interest in and skills in STEM through afterschool. The confluence of these two objectives offers an opportunity for more afterschool programs to elevate youth voice and ideas by engaging young people in solving complex community, national, and global challenges. This is in part because the STEM skills and knowledge that are introduced in these programs are also essential to solving today's systemic challenges, such as sustainable environments, food security, responsible deployment of artificial intelligence (AI), and more. To make change in today's STEM-driven world, young people need a strong grounding in STEM and the agency and opportunities to engage in issues that matter to them and the people they care about.

There are many examples of youth defining and leading community-centered projects that utilize STEM knowledge and skills to creatively solve problems they care about and spark community change. For instance, Birney & Cronin (2018) share research on youth restoring a disused garden, raising awareness about climate change, and inspiring action by family members through their participation in a 15-week science-focused afterschool program. Such contextually relevant and hands-on learning has the potential to help a diverse group of youth recognize that STEM is a valuable tool that supports their varied interests and serves their sense of purpose while offering opportunities to build agency and confidence to engage with the world around them, including preparing for the workforce. Communities also benefit from an intergenerational perspective on issues they need to address, gaining a richer, more nuanced understanding of challenges and opportunities when the insights and experiences of both young people and adults are actively sought, valued, and integrated into problem-solving and decision-making processes.

Unfortunately, understanding the broader societal benefits of youth engagement remains a critical, yet underexplored, area of inquiry. Socializing and normalizing routine youth involvement in societal decisions would be easier for afterschool programs with further evidence of efficacy: i.e., evidence demonstrating that young people's engagement meaningfully affects how or which problems are identified and whether better solutions are found when youth have a seat at the table. Typically, however, outcomes measured for youth involvement capture data about the impact on youth directly (such as measuring their increased sense of agency and confidence). While these individual impacts are important, we know less about what happens at the systems level when young people are positioned as important stakeholders in community conversations.

This paper examines this gap by reviewing emerging research on youth-led STEM initiatives, focusing on projects that address real-world problems like climate advocacy, issues of equity, safety, and more. To build on these findings, we also conducted semi-structured interviews with two OST STEM programs operating at different levels of scale to showcase practical strategies and challenges associated with fostering youth-led community change through STEM, and to provide concrete examples of how these initiatives operate in real-world settings. Synthesizing these examples, we offer practice-based recommendations grounded in PYD for designing afterschool STEM programs and activities that foster both individual growth and meaningful community impact.

NOTE: This exploration laid the groundwork for a proposal to the National Science Foundation (NSF) that was recently funded. Our new research project (Grant No. DRL-2517238) will build upon our background findings to systematically investigate the broader community impacts of authentic youth involvement in STEM.

FOUNDATIONS OF YOUTH-CENTERED STEM ENGAGEMENT IN AFTERSCHOOL

POSITIVE YOUTH DEVELOPMENT

Decades of research and practice in the area of youth development have established core principles and values for working with young people, including elevating youth voice, fostering youth's sense of agency, and encouraging feelings of empowerment through the Positive Youth Development (PYD) framework and other youth-centered approaches (Bloomer et al., 2023; Ginwright & James, 2003; Hamilton et al., 2004; Lerner et al., 2005). For example, in a large study of 1599 youth (grades 4–12) enrolled in 158 STEM-focused afterschool programs, the majority of youth reported increases in STEM engagement, identity, career interest, career knowledge, relationships, critical thinking, and perseverance (Allen et al., 2019).

PYD principles strongly align with the goals of afterschool settings, emphasizing the cultivation of young people's strengths, competencies, and positive relationships (Deutsch, 2017; Pittman, 2017). PYD frameworks advocate for creating environments where youth can thrive across various domains, including social, emotional, cognitive, and behavioral development. Hart's (1992) "Ladder of Young People's Participation" provides a valuable lens through which to examine the implementation of PYD in these settings, as it outlines different levels of youth involvement, ranging from tokenism to genuine partnership. Effective afterschool programs rooted in PYD strive to move beyond the lower rungs of the ladder, actively engaging youth in meaningful decision-making, leadership roles, and collaborative projects. By offering opportunities for authentic voice and choice, these programs empower young people, fostering their sense of agency, belonging, and contribution, ultimately leading to more positive developmental outcomes and a greater capacity for community engagement.

STEM IDENTITY

Supporting a strong sense of STEM identity is another well-documented positive outcome of youth's participation in high-quality afterschool STEM programs. STEM identity can be conceptualized as the way a person sees themselves in relation to the subjects of STEM and their sense of belonging in STEM fields (Anderson-Butcher & Conroy, 2002; Calabrese Barton et al., 2013; Carlone & Johnson, 2007). STEM identity develops through a process of performance and recognition, during which individuals begin to feel they belong in their chosen STEM field (Archer et al., 2017; Carlone et al., 2014; Master et al., 2016). To develop a stronger STEM identity, individuals must have opportunities to demonstrate their competence in STEM and be recognized for that competence by perceived experts (Carlone & Johnson, 2007).

Afterschool STEM programs provide opportunities to support young people's development of STEM identities, particularly for girls and people of color who continue to be underrepresented in STEM fields. Research demonstrates how STEM programs can provide powerful opportunities for youth to engage in hands-on, authentic science experiences, interact with diverse role models, and understand the real-world application of STEM (Calabrese Barton et al., 2013; King & Pringle, 2019; Riedinger & Taylor, 2016; Robinson et al., 2016). Research has also shown that afterschool and other OST STEM education programs improve girls of color's sense of belonging and other STEM identity components (Hughes et al., 2024; Ibourk et al., 2022; King & Pringle, 2019).

SOLVING COMMUNITY ISSUES THROUGH AFTERSCHOOL STEM

Young people are not only interested in gaining STEM skills and competencies, but they are also interested in the positive changes they can enact in their communities. Research has shown that the majority of young people believe they have the power to change things (76%) and even more believe they can do so by working with other generations (83%) (Booth, 2023). Afterschool STEM programs have the unique opportunity to build on these beliefs by actually engaging them in making improvements in their community. The community STEM model, for example, does this by contextualizing learning within community and environmental issues (Nation et. al, 2021; Nation & Hansen, 2021). A growing number of OST STEM programs have been building on this model, working to inspire young people to use their imagination to solve problems and spark community, environmental, and global change. For example, the Mapping (Climate) Justice program from trubel&co in partnership with Florida Gulf Coast University (FGCU) engages a diverse group of Southwest Florida youth in harnessing the power of geographic information systems (GIS) and data-backed storytelling to shed light on urgent climate issues in their own communities, including hurricane preparedness, coral bleaching, clean water access, and more. On a larger scale, Technovation, a global technology education nonprofit, empowers girls to become leaders, creators, and problem-solvers. They report that 50% of their program alumnae are now leading change in their communities (Technovation, 2024). More information about each of these programs is explored through case studies later in this paper.

DOCUMENTING YOUTH-LED CHANGE

While programs often measure the impact of afterschool STEM programs through metrics collected about the young people themselves (e.g., increased agency, skills, etc.), documenting the broader systemic changes within the community requires different methodologies and a focus on collective impact indicators. But there are barriers to carrying out this type of research. Community change can be complex and multifaceted, often unfolding over extended periods. Attributing specific outcomes directly to youth-led initiatives can be difficult, as change is often the result of multiple interacting factors. Thus, impact statistics like those provided by Technovation in the previous section are rare.

The research that *has* focused on the intersection of STEM programming and youth-led community change has been incredibly promising. Trott (2019) provides examples of youth-led projects that improved their communities, such as restoring a disused garden, raising awareness about climate change, and inspiring action by family members through their participation in a 15-week afterschool program, *Science, Camera, Action! (SCA)*. Birney & Cronin (2018) describe the "natural affinity between STEM education and the environment" when detailing how teachers and students directly participated in the planning and physical implementation of oyster restoration in New York Harbor. More recent research has shown that youth can even play a critical role in addressing marine debris challenges (i.e., challenges resulting from solid materials that are disposed of into marine environments) by promoting support for marine debris management policy and doing so across political boundaries (Hartley et al., 2021).

In order to gain more insight into the practical reality of running STEM programs like these that foster youth-led change, we interviewed leadership staff from two programs: trubel&co and Technovation. Technovation provides an example of a longstanding program with longitudinal impact data for its programs. trubel&co serves as an example of a newer program that is still developing its approach to documenting and tracking youth-led change.

CASE STUDIES: PROGRAMS INTEGRATING STEM AND COMMUNITY IMPACT

The following case studies were informed by one-hour semi-structured interviews with one or more leadership staff from each organization, conducted via Zoom. The goal of these interviews was to briefly learn about each program's history, their program models, and their approach to 1) engaging youth in community or global change and 2) their approach to documenting youth-led change. Technovation and trubel&co were selected as illustrative examples of OST STEM programs with a stated commitment to fostering youth-led social impact. These case studies serve to illustrate the practical approaches and difficulties involved in enabling youth-led community impact within STEM contexts, offering tangible examples of their operation.

TECHNOVATION

Technovation is a global technology education nonprofit that empowers girls to become leaders, creators, and problem-solvers who actively involved in brainstorm solutions to the issues their communities. Originally founded in 2006, Technovation has since trained 150,000 young women to be technology entrepreneurs and innovators.

Today, the Technovation Girls program equips girls and young women (ages 8-18) to become technology leaders who are focused on solving community and global issues. With the support of volunteer mentors and parents, girls work in teams to code mobile apps that address real-world problems. Technovation Girls uses a three-part model to guide its programming:
1) Participants identify real-world problems: A core element of the program model is that participants find a problem in their community and develop a solution to it, which helps bring technology to life in an immediate, tangible way. It is also the building block for teaching girls civic responsibilities and how to be active and informed community members.
2) Build a team: The Technovation Girls program includes a global competition element. After identifying a problem in their community, they work in teams to build a mobile or web app to help address it and submit their apps to the competition. These teams are supported by a mentor (and a parent, if the girls are younger than 12). As a team, they work together, share the workload, and cheer each other on while practicing responsible and collaborative decision-making.
3) Get the community involved: Technovation dedicates time to building trust with the local community leaders who bring Technovation to their schools, organizations, or towns.

Technovation programs are designed to be flexible so they can align with diverse community needs and goals and plug into existing support networks. Because of this, Technovation may look different in the different places it is run. The driving force behind Technovation is the curriculum, which is available freely with open access on the Technovation website. Because the curriculum is so robust, adults do not need a lot of experience to run Technovation programs, and mentors can learn alongside the participants.

Technovation's program is unique in the way it instills civic skills and responsibilities alongside technical skills; it focuses on developing a mindset in which young people believe they can make real, noticeable impacts in their communities. Through their participation in Technovation, girls have created a wide range of innovative and useful technology-based solutions, including a paper waste reduction app for schools, an app that uses AI to support individuals with hearing impairments, an app for finding community service opportunities, language-learning apps, and more. In one example of immediate community impact, a group of girls from Argentina developed an app to combat wildfires. Their local fire department adopted their app because it was better than the one they were using—the youth-developed app updated every four hours instead of every twenty-four hours.

Technovation highlights impact stories like the one described above to illustrate the systems-level change girls are enacting through participation in their programs. As a means of qualitative data collection, all apps developed by girls in their programs are collected. Their App Gallery (see: technovation.org/app-gallery) showcases some of the top solutions from recent years, with the goal of inspiring others to solve a problem they care about in their own communities. Technovation also partners with research organizations to assess and improve their programs' individual and community impact.

Technovation utilizes a comprehensive approach to data collection, gathering information from current participants, volunteers, alumnae, and external partners through surveys, project submissions, and qualitative sources to demonstrate the multifaceted impact of their programs on individuals and communities worldwide. Technovation publicly shares annual impact reports highlighting participants' skills and learning as well as their impact on solving community issues (see: technovation.org/impact). For example, their most recent impact report shares that in 2023 alone, 7,500 girls built technology solutions to community problems, 88% of girls were more confident in their ability to develop technology and help their communities, and 5,500 adult volunteers participated to make it possible for girls around the world to access high-quality technology education.

Another metric used for measuring systems-level impact is long-term tracking of Technovation alumnae. Five years or more after participating in Technovation programming, alumnae reportedly still credit the program with influencing their interests and career and professional pursuits. In terms of systemic impact, 50% of Technovation alumnae report that they are actively leading change in their communities. On a global scale, in 2023, Technovation alumnae spoke at the United Nations (UN) High-Level Political Forum, and an alum even won the International Children's Peace Prize.

trubel&co

trubel&co, founded in 2022, is a young nonprofit that empowers youth by integrating STEM education with civic innovation to tackle societal challenges. Founder Nick Okafor explained that his personal experiences in technology inspired trubel&co, which is dedicated to empowering the next generation of responsible innovators to cause "good trouble" to solve society's most complex issues. By combining technology with social impact, trubel&co also aims to broaden the pool of young people who are interested in STEM. Okafor explains that "communities of color and women are drawn into fields that have social impact… we're doing STEM a disservice when we divorce them."

Through their flagship program, Mapping Justice, which was piloted through MIT's high school STEM outreach, trubel&co empowers youth to use geospatial technology for social change. Mapping Justice teaches students to use geographic information systems (GIS) and data visualization as tools for understanding and addressing issues of inequity in their own communities, all while fostering data literacy, critical thinking, and community advocacy. Mapping Justice is a free, predominantly virtual summer program for high school students in Hawaii and the Gulf Coast states. During this 6–8-week project-based course, students spend 15 hours a week moving through a mix of synchronous and asynchronous activities that dive into climate and social justice issues in their local communities and the fundamentals of GIS. In addition to Mapping Justice, trubel&co also offers 90-minute virtual workshops for high school students across the United States on topics that Okafor calls "the missing curriculum in STEM," such as race, power, technology, and geospatial justice.

The trubel&co approach was designed to transform STEM pathways into platforms for liberation and equity, with the mission of ensuring every young person can contribute to a just and inclusive future. Their programs are designed to foster civic mindsets and dispositions by exposing young people to new information, promoting civic discourse, and providing opportunities for young people to have agency in addressing local issues they care about. trubel&co is rooted in the belief that young people are inherently interested in doing good and making meaningful changes in the world, and that STEM can equip them to make those changes in tangible ways in their communities.

As a newer program, trubel&co documents its impact at the individual level on its youth participants. These impacts are measured through surveys collected from youth participating in trubel&co programs, asking students to rate their comfort level with a series of skills. Recent impact reporting from trubel&co shows improvements in youth participants' technical proficiency, critical consciousness, and self-efficacy. While trubel&co is not yet collecting systems-level impact data, students' projects from Mapping Justice are all documented on their website, organized by year, serving as an archive of youth solutions for addressing inequities. Founder Nick Okafor, however, is interested in systematically capturing the benefits to communities that trubel&co youth are leading, saying, "That next-level community impact is critical. We haven't found an answer yet as to how to fully measure that outside of student reflections." His comment further reflects the need for resources and tools for programs to effectively capture these impacts.

RECOMMENDATIONS FOR AFTERSCHOOL PROGRAMS

While Technovation and trubel&co differ in their focus and the populations they reach, they overlap in their shared aim to empower youth to use STEM skills to enact real, systems-level change. Their programming is rooted in how young people understand, identify, and ultimately address issues they care about through technology. Both programs also surface some of the challenges around documenting the systems-level change that their young people are enacting. Having explored the practical approaches of Technovation and trubel&co in fostering youth-led community change through STEM, Table 1 presents a set of actionable recommendations for programs and practitioners designing afterschool STEM programs that intentionally cultivate both the individual growth of youth participants and their capacity for meaningful community impact.

Table 1. *Designing Afterschool STEM Programs that Empower Youth as Change Agents*

Recommendation	Description
Empower Youth Leadership in an Intentional and Robust Manner	Youth-led community engagement is most impactful when young people feel their voices are not only heard but also valued. Programs can create opportunities for youth to identify issues they care about, develop action plans, and lead initiatives. Providing platforms for them to express their opinions and take ownership of their actions will build confidence and a sense of agency, making the experience more engaging and sustainable.
Connect STEM to Real-World Community Issues	Young people want to make a difference and are often drawn to fields that they believe will help improve their communities and the world. Programs can help youth understand how STEM knowledge and skills can be applied to address local challenges and opportunities (e.g., environmental sustainability, public health, accessibility). In doing so, they can also help broaden participation in these fields by positioning civic engagement as the primary goal and using STEM as a supporting tool for community impact, rather than solely as a career path.
Connect Community Engagement to Youth Interests	Lean into the interests and passions of the members of your programs. Create opportunities for youth to identify issues that are personally and culturally relevant to them and support them in using STEM to address these issues.
Facilitate Partnerships for Tackling Community Issues	Cultivate authentic community engagement by intentionally positioning youth as key partners in tackling real-world challenges. Forge reciprocal partnerships with local organizations, community leaders, corporate partners, and policymakers, ensuring youth voices are central to the collaboration. These connections will not only provide youth with valuable learning opportunities and exposure to diverse perspectives but, more importantly, will empower them to co-create solutions and demonstrate their tangible impact as active community leaders. Engaging the wider community also provides vital resources, mentorship, and sustained support, recognizing youth as essential contributors to collective efforts.
Document Youth-Led Community Impact	Afterschool programs typically focus their collection of impact data on benefits to the youth themselves, not on tracking change to the community issues being tackled. Programs engaging young people in community challenges can fill this gap by documenting youth-led projects in various ways: student/alumni reflections or surveys, qualitative collection of STEM solutions or technologies developed by young people, documentation of youth projects, sharing case studies and impact stories online, and other similar methods. By broadening these documentation methods, programs can move beyond rigid metrics to define community impact in locally relevant ways—allowing for a richer discussion on what counts as success and how youth-driven STEM work authentically strengthens the community fabric.

By intentionally integrating these PYD-aligned practices, afterschool STEM programs will become powerful catalysts for afterschool STEM programs will become powerful catalysts for nurturing individual growth and empowering young people to be active contributors to their communities.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE WORK

While many afterschool programs engage youth in addressing community challenges or larger global issues, research published on program efficacy still predominantly focuses on capturing benefits to the youth themselves and not on tracking change to the issues being tackled. To demonstrate and amplify the wider community impacts of youth engagement on issues that matter to them, there is a need to develop and implement an assessment framework that tracks the systemic change youth in afterschool programs are leading in their communities.

Both case studies presented underscore the need for this type of resource, albeit in opposite ways. For a younger program like trubel&co, there is a desire to build from collecting student reflections into a more longitudinal, robust form of data collection on systems-level impact. For an established program like Technovation, their longevity has led to credibility and strong partnerships with research organizations, allowing them to collect and publish systems-level impact data (including data from their alumnae). Smaller, newer programs may not have the means or credibility to create these types of partnerships and follow this model or approach. These case studies highlight the necessity for further research and the development of practical tools and frameworks to document systems-level youth-led change. While not intended to be exhaustive, these case studies offer valuable insights into the strategies and challenges faced by programs actively working to empower youth as change agents through STEM.

To truly understand the broader impact of youth engagement, future research should delve into whether involving young people in developing solutions leads to demonstrably different or more effective approaches to systemic problems. This exploration could reveal unique insights and innovative strategies that arise from youth perspectives, potentially uncovering more sustainable and equitable solutions compared to adult-led initiatives alone. Investigating this question will not only highlight the value of youth voice but also provide evidence for the importance of effectively integrating their contributions in addressing complex societal challenges. Based on this need to understand and leverage youth impact, we recommend dedicated work to develop a comprehensive framework that systematically documents the critical importance and unique contributions of actively engaging young people in addressing community issues through afterschool STEM programs.

CONCLUSION

Young people are deeply interested in making positive changes in their communities and society, and they bring a different perspective and lived experience compared to adults. But too often, youth are left out of conversations that impact their lives, communities, and futures. The research highlighted in this paper showcases the importance of involving young people in authentic, community-engaged, and transformative work. Engaging in this type of work in afterschool and OST programs will help to both position STEM as relevant to young people's lives and socialize and normalize youth involvement in defining relevant problems to tackle in communities and finding appropriate solutions.

Afterschool and other OST programs, with their focus on positive youth development, are critical spaces that can offer youth community-centered STEM learning experiences that are personally and culturally relevant to them. Therefore, intentionally creating and valuing opportunities for youth voice within these programs is not just beneficial, but essential for cultivating engaged and empowered future leaders and strengthening our communities as a whole.

The groundwork laid in this paper directly informed the next phase of this research: the NSF-funded project, Beyond Individual Impacts (Grant No. DRL-2517238), which is now underway and specifically dedicated to developing a comprehensive framework to document the significant contributions of young people and the necessity of youth engagement in all facets of community issues. We hope that this new work will help realize the full potential of youth as change agents.

Acknowledgement: We acknowledge Amanda Sullivan (National Girls Collaborative Project), Anita Krishnamurthi (Afterschool Alliance), and Emily Howard and Katie Taylor (University of Washington) for their work developing this paper.

REFERENCES

Afterschool Alliance. (2025). *Lost opportunity: Afterschool in demand, but out of reach for many.* https://afterschoolalliance.org/AA3PM/

Anderson-Butcher, D., & Conroy, D. E. (2002). Factorial and criterion validity of scores of a measure of belonging in youth development programs. *Educational and Psychological Measurement,* 62(5), 857–876. https://doi.org/10.1177/001316402236882

Archer, L., Moote, J., Francis, B., DeWitt, J., & Yeomans, L. (2017). The "exceptional" physics girl: A sociological analysis of multimethod data from young women aged 10–16 to explore gendered patterns of post-16 participation. *American Educational Research Journal*, 54(1), 88–126. https://doi.org/10.3102/0002831216678379

Birney, L., & Cronin, J. (2019). Environmental habitat restoration and inquiry-based learning with New York City public schools—an urban model in STEM education. *Journal of Environmental Studies and Sciences*, 9, 322-326. https://doi.org/10.1007/s13412-018-0530-5

Bloomer, R., Harris, L. M., Brown, A. A., & Crosby, S. (2023). Exploring the promotion of youth voice in community-based youth development programmes. *Child & Family Social Work*, 28(2), 291-301. https://doi.org/10.1111/cfs.12961

Brown, A. A., & Gabriel, M. G. (2019). The role of youth voice in this Special Issue. *Journal of Youth Development*, 14(2), 205-208.

Calabrese Barton, A., Kang, H., Tan, E., O'Neill, T. B., Bautista-Guerra, J., & Brecklin, C. (2013). Crafting a future in science: Tracing middle school girls' identity work over time and space. *American Educational Research Journal*, 50(1), 37–75. https://doi.org/10.3102/0002831212458142

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187–1218. https://doi.org/10.1002/tea.20237

Carlone, H. B., Scott, C. M., & Lowder, C. (2014). Becoming (less) scientific: A longitudinal study of students' identity work from elementary to middle school science. *Journal of Research in Science Teaching*, 51(7), 836–869. https://doi.org/10.1002/tea.21150

Deutsch, N. L. (Ed.). (2017). *After-School Programs to Promote Positive Youth Development: Integrating Research into Practice and Policy, Volume 1*. Springer.

Flanagan, C. A., Syvertsen, K. L., & Wray-Lake, L. (2018). What motivates civic engagement among youth? A meta-analytic review. *Developmental Psychology,* 54(11), 2015–2034.

Ginwright, S., & James, T. (2003). From assets to agents of change: Social justice, organizing, and youth development. *New Directions for Youth Development*, 96, 27–46 https://doi.org/10.1002/yd.25

Hamilton, S. F., Hamilton, M. A., & Pittman, K. (2004). Principles for youth development. *The Youth Development Handbook: Coming of Age in American Communities, 2, 3* https://doi.org/10.4135/9781452232560.n1

Hart, R. (1992). Children's participation from tokenism to citizenship. 1992. Florence, *UNICEF Innocenti Research Centre*, 66.

Hartley, J. M., Stevenson, K. T., Peterson, M. N., DeMattia, E. A., Paliotti, S., & Fairbairn, T. J. (2021). Youth can promote marine debris concern and policy support among local voters and political officials. *Frontiers in Political Science*, 3, 662886. https://doi.org/10.3389/fpos.2021.662886

Hughes, R., Ibourk, A., Wagner, L., Jones, K., & Crawford, S. (2024). #Resilience is not enough for Black women in STEM: Counterstories of two young Black women becoming a STEM person. *Journal of Research in Science Teaching*, 61(4), 744-771. https://doi.org/10.1002/tea.21925

Ibourk, A., Hughes, R., & Mathis, C. (2022). "It is what it is": Using storied-identity and intersectionality lenses to understand the trajectory of a young Black woman's science and math identities. *Journal of Research in Science Teaching*, 59(7), 1099–1133. https://doi.org/10.1002/tea.21753

King, N. S., & Pringle, R. M. (2019). Black girls speak STEM: Counterstories of informal and formal learning experiences. *Journal of Research in Science Teaching*, 56(5), 539–569. https://doi.org/10.1002/tea.21513

Lerner, R. M., Almerigi, J. B., Theokas, C., & Lerner, J. V. (2005). Positive youth development a view of the issues. *The Journal of Early Adolescence*, 25(1), 10-16. https://doi.org/10.1177/0272431604273211

Master, A., Cheryan, S., & Meltzoff, A. N. (2016). Computing whether she belongs: Stereotypes undermine girls' interest and sense of belonging in computer science. *Journal of Educational Psychology*, 108(3), 424–437. https://doi.org/10.1037/edu0000061

Nation, J. M., Sen, F., Duncan, J., Sañosa, D., & Durán, R. P. (2021). With our community, for our community: Expanding possibilities for engaging in STEM. The *Journal of Applied Instructional Design*, 10(4), 225-243. https://doi.org/10.59668/329.5279

Nation, J., & Hansen, A. (2021). Perspectives on community STEM: Learning from partnerships between scientists, researchers, and youth. *Integrative and Comparative Biology*, 1-34. https://doi.org/10.1093/icb/icab092

Pittman, K. (2017). Why after-school matters for positive youth development. In *After-School Programs to Promote Positive Youth Development: Integrating Research into Practice and Policy*, Volume 1 (pp. 1-12). Cham: Springer International Publishing.

Riedinger, K., & Taylor, A. (2016). I could see myself as a scientist: The potential of out-of-school time programs to influence girls' identities in science. *Afterschool Matters*. Spring 2016.

Robinson, A., Pérez-Quiñones, M. A., & Scales, G. (2016). African-American middle school girls: Influences on attitudes toward computer science. *Computing in Science & Engineering*, 18(3), 14-23.

Taylor, K. H., & Hall, R. (2013). Counter-mapping the neighborhood on bicycles: Mobilizing youth to reimagine the city. *Technology, Knowledge and Learning*, 18, 65-93.

Technovation (2024). Our Impact. https://www.technovation.org/impact/

Trott, C. D. (2019). Reshaping our world: Collaborating with children for community-based climate change action. *Action Research*, 17(1), 42-62. https://doi.org/10.1177/14767503198292

Zeldin, S., Gurtner, J., & Chapa, B. (2018). Preparing for Youth Engagement: Youth Voice, Youth-Adult Partnership, Youth Organizing. *ACT for Youth*.