

AFTERSCHOOL STEM QUARTERLY RESEARCH REVIEW



Photo credit: Boys & Girls Club of the Flathead Reservation and Lake County

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Hello!

Published by the [Afterschool STEM Hub](#), the ASQRR brings you the latest and most relevant research from the field of out-of-school time (OST) science, technology, engineering, and mathematics (STEM) education. The ASQRR connects practitioners, policymakers, and advocates with the evidence and data that matter.

September is [Workforce Development Month](#), and this ASQRR edition highlights how afterschool programs are a vital piece of the broader STEM education and workforce ecosystem. These programs engage youth in career-connected learning, pair them with STEM mentors, and build pathways into various STEM fields, as described in our recent *America After 3PM* STEM special report, [Afterschool STEM Takes Off](#).

STEM occupations are projected to grow at [more than twice the rate](#) of other fields by 2035, and every community needs STEM-literate citizens in our increasingly complex world. As a member of the [STEMM Opportunity Alliance \(SOA\)](#), a network of hundreds of partners working to add 20 million new STEMM workers to the U.S. economy by 2050, we are ensuring that afterschool STEM programs are valued and supported as part of the solution. In fact, afterschool is woven throughout several of the five pillars in SOA's national [strategy](#).

With this in mind, we are delighted to feature the following two articles, which offer timely insights into afterschool programs building bridges between STEM education and workforce systems:

- Habig, B., Geller, F., Gupta, P., et al. (2026). Expanding the realm of possibilities: The role of informal STEM programs in promoting STEM major and STEM career awareness. *Frontiers in Education*, 10, 1717945.
- Lincoln, B., White, A. E., Lund, T. J., et al. (2025). Moving from passion to purpose: A STEM-focused after-school program's influence on purpose outcomes. *Journal of Adolescent Research*, 40(4).

These articles show the many ways afterschool STEM programs play a critical role in expanding the range of careers young people see as possible for themselves, inspiring youth to pursue a future in STEM. In addition to the articles, we provide insights from our recent research on parent priorities for afterschool and how they relate to workforce development, along with an expert editorial from the Institute for a STEM Ready America at STEM Next Opportunity Fund.

We hope you find the issue helpful and informative for your practice, research, or policy work in afterschool STEM education. We also invite you to share your feedback, suggestions, and questions with us at stemhub@afterschoolalliance.org. We would love to hear from you and learn more about how the ASQRR can support your interests and needs.

Thank you for reading and subscribing to the ASQRR. We look forward to bringing you more high-quality and timely research in the next issue. Until then, happy reading, learning, applying, and advocating!

Sincerely,
The ASQRR Editorial Team
Anita Krishnamurthi, PhD
Leslie Brooks, DVM, MPH
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RECENT RESEARCH FROM THE AFTERSCHOOL ALLIANCE

Afterschool STEM Takes Off:

Programs Offer More STEM Than Ever, But Too Many Young People Still Miss Out

The Afterschool Alliance conducts a large-scale, national tracking survey of parents and guardians every five to six years to examine the demand for afterschool and summer programs in the United States. The findings are presented in the *America After 3PM* reports, including special reports on STEM. The latest *America After 3PM* STEM report, [Afterschool STEM Takes Off](#), provides data that demonstrates the role of afterschool in connecting STEM education to the STEM workforce. Once in an afterschool program, most youth now have access to STEM enrichment: A record 92% of parents report that their child's afterschool program offers STEM learning opportunities—up from 69% in 2014. Afterschool programs are an integral venue for STEM learning, meeting young people where they already are—in school buildings, community centers, libraries, and clubs across the country.

As children get older, their parents value not only STEM but also opportunities for college and career exploration, work-based learning experiences, and community engagement through service learning. In addition, parents of high schoolers highly prioritize durable skills such as communication, teamwork, critical thinking, and leadership, with 91% rating them as extremely or somewhat important, compared with 89% of middle school parents and 84% of parents of elementary school students. And 90% of parents of children of all ages value the important role afterschool programs play in developing social skills, confidence, and a sense of belonging.

Parents are clearly outlining their expectations for how they want afterschool programs to prepare teens for their futures and the workforce. These attributes and skills are also what employers are seeking in job candidates, positioning afterschool as a key partner in supporting career-connected learning.

To learn more and find data for your state, visit aa3pm.co.

Percentage of parents reporting the following factors as extremely or somewhat important in their selection of afterschool programs:

● K-5 ● 6-8 ● 9-12

College or career exploration



Work-based learning experiences



Service learning/community service



Opportunities to develop skills like communication, teamwork, critical thinking, leadership, and entrepreneurship



EXPERT EDITORIAL

The Next Opportunity for Afterschool STEM Is Career Connection

Author: Camsie McAdams, Director of the Institute for a STEM Ready America at [STEM Next Opportunity Fund](#)

Over the past 15 years, afterschool STEM learning has moved from the margins to the mainstream, becoming a core part of what millions of young people experience outside the classroom. The share of parents [reporting](#) that their child's afterschool program offers STEM learning experiences rose from 69% in 2014 to a record 92% in 2025. That growth reflects years of intentional investment in afterschool educators, programs, partnerships, and infrastructure—and a growing understanding of what makes STEM learning outside the classroom uniquely powerful.

Afterschool and summer programs are more equipped than ever to help young people see science, technology, engineering, and math not simply as subjects they study, but as things they can do. Young people can design and test a prototype, investigate a question that matters to them, try ideas that don't work, and change course. In the process, they build durable skills like problem-solving, teamwork, communication, and persistence.

Getting young people engaged in STEM through afterschool has been an enormous achievement. Now, the next opportunity for the field is to build on that excitement: helping young people more intentionally connect what they are learning and doing today to where those skills and interests could take them tomorrow.

The need is clear. In a 2025 global [study](#), fewer than half of U.S. teens reported attending a job fair, visiting a workplace, or speaking with a career advisor. Another [study](#) found that 62% of K-12 students in the U.S. are interested in STEM jobs, yet 33% said school is doing a bad job preparing them for these careers.

Afterschool has a tremendous opportunity to help fill the gap by building on what works to engage kids in STEM in afterschool. An engineering challenge can introduce youth to professionals solving similar problems and give them opportunities to receive feedback on their designs. A science camp can connect students to local research institutions and experts. The goal isn't to ask young people to choose a career earlier, but instead to widen the possibilities they can see before they are asked to make choices about their futures.

Making career connection a fundamental part of afterschool STEM will require the same field-wide commitment that helped high-quality STEM reach millions of students over the past two decades. That means equipping educators with practical tools and approaches they can integrate into the STEM experiences they already provide. STEM Next's [Career-Connected Learning Framework](#) supports that work, helping educators intentionally build career awareness, exploration, and preparation into afterschool and summer STEM.

It also means building cross-sector connections. Statewide networks and intermediaries can connect programs with employers, universities, and workforce partners. Employers can provide mentors and real-world exposure. Funders can invest in capacity building and scale. Education and workforce leaders can ensure afterschool is part of the broader system preparing young people for careers.

We already know afterschool can achieve ambitious goals at scale. The opportunity now is to bring that same ambition to career-connected learning—and make it a fundamental part of high-quality afterschool STEM nationwide.



STUDY REVIEW

Expanding the realm of possibilities: The role of informal STEM programs in promoting STEM major and STEM career awareness

Habig, B., Geller, F., Gupta, P., et al. (2026). Expanding the realm of possibilities: The role of informal STEM programs in promoting STEM major and STEM career awareness. *Frontiers in Education*, 10, 1717945. <https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2025.1717945/full>

STUDY SUMMARY:

This study examined how informal STEM programs influence young people's awareness of STEM majors and STEM careers. Researchers conducted a systematic literature review and meta-synthesis of research on K–12 informal STEM programs, including programs offered by museums, universities, zoos, and other out-of-school settings. The review focused on studies that used experimental or quasi-experimental designs, were grounded in a theoretical framework, and met minimum sample requirements to ensure that the research was rigorous. The review addressed three research questions: how these programs affect youth's STEM awareness, which program features are associated with strong outcomes, and which strategies work best for underserved populations.

Researchers first identified academic and professional papers that measured impacts on STEM major or STEM career awareness. They then used validated rubrics to evaluate each study's research design quality and evidence of impact, and conducted quantitative and qualitative analyses only on the strongest studies.

There were too few rigorous studies focused on awareness of STEM majors to conduct a meta-analysis, but researchers found a significant positive association between informal STEM program participation and STEM career awareness. Career exploration and experiential learning emerged as important program features with strong evidence of overall impact. Programs serving girls and historically underrepresented groups that had strong evidence of impact used mentoring and same-gender or same-race/ethnicity role models as valuable program elements.

RESULTS:

Researchers found that participation in an informal STEM program predicted STEM career awareness. Programs serving high school students had stronger effects than programs serving primarily middle school students, and girls-only programs had stronger effects than programs serving all genders. The authors do not specify if the stronger effects referred to girls only or all genders.



Photo credit: Sawhorse Revolution

KEY TAKEAWAY:

A review of rigorous experimental and quasi-experimental research studies found that informal STEM learning programs can increase youth awareness of STEM careers, particularly through career exploration and experiential learning. The research also found that mentoring and relevant role models are especially valuable for supporting underserved groups.

POPULATION:

The review included research on K–12 youth participating in informal STEM programs in the United States, including those serving middle and high school students and those specifically designed for girls and youth from historically underrepresented groups. Among the 32 rigorous studies that contributed to the qualitative synthesis, 15 specifically focused on girls and 14 focused on historically underrepresented groups based on socioeconomic status, race, or ethnicity. The researchers examined these groups separately to identify program features associated with increased STEM major and career awareness.

The most common program features associated with stronger STEM awareness were mentoring (81%), same-gender or same-race/ethnicity role models (63%), authentic research experiences (38%), and apprenticeship models (32%). Common effective practices included hands-on learning (91%), collaborative learning (78%), exposure to careers not typically introduced in school (75%), and career-exploration workshops (59%).

The authors also identified strategies for underserved and underrepresented groups. Among studies focused on girls, 93% included same-gender role models and 80% included mentoring. The authors identified these approaches as particularly promising for increasing knowledge of STEM careers among groups historically marginalized in STEM.

CONCLUSIONS:

Awareness of STEM majors and careers is a critical first step toward long-term engagement in STEM. Although much existing research on informal STEM programs was not sufficiently rigorous to include in this study's analysis, the strongest studies provide evidence that these programs can help young people expand their knowledge of possible STEM careers. The findings also suggest that program design matters. Career exploration and experiential learning emerged as key pedagogical components, along with a focus on girls and historically underrepresented groups. For the latter, mentoring and same-gender or same-race/ethnicity role models were especially prominent features.

To better understand the value of informal learning on STEM majors and career awareness, more rigorous research is needed. Nevertheless, the authors conclude that informal STEM programs can broaden the possibilities young people imagine for their futures, inspiring more of them to pursue a path in STEM.



Photo credit: Boys & Girls Club of the Flathead Reservation and Lake County

METHODS:

Researchers conducted a systematic review of peer-reviewed articles, program evaluations, conference proceedings, and books published from 1980 through 2023, focusing on U.S. K–12 informal STEM programs that measured awareness of STEM majors or STEM careers. They searched three databases and additional STEM education sources, ultimately identifying 27 studies of STEM major awareness and 266 studies of STEM career awareness.

Using validated rubrics, researchers assessed each study's research design quality on a four-point scale: 1 = weak; 2 = adequate; 3 = strong; and 4 = exemplary. Studies were considered exemplary if they used an experimental or quasi-experimental design, were grounded in a theoretical framework, and met minimum sample-size requirements of 50 subjects per group for quantitative studies and 20 participants per group for qualitative studies.

Researchers also rated each study's evidence of impact on a four-point scale, from little or no evidence of impact to exemplary evidence of impact, based on quantitative and qualitative findings related to STEM major or career awareness.

The researchers conducted quantitative meta-analyses only on studies rated strong or exemplary. The meta-analysis included 18 studies with 36 analyses of STEM career awareness. Researchers also conducted qualitative analyses of 32 rigorous studies with strong or exemplary evidence of impact to identify program design principles, effective practices, target audiences, and technological innovations associated with STEM major and career awareness.

STUDY IMPLICATIONS

IMPLICATIONS FOR PRACTICE:

■ Make STEM Careers Visible

Afterschool STEM programs should intentionally expose youth to a broad range of STEM careers, especially those not introduced through school. Career exploration can help young people understand the many STEM pathways available to them.

■ Prioritize Experiential Learning and Mentoring

Hands-on learning, collaborative experiences, mentoring, and authentic research can help youth develop knowledge of STEM fields while experiencing what it means to participate in STEM. Programs serving girls and historically underrepresented youth should consider same-gender or same-race/ethnicity role models as an additional support.

IMPLICATIONS FOR RESEARCH:

■ Use Research Quality Criteria

Researchers and program evaluators should consider research design, theoretical grounding, sample size, and strength of evidence when designing and assessing informal STEM research. Using explicit criteria can help distinguish promising findings from stronger evidence of program impact.

■ Study STEM Major Awareness

Very few studies of STEM major awareness met the researchers' criteria for rigorous research design. Future research should examine whether increases in awareness translate into greater interest in STEM majors and, eventually, STEM career engagement.

IMPLICATIONS FOR POLICY:

■ Invest in Career Exploration

Funding for informal STEM programs should support opportunities for youth to explore a broad range of STEM careers through hands-on experiences, mentoring, authentic research, and meaningful engagement with STEM professionals.

■ Build Bridges Between STEM Education and Workforce Systems

Where gaps persist, streamline communication across afterschool and workforce systems, such as by including afterschool program leaders on workforce development boards. Additionally, include afterschool and other informal STEM learning experiences in state-level Portrait of a Graduate frameworks, and ensure these programs are eligible avenues for students to earn credit for learning outside school hours.

STUDY REVIEW

Moving from passion to purpose: A STEM-focused after-school program's influence on purpose outcomes

Lincoln, B., White, A. E., Lund, T. J., et al. (2025). Moving from passion to purpose: A STEM-focused after-school program's influence on purpose outcomes. *Journal of Adolescent Research*, 40(4). <https://journals.sagepub.com/doi/10.1177/07435584231182137>

STUDY SUMMARY:

Researchers examined Change Makers, an afterschool STEM program for teens and preteens, to explore how informal learning can cultivate purpose. Purpose was defined as a personally meaningful, long-term aspiration that motivates action and contributes to something beyond oneself.

Through hands-on science activities and career and purpose development workshops, Change Makers aims to help youth from underrepresented groups become more purposeful and future-oriented, develop stronger science identities, and engage in social justice issues. The program includes weekly afterschool sessions and a month-long summer program. As part of this design, once older youth are comfortable with the science content, they lead activities for their younger peers.

Researchers analyzed interviews with 13 youth and three instructors. Most youth entered the program with an existing interest in STEM, which the authors describe as a "spark." The interviews identified three purpose-related areas associated with students' experiences in the program: confidence in their abilities, exploration of STEM careers, and motivation to use their skills to help others. But because the study analyzed only post-program interviews and no comparison group, it cannot confirm causality.

RESULTS:

Most students reported having an interest in science before joining Change Makers and said they expected science to play a major role in their future. Three purpose-related outcome categories emerged from the interviews: self-efficacy, career exploration, and prosocial motivation.

- **Self-efficacy:** Most students described confidence in their ability to accomplish goals and overcome challenges, including confidence related to science. Students and instructors connected these experiences to the program's hands-on, mastery-oriented activities, collaborative environment, and opportunities to develop and demonstrate skills.



Photo credit: Gary Comer Youth Center/GCYC

KEY TAKEAWAY:

Afterschool STEM programs may help youth from groups underrepresented in STEM connect an existing interest in STEM to a broader sense of purpose. Youth in Change Makers described program experiences that supported their confidence, exploration of STEM careers, and desire to use STEM to benefit others.

POPULATION:

The study included 13 youth ages 14–17 from public high schools in three northeastern U.S. cities. Nine were male, and four were female. Of the 12 youth who reported race/ethnicity, six identified as Latino/Hispanic and five identified as Black/African American or another Black identity; one identified as Asian American/Pacific Islander and Black/Caribbean. Ten of the 12 youth who reported parent education had parents whose highest education was a high school diploma or less, and nine of the 10 who reported school lunch eligibility qualified for free lunch. The study also included three Change Makers instructors who had worked with the program for 2.5 to 4.5 years.

- **Career exploration:** Students described becoming aware of a broader range of career possibilities and more willingness to explore different paths. Program activities encouraged them to consider how their interests and strengths could connect to different STEM careers, what education those careers required, and alternative options if their initial plans changed.
- **Prosocial motivation:** Students described wanting to use their skills to benefit society. Opportunities to mentor younger students gave them direct experience helping others, while exploring topics like hydroponics and food justice connected STEM learning to community issues.

The authors interpreted these themes as a possible pathway from an existing STEM “spark” toward a more developed sense of purpose.

CONCLUSIONS:

The authors argue that Change Makers’ combination of hands-on learning, reflection, career exploration, mentoring, and opportunities to address community issues helped youth ignite their “spark” for science and nurtured their sense of purpose. The authors suggest that these elements may be particularly valuable for youth from groups underrepresented in STEM. Connecting STEM to personally meaningful interests and prosocial goals may help youth envision STEM careers that align with their identities, values, and desire to contribute to their communities.

The authors note that the study provides exploratory, not causal, evidence. The sample was small, geographically limited, and predominantly male, and youth elected to participate in the program. In addition, the researchers analyzed only post-program interviews and did not use a comparison group, so they could not determine whether students’ self-efficacy, career exploration, or prosocial motivation resulted from program participation. The authors call for larger, more diverse, longitudinal, and experimental studies to test whether integrating STEM and purpose programming produces these outcomes and whether they contribute to long-term STEM persistence.

METHODS:

Through semi-structured, post-program interviews lasting 10–35 minutes, researchers asked 13 randomly selected youth in Change Makers about their values, strengths, goals, desired impact on others, STEM careers, and perspectives on science.

Researchers used a modified grounded theory approach, developing themes and relationships through an iterative analysis of the interviews informed by existing research on purpose and career development. They coded a subset of interviews in pairs, compared their interpretations, and developed a shared set of codes. They then coded the remaining interviews, repeatedly refining the codes and focusing on patterns related to purpose and students’ experiences in the program.

Based on findings from the student interviews, the researchers developed questions and interviewed three Change Makers instructors to fill gaps and identify additional themes. Researchers coded the instructor interviews and compared them with the student interviews before developing a final model of how students’ existing STEM interests and program experiences related to the three purpose-related themes identified in the study.



Photo credit: Boys & Girls Clubs of Western Pennsylvania

STUDY IMPLICATIONS

IMPLICATIONS FOR PRACTICE:

■ **Connect STEM Interests to Purpose**

Afterschool programs can help youth explore how their existing STEM interests connect to their strengths, values, career possibilities, and goals for contributing to society by integrating purpose-development activities with hands-on STEM learning.

■ **Give Youth Opportunities to Use STEM for Others**

Linking STEM learning to authentic community needs can motivate engagement and help youth see themselves as valuable contributors to society.

IMPLICATIONS FOR RESEARCH:

■ **Measure Change Over Time**

Post-program interviews can provide insight into youth perceptions, but they cannot establish that a program changed attitudes or behaviors. Future studies should collect and analyze data before and after participation and include comparison groups.

■ **Examine Who Chooses to Participate**

Research should distinguish between programs' ability to spark STEM interest and their ability to deepen or sustain existing interest. When measuring changes in STEM attitudes and behaviors, researchers should account for preexisting differences in the study participants.

IMPLICATIONS FOR POLICY:

■ **Support STEM Programs That Address Broader Youth Development**

Investments in afterschool STEM should fund opportunities that integrate content learning with career exploration, mentoring, and community engagement.

■ **Expand Access While Examining Who Is Reached**

Efforts to engage underrepresented groups in STEM should consider not only whether programs are accessible, but also what recruitment and supports may be needed to reach youth who are not already STEM-oriented.

ADDITIONAL ARTICLE OF INTEREST

Ai, S., & Eagan, M. K. Jr. (2026). From club to college: The impact of science clubs/groups on high school students' intentions to pursue a STEM major. *Research in Higher Education*, 67, 32.

<https://link.springer.com/article/10.1007/s11162-026-09892-8>

STUDY SUMMARY:

Drawing on national longitudinal data that followed students from grade 9 into college, researchers examined who was most likely to participate in science clubs during high school and whether science club participation was associated with students' intentions to pursue a STEM major after entering college. Researchers used 9th-grade data to account for pre-existing characteristics, including students' backgrounds, STEM career aspirations, math achievement, science interest, school experiences, and prior formal and informal STEM opportunities.

Students who later participated in science clubs differed from non-participants when they entered high school. They had higher math achievement and science interest and were more likely to enter high school with STEM career aspirations. After researchers accounted for these and other preexisting differences, science club participation remained associated with intending to pursue a STEM major during the first year of college. However, while girls were more likely than boys to participate in a STEM club, boy participants were more likely than girls to pursue a STEM major.

PROGRAM SPOTLIGHT

Dent Education

[Dent Education](#) is a Baltimore-based nonprofit that delivers paid "Earn-to-Learn" innovation programs for youth ages 14–24, blending career-connected learning with hands-on skill-building in areas like 3D printing, AI tools, product design, and design thinking. Participants earn industry-recognized credentials while working through structured, multi-week curricula guided by educators, entrepreneurs, and industry professionals—directly aligning with workforce goals like Maryland's push for more students to graduate with credentials or apprenticeships.

Beyond training, Dent Education functions as an intermediary between youth and the local innovation economy. It has built a network of community and industry partners who provide mentorship, real-world project input, and internship placements where youth apply their newly earned credentials in paid, employer-based settings. This "earn, then apply" model lets participants translate classroom-style innovation training directly into workplace experience, building both technical skills and professional/social capital. Dent Education facilitates various pathways into STEM, connecting career exploration, credentialing, and paid internship placement for underserved youth.



We hope you enjoyed exploring this issue! Additional similar publications are listed below. Until our next issue, you can also read more about research highlighting the updated evidence of afterschool STEM in our [research brief](#) as well as explore evaluation summaries of afterschool programs in the Afterschool Alliance's [Impacts Database](#). You can also follow us on [LinkedIn](#) to learn more and stay up to date on what we are working on.

You can register for our upcoming newsletters and receive a copy of any articles that are not open access by completing [this Google form](#).

ADDITIONAL PUBLICATIONS TO NOTE

Fletcher, T., Alharbi, A., Qasim, M., et al. (2025). Examining Black students' and mentors' experiences in a summer engineering experience for kids program. *Journal for STEM Education Research*, 1-25.

<https://link.springer.com/article/10.1007/s41979-024-00142-z>

Gossen, D. and Ivey, T. (2023). The impact of in-and out-of-school learning experiences in the development of students' STEM self-efficacies and career intentions. *Journal for STEM Education Research*, 6(1), 45-74.

<https://doi.org/10.1007/s41979-023-00090-0>

Price, C. A., Tai, R. H., & La Nguyen, C. (2025). A longitudinal study of a museum-based out-of-school time program's impact on STEM career pathways. *Journal of Applied Developmental Psychology*, 100, 101854.

<https://www.sciencedirect.com/science/article/pii/S0193397325001017>