Empowering Youth in STEM: Bridging STEM Programming Gaps in Southeastern Michigan

Girl Scouts of Southeastern Michigan December 2024 White Paper



Abstract

This paper explores the importance of Science, Technology, Engineering, and Mathematics (STEM) education in empowering youth, addressing disparities, and fostering economic growth in Southeastern Michigan. While there are many STEM programs available in the region, there are still challenges and opportunities for growth. Girls and women, students of color, and students from lower socioeconomic backgrounds are significantly underrepresented in STEM fields. Girl Scouts of Southeastern Michigan (GSSEM) seeks to identify STEM opportunities and to launch innovative solutions, including the **GSSEM Mobile STEAM Lab Powered by GM**. This initiative represents a commitment to breaking down barriers to access and inspiring the next generation of STEM leaders. GSSEM will continue to use strategic partnerships and community engagement to expand youth access to high-quality STEM experiences.

Introduction

As STEM fields rapidly expand, more skilled professionals are needed to fill these roles. STEM education not only prepares students to step into these careers, but also develops critical thinking, problem solving, and collaborative skills. Despite the importance of this education, K-12 students in underserved and rural communities still have limited access to STEM opportunities.

This paper looks at the state of STEM education in Southeastern Michigan, a region characterized by its diverse geographic and socioeconomic landscape. Using the Data Drive Detroit (D3), GSSEM, and General Motors (GM) 2023 "STEM Opportunity in Southeast Michigan" report, we identify critical gaps in STEM programming and propose actionable strategies to address them. One of the tools GSSEM will use is the Mobile Science Technology Engineering, Art, and Mathematics (STEAM) Lab, an innovative project designed to deliver hands-on, high-quality STEAM experiences directly to youth. GSSEM seeks to inspire the next generation of STEM leaders by prioritizing equity and innovation and bridging the opportunity gap.

STEM Education

The Importance of STEM Education

STEM education significantly benefits students beyond the specific STEM subject matter they are learning. Students explore problems, analyze data, and create solutions that help them in many other subjects and areas of life.¹ Research has found statistically significant differences in critical thinking assessment scores between students who participated in STEM programs and those who did not.² These critical thinking skills support students throughout their academic careers. In addition, hands-on STEM activities promote "creativity, cooperation, and students' using their prior knowledge."³ Creativity and engagement can increase students' enthusiasm for learning and continuing in STEM education.

Along with academic and personal gains, additional STEM programming and education are essential as the United States is currently facing a STEM labor shortage.⁴ The U.S. Bureau of Labor Statistics projects that STEM occupations will grow by 11% between 2021 and 2031, over two times faster than non-STEM careers (5%).⁵ Individuals who enter the STEM career field have a higher earning potential than their non-STEM counterparts. As of May 2021 the median annual wage for STEM careers was \$95,420 compared to \$40,120 for non-STEM careers.⁶ Together with the benefit of employment opportunities and earning potential, STEM careers empower individuals to get involved with solving society's most pressing challenges, from health to environmental stability.⁷

Challenges in STEM Education

Nationally, students in rural and underserved communities often lack access to these critical STEM programs, and specifically hands-on STEM education, due to limited resources, teacher shortages, and inadequate facilities.⁸ Moreover, there are still significant gender disparities in STEM. Girls and boys tend to participate similarly and perform equally well in science and math standardized testing in K-12 education⁹, but by the time they get to college, women are underrepresented in STEM majors. Women make up only 21% of engineering majors and 19% of computer science majors¹⁰, despite making up 58% of all students in higher education.¹¹ As of 2021 the National Science Foundation reported that only one-third of people employed in STEM fields were women.¹²



Data suggests that STEM activities, especially hands-on STEM activities, increase students' interest in science-related careers as early as second grade.¹³ This highlights the importance of STEM exposure for all youth, with a special focus on girls. Early hands-on STEM programming gives youth an opportunity to develop important skills while gaining a lifelong passion for STEM. It is essential that all youth have access to STEM programs regardless of gender, geographic location, and socioeconomic background. This exposure can lead to important academic and personal growth, increased financial and career opportunities, and involvement in future change-making.

The Current State of STEM Education

Since the COVID-19 pandemic shut down in early 2020, which caused most schools to turn to remote learning, there have been significant declines in science achievement. Early 2024 data showed some uneven recovery in this achievement for elementary and middle schoolers. Research shows that eighth graders are the group still struggling to recover to pre-COVID levels.¹⁴ Students entering eighth grade in 2023 missed valuable interactive learning experiences during the COVID shutdown, which occurred during their fourth and fifth grade years. Any hands-on STEM opportunities that would have occurred in these formative elementary years were moved to remote lessons. Interventions during their middle school education aimed to ameliorate this learning gap have not yet resulted in this cohort's full academic recovery. This trend underlines the importance of providing in-person learning experiences for youth in grades K-5.

STEM in Southeastern Michigan

Girl Scout programming has shown promise in promoting girl's interest in STEM as a field and a career. The Girl Scouts Research Institute (GSRI) has studied the benefits of STEM programming on girls in K-12th grades. One study found that exposure to at least one STEM activity led to higher levels of STEM interest, confidence, and an increased rating of the value of STEM to society at the end of the program year.¹⁵ In 2020 GSSEM began to examine how it could harness the successes of their existing STEM programming to benefit the larger Southeastern Michigan community, while continuing to focus on empowering girls to develop their passion and future in STEM fields.

The region that GSSEM serves is a unique mix of urban, suburban, and rural geographic areas. Because of the varied population, GSSEM recognized the importance of including state and local data to better understand the region's STEM programming needs. In September 2023 Data Driven Detroit (D3), in partnership with GSSEM and General Motors, published a report, "STEM Opportunity in Southeast Michigan."

D3 used national, state, and local data to create the STEM Opportunity report. It analyzed data from STEM-related standardized testing, Advanced Placement level (AP-level) STEM courses, and access to STEM classes taught by certified teachers. D3 used this data to create a "STEM Opportunity Index" ranging from 0 to 7 (the higher the value, the higher the quality).

Researchers determined geographic areas based on GSSEM's service area, which is broken into twelve "Communities." Of the twelve Communities examined, only three scored as already having a high STEM opportunity quality range (a score of 5-7). Less than 40.1% of students met or exceeded 5th Grade Science standards in six of the Communities studies. Based on this information, GSSEM started exploring opportunities to bolster STEM opportunities in these areas.

Recommendations

Southeastern Michigan currently has many STEM opportunities for youth.¹⁶ GSSEM often partners with local STEM organizations and companies to provide comprehensive and interactive STEM programming for Girl Scouts. The following recommendations build upon the research of how to promote STEM programming and opportunities, as well as the innovative practices that many of our partners have employed in making STEM more accessible in Southeastern Michigan.

Engage with Educators

Community organizations have a unique opportunity to partner with educators to provide STEM experiences. Engaging community resources is important to effective STEM education. Programs that involve community institutions, such as science museums and planetariums, help teachers connect classroom STEM topics to the real world.¹⁷ Community engagement is also linked to the growth of teacher leadership, something that benefits youth in the classroom.¹⁸ Encouraging educators to provide opportunities for STEM engagement can provide an opportunity to connect students with experts in different STEM fields, allowing them to interact with adults who are already employed in STEM fields.



Integrating Interdisciplinary Learning

As the education community looks for ways to improve STEM learning, educators are exploring creative ways to deliver the content. Recent research shows that art integration into lessons promoted development in engineering, literacy, numeracy and the arts.¹⁹ In addition, merging art with STEM encourages student engagement, creativity, innovation, and problem solving.²⁰ Furthermore, art in STEM has a positive effect on encouraging girls' interest in STEM.²¹ Including art in students' hands-on STEM learning can unlock important benefits and encourage students to pursue further STEM opportunities in the future.

Innovative Delivery Models

While GSSEM partners with educators, it's important to adjust programming to meet local needs and to invest in community partnerships.²² Through an extensive evaluation completed by GSSEM, we recognized that transportation and schedule flexibility were often a barrier to youth participation in extra-curricular programming in Southeastern Michigan.²³

Applying many of these recommendations is GSSEM's Mobile STEAM Lab. This mobile platform will feature workshops on robotics, app development, environmental science, and other STEM topics, directly reaching youth in their neighborhoods. By eliminating barriers like transportation, the Mobile STEAM Lab aims to create equitable access to high-quality STEM programming.

The Mobile Lab will arrive in early 2025, with a grade K-5 pilot program launching in Spring 2025. GSSEM has partnered with The Lab Drawer, an organization with experience developing and providing STEAM programming in metro-Detroit, to create evidence-based STEAM curriculum for these grade levels. The Mobile Lab will initially partner with schools in Southeastern Michigan with Mobile STEAM Lab facilitators running all programming and providing resources to participating classrooms.

Conclusion

Investing in STEM education supports economic and social prosperity in our region, addresses workforce disparities, and empowers young people to address complex global challenges. An interdisciplinary approach that includes art in STEM (STEAM) supports creativity, innovation, and problem-solving. This integration enhances engagement and accessibility for all youth, as well as encouraging girls to pursue opportunities in STEM.

GSSEM's Mobile STEAM Lab will offer high-quality, hands-on STEAM experiences tailored to the specific needs of Southeastern Michigan communities. By eliminating barriers such as transportation and resource limitations, the lab aims to provide all students in Southeastern Michigan with the opportunity to access STEAM programming. While the Mobile STEAM Lab will provide services to children regardless of gender, this initiative is an important step toward addressing gender disparities in STEM.

Through strategic collaborations with educators, local organizations, and community leaders, GSSEM aims to inspire a lifelong passion for STEAM and to support young people as they learn to lead in an increasingly complex world. By investing in inclusive, innovative STEAM education, we empower youth with the skills and confidence to make the world a better place.

⁵U.S. Chamber of Commerce. (2022).



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² Hacioglu & Gulhan. (2021).

³Waddell, Brooke, *Influence of STEM Lessons on Critical Thinking [Master's Thesis]*. (2019). University of Nebraska-Lincoln Student Research, and Creative Activity: Department of Teaching, Learning and Teacher Education. 103. https://digitalcommons.unl.edu/teachlearnstudent/103 ⁴United States Chamber of Commerce. (2022). *Addressing the STEM workforce shortage*. https://www.uschamberfoundation.org/education/ addressing-stem-workforce-shortage

⁶United States Department of Labor. (2024). *Employment Projections*. https://www.bls.gov/emp/tables/stem-employment.htm Retrieved December 2, 2024 from https://www.bls.gov/emp/tables/stem-employment.htm

⁷National Science Foundation. (2023). *Diversity and STEM: Women, Minorities, and Persons with Disabilities*. https://ncses.nsf.gov/pubs/ nsf23315/report/the-stem-workforce

⁸National Science Board. (2022). The U.S. must improve K-12 STEM education for all. https://www.nsf.gov/nsb/sei/one-pagers/K-12-

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⁹National Science Board, National Science Foundation. (2021). Elementary and Secondary STEM Education. *Science and Engineering Indicators* 2022. NSB-2021-1. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20211/

¹⁰ American Association of University Women. (2018). *The STEM Gap: Women and Girls in Science, Technology, Engineering, and Mathematics*. https://www.aauw.org/resources/research/the-stem-gap/

"National Center for Education Statistics. (2021). *Fast Facts: Enrollment*. https://nces.ed.gov/fastfacts/display.asp?id=98#:~:text=In%20fall%20 2021%2C%20female%20students,71%20million%20students%2C%20respectively)

¹² National Science Foundation. (2023).

¹³ Hacioglu & Gulhan. (2021).

¹⁴ Northwest Evaluation Association. (2024). COVID's impact on science achievement: Trends from 2019 through 2024. https://www.nwea.org/ uploads/Covids-impact-on-science-achievement-trends-from-2019-2024_NWEA_researchBrief.pdf

¹⁵ Girl Scouts Research Institute. (2012).

¹⁷ Kumar, D. D. & Moffitt, S. (2020). STEM teacher leadership development through community engagement. *Science Education and Civic Engagement*, 12(1), 5–11. https://files.eric.ed.gov/fulltext/EJ1388889.pdf

¹⁸ Kumar & Moffitt. (2020).

¹⁹ Dell'Erba, M. & Weyer, M. (2024). Key lessons from effective K-12 STEAM education organizations. *Education Commission of the States*. https://www.ecs.org/key-lessons-from-effective-k-12-steam-education-organizations/

²⁰ Ng, W., & Fergusson, J. (2020). Engaging high school girls in interdisciplinary STEAM. *Science Education International*, 31(3), 283–294. https://files.eric.ed.gov/fulltext/EJ1268318.pdf

²¹Ng & Ferguson, 2020

²² Nation, J. M., & Hansen, A. K. (2021). Perspectives on community STEM: Learning from partnerships between scientists, researchers, and youth. *Integrative and Comparative Biology*, 61(3), 1055–1065. https://doi.org/10.1093/icb/icab092

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