Courage Hope Care Institute
White Paper August 2024

The school year 2023-2024

I. Introduction

(1) Advancements and Obstacles in STEM Education

Over the past decades, there has been a substantial increase in the attention and resources allocated to STEM education nationwide. Numerous states have effectively implemented STEM-focused standards, curricula, and programs in K-12 schools. The enrollment of students pursuing STEM degrees in college has seen a promising upswing, indicating a positive trend. The expansion of public-private partnerships and STEM education initiatives has created more opportunities for students, painting a hopeful future for STEM education.

One example is District of Columbia, DC's commitment to prioritizing STEM education by implementing STEM learning standards and programs. The District has also witnessed the launch of several STEM-focused public charter schools in recent years. Efforts have been made to improve access to computer science and coding education in public schools. Partnerships with local universities, nonprofits, and businesses have broadened STEM learning opportunities for D.C. students.

Despite the progress, STEM education still grapples with challenges. Nationally, there are persistent achievement gaps in STEM subjects across different demographic groups. Many schools, particularly in underserved communities, lack sufficient STEM resources, curriculum, and qualified teachers. There is an urgent need to engage and retain underrepresented minorities and women in STEM fields.

Disparities in STEM education also persist in DC. There are achievement gaps in STEM subjects between students from diverse socioeconomic and racial/ethnic backgrounds. Many public schools, especially those in low-income neighborhoods, need help in providing comprehensive STEM programming. There is a crucial need to enhance access and opportunities for all D.C. students, particularly those from underrepresented groups, to participate in high-quality STEM education.

(2) Strategies to Address STEM Disparities

Several key strategies have been identified to help remedy the STEM education gaps at both the national level and in Washington, DC:

National Strategies to Address STEM Disparities:

- Improve access to and quality STEM education in K-12 schools, particularly in underserved communities.
- Enhance the representation of women, minorities, and other underrepresented groups in STEM fields through mentorship, role models, and targeted recruitment.
- Expand STEM learning opportunities beyond the traditional classroom setting, such as through afterschool and summer programs.
- Strengthen the pipeline of STEM educators by providing better training, support, and incentives.
- Increase funding and resources for STEM education programs, especially in high-need schools.
- Engage parents and communities to foster a culture that values STEM education.
- Gather and utilize data to identify gaps and monitor progress in addressing STEM participation and achievement disparities.

Strategies for DCPS to Address STEM Disparities:

- Implement high-quality, standards-aligned STEM curriculum and instruction across all D.C. Public Schools.
- Enhance access to advanced STEM coursework, particularly in underrepresented schools.
- Expand STEM-focused afterschool and summer programs by collaborating with local nonprofits and community organizations.
- Recruit, develop, and retain a diverse STEM teaching workforce through targeted recruitment, training, and support.
- Strengthen STEM-focused career exploration and work-based learning opportunities for D.C. Public School students.
- Enhance family and community engagement to raise awareness and interest in STEM.
- Use data to identify and tackle STEM achievement and participation gaps at the school and student levels.
- Secure additional funding and resources to support STEM education initiatives in high-need D.C. Public Schools.
- The key lies in implementing a multifaceted approach that addresses access, representation, instruction, and community engagement to bring systemic change and bridge persistent STEM gaps.

II. Courage Hope Care STEM Afterschool Program: We provide a value-added program, which is a crucial initiative in our efforts to bridge the STEM education gap in our community.

(1) Who we are

The organization aims to reduce STEAM gaps by increasing awareness of the importance of STEAM education and enhancing access to STEAM education for children in impoverished communities. Our goal is to make STEAM education accessible and to offer a demand-driven STEM afterschool program. During the school year 2023-2024,

- The organization has continued provided the community-based informal STEM afterschool program at the D.C. Public Library – Parkland-Turner, SE, in Ward 8, marking a significant milestone in our efforts to bridge the STEM gap. This successful initiative reassures us of the effectiveness of our programs and the potential for further success.
- It successfully provided the school-based STEM afterschool program at Turner DC public elementary school.
- It successfully provided a math intervention tutoring program at Malcolm X DC public elementary school. We provided one-on-one, in-depth math tutoring intervention programs.
- It also provided a field trip to the National Children's Museum, where children could experience STEM activities.

During the STEM Afterschool program at D.C. schools and D.C. public library, children learned all STEM subjects using virtual reality devices, STEM robotic kits, and hands-on activities and were exposed to digital and high-tech experiences. We provided **S**cience activities via Virtual Reality experiences using V.R. headsets; **T**echnology subject using R.C. robots, such as Sphero mini balls and apps; **E**ngineering, electronics, and coding principles using robotic kits, such as Lego robotic kits and building toys. For **M**ath, we provided hands-on activities, such as money games.

(2) How we offer the program

Science subject using Virtual Realty (V.R.) headsets and platforms.

We use virtual reality (V.R.) for science subject. V.R. can be a valuable tool for teaching and learning STEM subjects. By incorporating virtual reality into STEM education, we can create engaging, immersive learning experiences that help students better understand and apply scientific and mathematical concepts. This can lead to improved learning outcomes, increased student engagement, and a stronger foundation for future STEM-related studies and careers. Among STEM subjects, we use V.R. for Science subject and virtual field trips to places like museums, laboratories, or even outer space, expanding the range of experiences available to students. However, it's important to note that V.R. experience is limited to 10 minutes for an individual kid under supervision.

Technology subject using remote-controlled robot toys

We use remote-controlled robot toys, such as Sphero coding balls/apps and mini drones, for technology subjects. Among STEM subjects, we use remote-controlled robot toys for technology subject because remote-controlled robots utilize various technological components, such as microcontrollers, wireless communication, and programming. Interacting with and programming these robots can introduce children to technology and computer science fundamentals.

By interacting with these toys, children understand how technology works and how to control it. They also explore the relationship between cause and effect by experimenting with different control inputs and observing the robot's responses. Also, children gain exposure to basic coding and programming concepts, which can lay the foundation for further STEM learning.

Engineering, electronics, coding subjects using robotic kits and building STEM toys

We use robotic kits, such as Lego robotic kits, for engineering subjects for higher grades and building STEM toys for lower-grade kids. STEM robotic kits provide a hands-on, engaging, and educational experience that can help children develop a wide range of skills, from problem-solving and critical thinking to creativity and collaboration. Lego robotic kits primarily focus on STEM's engineering aspect. Other robotic kits also provide an understanding of engineering, mechanical, and electrical systems, as well as teamwork and collaboration. Building STEM Toys for K1-2 is used for lower-grade children because these activities align with STEM principles and skills: engineering and design, problem-solving, visualization, experimentation, and creativity

During our program, children learn design and construction as well as mechanical and electrical systems because Lego and other robotic kits often incorporate motors, gears, and other mechanical components that allow the robots to move and perform various actions. Children also understand programming and control as Lego robotic kits typically include programming interfaces that allow users to write code to control the behavior and movements of the robots. This iterative problem-solving approach is a fundamental engineering skill, as engineers usually need to identify and address issues through multiple iterations. As many robotic kits are designed for group projects, this fosters teamwork, communication, and collaboration skills. Robotic kits are often engaging and interactive, which can help maintain children's interest and enthusiasm for learning. This can lead to a more positive and rewarding educational experience.

Math using hands-on

We used fake money to teach mathematical concepts in a practical context. The money game is entertaining and compelling for developing essential financial skills for real-life situations. The game format generates interest and boosts participation, fostering a positive attitude toward learning using a hands-on experience such as handling real money.

During the program, we support kid’s better grasp mathematical concepts and improve problem-solving skills because activities require students to solve various math problems, enhancing their problem-solving abilities. Also, the activities reinforce mathematical concepts as students can practice calculations, budgeting, and transactions, applying theoretical knowledge to real-world situations. Children also built confidence in their mathematical abilities, motivating them to tackle more complex concepts.

(3) **What we have accomplished:**

- Increasing Community Awareness: The community learned the meaning and importance of STEM education. Parents who realized the importance of STEM education through our program started bringing their children to it.
- Establishing Demand-driven Program: Children want to participate in our program because we provide fun activities using hands-on materials.
- Filling the Gap in School STEM: We fill the gap in school STEM education by providing various STEM activities and supplies.

II. Expansion of STEM afterschool program:

Dr. Joo, Founder and C.E.O., envisions C.H.C. working to raise awareness about the importance of STEAM education and provide STEAM education opportunities for children in low-income communities. Building on the achievements of 2023-2024, in 2025, C.H.C. plans to further expand and strengthen its curriculum by expanding the program from STEM to STEAM by adding Arts subjects using AI-powered tools for K4-5. Furthermore, to respond to close the digital gaps, the organization will provide A.I. literacy learning using AI-powered tools for K4-5. By introducing A.I. literacy in the early grades, schools can help children develop a foundational understanding of this transformative technology, prepare them for the future, and cultivate the skills needed to navigate an increasingly AI-driven world.