

2022

## STEM for Success Inaugural Annual Report

James Lipuma

*New Jersey Institute of Technology*, lipuma@njit.edu

Bruce G. Bukiet

*New Jersey Institute of Technology*, bruce.g.bukiet@njit.edu

Cristo Leon

*New Jersey Institute of Technology*, leonc@njit.edu

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**2022**

**INAUGURAL  
ANNUAL  
REPORT**

**STEM for Success**



# LETTER FROM THE DIRECTOR



Welcome to the Inaugural Annual Report of STEM for Success at New Jersey Institute of Technology (NJIT). STEM for Success is a project of the Collaborative for Leadership, Education, and Assessment Research (CLEAR) a center housed in the College of Science & Liberal Arts (CSLA) Office of the Dean. I am pleased to provide this annual report of our activities and those of our collaborators and partners in our on-going work to promote success for all through STEM.

Our focus has been to develop and expand our efforts to broaden participation in STEM by building on our grants and previous projects in our region in order to reach a larger collection of stakeholders and increase our impact.

After the global pandemic, the road to normality has been long and the travel slow at times.

However, our persistent efforts and continued collaborative co-design work has allowed us to remain active and continue to support K-20 learners and those stakeholders that seek to make a positive impact through STEM.

This past year has been busy as we supported Hands-on STEM while creating an alliance of organizations to develop our shared vision and other components of a collaborative infrastructure. We were able to recruit partners as shown in this report but also reconnected with our previous collaborators and school districts. It is encouraging that our partner districts reported to us that they have continued their Hands-on STEM clubs during and beyond the pandemic. One of our teachers just shared that her weekly STEM Club created their own floats for a mini-Thanksgiving-day parade in their school. These floats were built on robots the girls designed and assembled themselves and drove through the hallways as a celebration. It was so successful that the other science teachers will be using it in their classrooms this coming year.

Our efforts continue as S4S works to grow our impact for STEM month in March 2023 and leverage the STEM efforts of our partners everywhere. Remember, STEM is in everything you do!



**JIM LIPUMA**  
Director, CLEAR

# WHAT IS STEM FOR SUCCESS?



STEM for Success (S4S) is an integrated program to broaden participation in STEM, especially for those in traditionally underrepresented groups. Our just cause is comprised of three initiatives: to foster collaborative community engagement, to provide STEM education resources, and to promote broadening participation in STEM enhanced with our digital commons footprint.

These free resources are available virtually and work to help everyone discover, engage, access, learn, and share, through showcases, student journals, and outreach activities and experiences.

The STEM for Success just cause is to empower children to have freedom and agency to follow their own path and solve the problems they will face as they pursue their own passions in life. We are looking for people to collaborate with us as we enact our vision.

## VISION:

**STEM for Success envisions a system to broaden the participation of children in STEM, especially among traditionally underrepresented groups.**

**MISSION: STEM for Success fosters collaborative change in STEM by engaging multiple stakeholders around STEM experiences.**

## GOALS

- Establish and grow our digital repository to collect, share and display STEM accomplishments of students as they develop skills to become productive members of the future workforce. In this way, we will achieve persistent participation.
- Better prepare the students in acquiring these sets of skills. We will help to foster a growth mindset, critical thinking, reflection, problem-solving, leadership, communication, collaboration, and other essential skills.
- Meet all children where they are to provide multiple sustained ongoing STEM experiences so that students will be able to pursue multiple paths to explore and follow their personal passions and have a successful life.

# OUR VALUES

## LEADERSHIP:

Leadership is taking responsibility for yourself and others to achieve goals.



## TEAMWORK:

Teamwork is individuals cooperating towards the successful attainment of a common goal, through a shared vision, distributed leadership, commitment, agency, and action.



## EDUCATION:

Education is a system of planned experiences and activities to facilitate learning and foster Science Technology Engineering and Math (STEM) literacy.



## INNOVATION:

Innovation is the inspiration, imagination, and integration of new ideas or new ways to apply an existing idea through research and development.



## PASSION:

Passion is investing your human capital to serve others to achieve a common purpose.



## AGENCY:

Agency is taking action to attain your goal and make positive change through self-efficacy and self-directed learning, leveraging partnerships and collective action.



# OUR PRINCIPLES

## SOCIAL RESPONSIBILITY:

Individuals and organizations have an ongoing and committed ethical obligation to act to benefit society.

## COLLABORATION:

Effective individuals work with others in teams with a shared vision to attain a common goal together (Peer engagement).

## COLLECTIVE IMPACT:

Leadership and organizational support through a strong backbone is essential for programs to harness individual inputs to reach scale and be successful (Organization engagement).

## COLLABROTIVE CHANGE:

To truly create large-scale sustainable change, individuals and organizations must come together mindfully to change the situation and the system (System engagement).

# DIVERSITY, EQUITY, AND INCLUSION STATEMENT

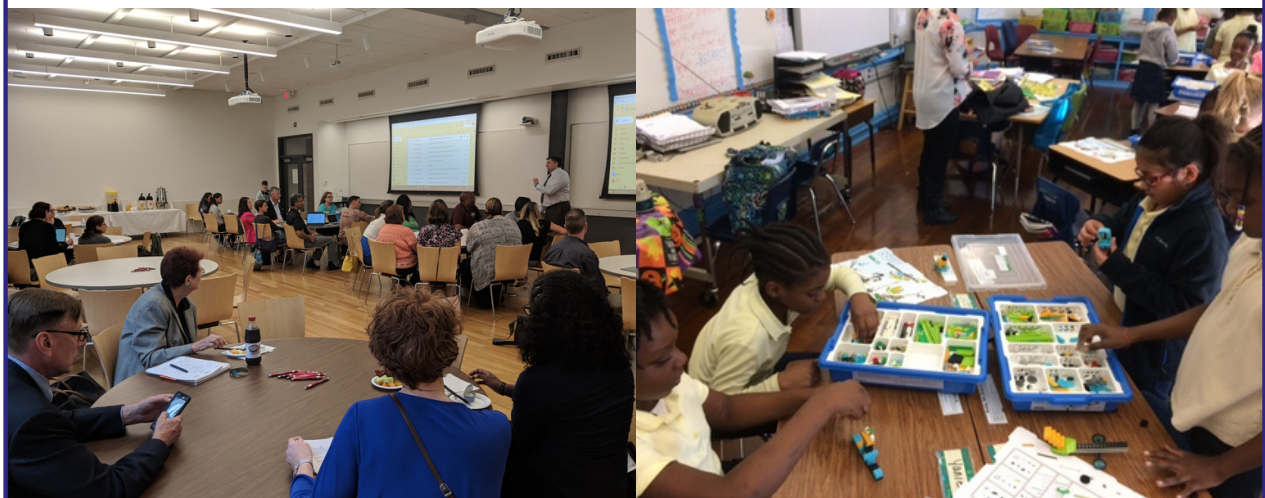
STEM for Success recognizes that each individual has a unique persona, background, culture, community, set of interests, and desires. S4S strives to provide STEM experiences for all as a means of promoting success through STEM. We embrace the principles of Universal Design (UD).

According to the Center for Universal Design, UD is “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.” For our STEM experiences, we strive to make each accessible, flexible, and appropriate to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design beyond that which customizes it for the specific scenario in which it is used and purpose for which it is best suited.

In this way, we hope everyone can find a way that our STEM experiences intersect with each person’s unique characteristics, allowing each individual to discover, engage with, access, learn and share, and thus pursue their own passions in life.

**PHILOSOPHY:** How we collaborate: Co-Design with Community  
STEM for Success fosters collaborative change in STEM by engaging multiple stakeholders around STEM experiences.

## Brand Mantra: Promoting Success through STEM



# S4S ALLIANCE IN 2022

A major initiative this past year relates to the submission of an alliance proposal to the NSF INCLUDES project. The S4S Alliance seeks to increase participation in STEM experiences by females in K-12 to increase the numbers of females participating and persisting in STEM pathways for college and career. S4S uses a collaborative convergence research approach with collective impact and co-design to achieve social innovation at national scale. Without participant data on STEM experiences, pathways, and supports needed for success, isolated efforts serve as disjoint treatments and activities that might produce pockets of excellence, rather than a means of leading collaborative systemic change. S4S will establish shared data gathering to determine the factors and influencers affecting female participation and persistence in STEM experiences, and implement the needed mechanisms to increase persistence. Partners representing multiple organizations and stakeholders will collaborate at all levels to attain these goals. They include: International STEM League, Ten80 Education, US Army STEAM Tank, Northern New Jersey Junior Science and Humanities Symposium, Research and Development Council of NJ-NJ STEM Pathways Network STEM Ecosystems, Red de Investigadores de Jugo's de Roll (English: Role Play Researchers Network) as well as several school districts like Morris Plains School District. These groups have wide reach but lack connections to bridge silos to foster true collaboration and synergy. S4S will bring them together with the shared vision of increasing female participation in STEM by better understanding current participation, best practices, and means of implementing strategies to increase awareness, access, and persistence in STEM experiences for all.

When the collaborative convergence research approach is applied to highly complex social issues, the resulting knowledge, language of discourse, and engagement are more resilient. The new domains created provide new norms of typical interactions that foster a community to explore and expand the new space while adding new partners. S4S uses this approach to develop the needed new space for collaboration and innovative methods of knowledge creation around STEM participation (especially for females and other traditionally underrepresented groups) as a foundation to broaden participation and enhance all pathways toward STEM careers and a STEM literate society. S4S works to develop data instruments, dashboards, and digital repositories to promote broader participation and positively affect STEM research and education. The S4S community of practice will provide equitable access to digital resources and a communication playbook of common tools and best practices for the public

S4S has brought together a range of partners to meet the needs of convergence research and collaborative change at a national scale. The key to this alliance is the co-design approach in which partners offer value to one another as they simultaneously learn from the efforts of the other partners. NJIT as the backbone serves to facilitate this interaction and new space centered on the desire of all to promote female participation in STEM experiences. Below is a description of the partners and their core activities undertaken.

## International STEM League (INSL)



The International STEM League (INSL) is a 501C-3 nonprofit charitable organization in operation for more than two decades with the purpose of increasing STEM equity and engagement. INSL has identified three areas of focus, including exemplary curriculum, trained mentors and sustainable programs as its core approach to making a significant and positive increase in the number of traditionally underrepresented students that are encouraged to pursue problem solving through STEM fields.

INSL was recognized for developing award-winning "scalable and exemplary" programs by Change the Equation & the STEM works Database. The STEM for Success platform will further the International STEM League mission in significant ways: co-development of meaningful programs; shared resources; the opportunity to interact with equally invested organizations; ability to update research on the efficacy of programs, and access to additional funding to expand outreach to females in identified regions.

Success in mathematics, data collection, analysis and measurement build toward confidence in problem solving. INSL works with educators, students and mentors across the USA and China to build data driven decision-makers from pre-kindergarten through early college. INSL educators and STEM professionals come from backgrounds in enterprise, education, industry, STEM fields and nonprofit management. Programs engage students in STEM, while developing critical life skills and preparing students to become problem solvers in the 21st Century.

INSL understands the level of commitment needed to develop and foster student participation in long-term projects and skills-reinforcing activities. The original INSL engineer-educator team featured Carnegie Mellon's Jeffrey Thompson and award-winning teacher, Beverly Simmons. The two collaborated in Beverly's classroom as early as 1996 to enhance math and science lessons with "hands-on" activities, inquiry-based programs and project-based learning. Those original educational pilots grew in scope with input from expert curriculum developers and researchers to become the INSL Perks to Pro Pathway currently engaging students around the world. Our collaborations will enhance INSL's outreach and mentoring as learning communities navigate the virtual focus that has become so important in the current educational climate.

Our alliance collaboration will help the International STEM League meet its mission to "launch a generation of avid global problem solvers" with PreK to Pro Pathways in STEM for young women.



## New Jersey Northern Junior Science and Humanities Symposium



The New Jersey Northern Junior Science & Humanities Symposium (NJNJSHS) at Rutgers University is an annual research showcase that serves as a regional competition of the Junior Science and Humanities Symposia (JSHS).

The JSHS Program is a tri-service – U.S. Army, Navy, and Air Force – sponsored STEM competition that promotes original research and experimentation in the sciences, technology, engineering, and mathematics (STEM) at the high school level and publicly recognizes students for outstanding achievement. By connecting talented students, their teachers, and research professionals at affiliated symposia and by rewarding research excellence, JSHS aims to widen the pool of trained talent prepared to conduct research and development vital to our nation.

This year, the symposium was virtual. The regional symposium will celebrate a group of top oral and poster presenters for their admittance into the National Junior Science & Humanities Symposium.

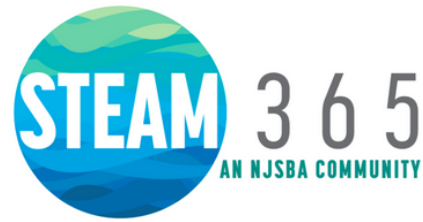
The symposium will also recognize the top three researchers in each of the eight poster research categories. High school students research and present novel investigations in STEM. Each student presents academic research to a panel of judges and an audience of their peers.

Endorsed by the National Association of Secondary School Principals (NASSP), JSHS regional and national symposium are held during the academic year and reach more than 8,000 high school students and teachers throughout the United States, Puerto Rico, and the Department of Defense Schools of Europe and the Pacific Rim. Students must first participate in their regional symposia where they compete for selection to present at the national symposium each year.

There were over 165 unique student research projects being judged and paired with mentors to foster effective STEM research practices. A new early high school research pitch was rolled out this year for 9th and 10th graders to solicit feedback and possible research mentors.

This project was developed in conjunction with NJIT's CLEAR and serves as a launching point for the expansion of smaller sub-regional events and more student recruitment activities aligned with the mission of JSHS.

## NJ School Boards Association-US Army STEAM Tank 365



The New Jersey School Boards Association (NJSBA), a federation of boards of education, provides training, advocacy and support to advance public education and promote the achievement of all students through effective governance. This includes STEM and STEAM education to board members and their staff.

The more informed board members are in the areas of STEM education the better they are at developing policy, making decisions about the programs, teaching, and learning best practices that will be introduced within their school district. NJSBA serves 580 local boards of education and 84 of the 89 charter schools in the state. This represents more than 6000 board members and 1.4 million students. NJSBA has a vast network of connections within schools and NJSBA provides several publications that provide up to date information for not only board members but also the leadership of all the schools in NJ.

NJSBA also works closely with the other education organizations in the state of NJ including the Department of Education, the Education Association, Principal, and supervisors Association, Parent-Teacher Association, School Business Administrators association, and the Association of School Administrators.

NJSBA's STEM education initiative is the STEAM Tank Challenge, a statewide design challenge where students apply as teams to invent something new, modify an existing product, or identify a situation or real-world problem that needs attention. Teams are provided minimal criteria, and a panel of experts judge their designs and/or solutions. STEAM Tank is also a community of learners and is designed with multiple learning opportunities for teachers, parents and board members to increase their knowledge and learn how to shift their thinking away from the traditional silo and compartmentalized educational model to an integrative, collaborative and connected learning approach. Created seven years ago through a one of a kind collaboration between the U.S Army and NJSBA and the STEAM Tank Challenge has engaged thousands of students and many districts in NJ. The arts in STEAM in this challenge is to bring attention to design thinking and creativity. The challenge is open to all K-12 public school students in New Jersey. During the 2020 and 2021 seasons, 350 teams applied to participate. The 2022 season had over 450 teams and was virtual. STEAM Tank regional design challenges have taken place on the NJIT campus and NJIT staff and graduate students provided judging support as well as mentoring for K-12 students.

## Red de Investigadores de Juego de Rol (RIJR) (Role-Play Researchers Network)



STEM and Role-Play Games are closely tied at young ages and throughout the academy. Currently, the RIJR has an international reach and appeals to citizens from all around the world. The RIJR gathers researchers interested in a wide range of topics. In particular, the Women in Role Playing and STEM research group's special interests are closely aligned with the work of the alliance. RIJR and STEM for Success have worked together to produce two proceedings of the Role-Playing Studies Colloquium, as well as the International Journal of Role Playing Studies and STEAM (JRPSSTEAM), and host an international roundtable conference at NJIT:

- [Memorias del 3er. coloquio de estudios sobre juegos de rol](#)
- [Memorias del 4o. coloquio de estudios sobre juegos de rol](#)
- [Journal of Roleplaying Studies and STEAM](#)
- [STEM Month 2022](#)

## Research and Development Council of NJ-NJ STEM Pathways Network (NJSPN)



The mission of the R&D Council is to foster collaboration among leaders in industry, academia, and government to drive New Jersey's innovation economy. The council work supports STEM education to fuel New Jersey's innovation economy, advocates for New Jersey's research-driven companies and universities, and fosters collaboration among leaders in the industry, academia, and government. In 2014, NJSPN was formed as a statewide convener of STEM leaders and now works with over 500 public and private entities throughout New Jersey. The state convener manages six STEM learning ecosystems, in addition to working in four key priority areas: teacher recruitment & preparation, workforce development, computer science and early learning. The worldwide STEM Learning Ecosystems contribute to the larger STEM education and learning landscape. Each of the 94 worldwide ecosystems participates in a Community of Practice, or a national and regional peer-to-peer professional learning network for communities to share information and expertise. In conjunction with S4S, NJSPN hosts STEM Month, which promotes and celebrates STEM engagement by students and community stakeholders.

## Ten80 Education



The initial connection between Ten80 and NJIT was established in 2017, through one-day STEM events in New York City and Philadelphia that revealed an aligned mission to reach underrepresented groups.

Built on 15+ years of effective STEM programming, Ten80 is a national educational resource for curriculum, competitions, and events that serve schools, community-based organizations, and industry partners.

With vehicle technology and all the derivative topics at its core, Ten80 is uniquely experienced in producing a broad range of one-day STEM “micro-challenges” that introduce skills, opportunities, and career pathways to middle and high school students.

For example, Ten80 produced an Innovators-in-Training tour sponsored by the U.S. Army beginning in 2012, reaching 500+ students per event in up to 12 cities annually. Surveys revealed that approximately 42% of participants in the one-day STEM Challenges identified as female.

Ten80 engaged more than 7,000 students in 24 one-day STEM Challenges, with an estimated 50% female audience.

In addition to producing popular 1-day STEM events, Ten80 provides curriculum and competitions that have students competing in the Ten80 STEM Challenges and National STEM League Finals, Deepening the understanding of these programs will keep Ten80 true to its data-driven iterative design principles.

Our activities required strategic alliances with partners committed to broadening participation in STEM, especially in early grades. The point of contact between the learner and facilitator is the essential connection for all our activities.



In light of that, we work with strategic partners that provide access to these stakeholders and provide us other needed expertise and support to better serve the population. During the pandemic, many schools limited all access to outside organizations and only now are we beginning to rekindle our connection with these vital partners. At the same time, we must continue to work with consultants and for-profit groups that are essential for attaining our goals and fulfilling our missions.

Partnerships in Education and Resilience (PEAR) aids S4S and its partners to understand and best utilize evaluation tools like those in the Common Instrument Suite. Several partners contract with PEAR for evaluation services and support.

Our most vital partners are the school districts we engage with directly and through our partnerships. This past year we connected with a range of districts across New Jersey including Morris Plains, Newark, Princeton, Manalapan, West Orange, Rockaway, and others. An example of one school we work closely with is the Morris Plains Schools.

This is a comprehensive public school district that educates students from Pre-K through eighth grade from Morris Plains, in Morris County, New Jersey. Graduating eighth graders attend Morristown High School for grades nine through twelve, as part of a sending/receiving relationship with the Morris School District, which also serves the communities of Morristown and Morris Township.

Morris Plains School District's minority enrollment is 30%. In addition, 10% of students are economically disadvantaged. There are four schools in the district with one pre-school, two elementary schools and one middle school with over 600 students in attendance.

# ACTIVITIES

This past year S4S has engaged in a variety of activities aimed at promoting Hands-on STEM and broader participation. We have tested several new activity plans with classes related to Tie Dye and Slime-making for K-8 students, and educators. In conjunction with our school district partners, our projects had 350 K-8 students work with Hands-on STEM to learn about chemistry, brain activity with your senses, color-science, and light, fluorescence, luminescence and bioluminescence.



Beyond these one-time activities, S4S supports a program for 36 middle school girls to come to NJIT's campus after school twice a week and every Saturday to learn about STEM and participate in the First-Tech Challenge. 150 students came for a related summer program in 2022. A larger set of initiatives were tied to Women's History Month and STEM Month 2022, both coinciding in March. S4S sponsored several workshops and virtual conferences this past year leading to the STEM Interest Sweepstakes that asks for educators and parents to assist their K-12 students to 'show what they know and share why they care'. The sweepstakes impacted 1550 students last year. It will be repeated in 2023 for STEM Month at which time the entries will be tweeted out and showcased at the STEM Month kick-off party on March 1, 2023.

STEM for Success has created a digital student journal entitled [STEM Month](#) along with other digital repositories and showcases. We work with our alliance partners and educational stakeholders to provide access for students to showcase their work, share ideas, and be recognized for the STEM activities happening all the time but which are not visible to others outside their schools. Currently, this collection of digital assets have reached across the USA and to nearly 70 countries through views and downloads of materials.

As part of the journal, S4S has two high school interns working as editors and content creators. Their work is paving the pathway for other students in high school to become involved in S4S, engage with problems in their own community, and provide Hands-on-STEM activities for younger students in their own school districts. At the same time, these high school ambassadors complete virtual courseware on workforce readiness and 21st century skills as part of their intern experience. This preparation is meant to engage them and provide them with workplace professionalism experience.

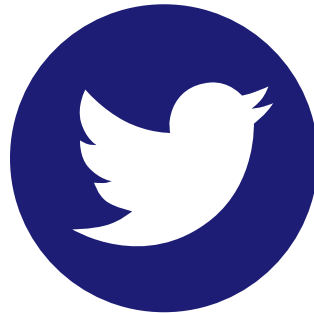
In conjunction with NJN-JSHS, S4S and its interns created a means for high school students to have an easy and FREE digital publishing opportunity, so their abstracts and videos can be showcased and shared. This provides the students with experience in submitting to a journal and the editorial review process. Moreover, a special issue of the journal will be created for NJN-JSHS to document the great work of participants with searchable and linkable evidence of their hard work. This will benefit the student by adding a globally searchable, vetted item that can be linked in resumes and LinkedIn etc. as well shared via social media. Additionally, for younger students it can serve as a means of gathering, mentoring or other supports from a broader community of interested stakeholders. For the larger community, it can help recruit and prepare future applicants as well as inform parents, educators and others in the public of the tremendous efforts and accomplishments of these JSHS students. Since the platform is contracted by the NJIT library with Bepress Digital Commons, it is freely available to anyone in the world.



STEM for Success collaborated with New Jersey Gear-Up / College-Bound, a program in the Center for Pre-College Programs at NJIT to provide a Saturday STEM program for 6th – 12th grade students that included First-Tech Challenge robotics for girls and intensive mathematics tutoring using the Edmentum Exact Path platform. Students met in a club space provided by STEM for Success to build and program robots, take diagnostic assessments in mathematics, and work on individualized mathematics tutorials with a graduate of NJIT’s chemical engineering program, and a graduate with a B.S. in mathematics who is currently enrolled in NJIT’S M.S. in Business program. STEM for Success provided a meeting space, supplies, t-shirts, bags, access to computers, and an iPad for student projects. Student projects included Tetrix Prizm robotics, New Path Learning online mathematics board games, Scottie Go! Coding board games and light and optics flip charts and teaching videos. Students met to participate in these activities on Saturdays from September 2021 until May 2022. Students also met Mondays – Thursdays during the summer from July 2022 – August 2022.

# REACH AND IMPACT

Our reach and impact are through the services we provide to support Hands-on STEM as well as through our social media outreach and the work of our partners. We have utilized our webpage and the NJIT digital Commons STEM for Success collection of digital tools and repositories to make our content available and engage with our stakeholders.



Our webpage contacts now number nearly 1200 participants. The twitter account has grown from just over 400 followers to over 1500 followers this past year with many likes and retweets. Our collection of STEM for Success repositories is managed by members of CLEAR, it includes:

- STEM for Success educational resources and support repository
- Showcase of work
- STEM Month Journal Collection
- Digital conference tools

A total of 46 works were posted during the period of 04/16/2018 to 11/28/2022. Through this footprint, we have reached 105 institutions, 69 countries, and 92 referrers with over 1000 downloads, which can be viewed by clicking the button below:

[\*\*DASHBOARD REPORT\*\*](#)



In conjunction with our partners, we have impacted a large number of students, educators, parents, and other stakeholders. Together, S4S and its partners have worked to utilize the NSF INCLUDES shared metrics to align our goals and communication about whom we serve and how well the programs are working to broaden participation.

**Our partners and S4S directly have affected a total of 68,872 individual students and had an overall impact of 167,630 stakeholders.**

We have provided a summary table from our partners in the tables below. Not every partner tracked all types of data so this report is aggregated to provide a rough number of participants in the shared metric categories provided by the National Science Foundation INCLUDES project.

<b>PARTNER</b>	<b>NON-DUPLICATE STUDENTS</b>	<b>DUPLICATE STUDENTS</b>	<b>TOTAL STUDENTS</b>
<b>S4S/CLEAR</b>	<b>1,991</b>	<b>8,280</b>	<b>9,106</b>
<b>INSL</b>	<b>10,599</b>	<b>–</b>	<b>67,752</b>
<b>NJSPN</b>	<b>42,000</b>	<b>–</b>	<b>70,000</b>
<b>NJN-JSHS</b>	<b>273</b>	<b>700</b>	<b>1,272</b>
<b>RIJR</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>STEAM Tank</b>	<b>1,800</b>	<b>6,000</b>	<b>12,500</b>
<b>Ten80</b>	<b>–</b>	<b>–</b>	<b>7,000</b>
<b>TOTAL</b>	<b>68,872</b>	<b>82,722</b>	<b>167,630</b>

## FUTURE WORK

We look forward to 2023 as we continue our co-design work around Hands-on STEM experiences. We will once again host the STEM Interest Sweepstakes as well as initiating our High School STEM Ambassadors program to promote community involvement and broader participation in STEM.

We will continue to support the work of our partners by holding several conferences, publishing more issues of our digital journals and adding resources to all the digital channels explained earlier. We look forward to growing the number of school district partners as we expand our network and strive to enhance our alliance connections in our collaborative infrastructure allowing us to sustain this work.

## ACKNOWLEDGEMENTS

We acknowledge support for Leadership and iSTEAM for Females in Elementary School (LiFE) and STEM for Success from the National Science Foundation under award number #1744490 and from Howmet Aerospace Foundation.

We also thank our partners and collaborators for their invaluable engagement with our shared vision and mission.

