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BOARD # 363: Effective Strategies to Support Student Success in an NSF S-STEM Program

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Diana Samaroo is a Professor in the Chemistry Department at New York City College of Technology of the City University of New York (CUNY). She received her bachelor's degree from Hunter College, and doctorate from CUNY Graduate Center. She has a broad range of experience in curricular and program development and project administration. Dr. Samaroo was the Chairperson of the Chemistry Department from 2015–2021. She is a CUNY Faculty Leadership Fellow. She served as co-PI on several grants, which include NSF S-STEM, IUSE, RCN-UBE, and NEH grants. Her current projects focus on academic success, integrating undergraduate research into the curriculum, improving student retention/graduation, and first-year experience. She has organized several conferences and faculty professional development workshops.

Dr. Urmi Duttagupta, New York City College of Technology, City University of New York

Urmi Duttagupta is the Coordinator of the Computer Science Program and a Professor of the Mathematics Department at New York City College of Technology, City University of New York. She received a Ph.D. in Applied Mathematics jointly from the New Jersey Institute of Technology and Rutgers University and a B.S. in Applied Mathematics from The Ohio State University. Her current research interests include parameter estimation via optimization, infectious disease modeling, applications of graph theory in criminal network analysis and developing and applying bio-math related undergraduate modules in various SENCER related projects. She has several publications in peer-reviewed journals and is the recipient of several MAA NREUP grants, a SENCER leadership fellowship, Department of Homeland Security grants, and several NSF S-STEM and PSC-CUNY grants/awards. She also has an extensive experience of mentoring undergraduate students in various research projects. She has mentored more than 45 students in various research projects through Emerging Scholars program, Honors Scholars program, NYC LSAMP grant, CURM mini-grant, MAA NREUP grant, and DHS grant for undergraduate research. She is originally from Kolkata (Calcutta), a cosmopolitan city located in Eastern part of India. As an Asian American, she embraces multiculturalism and diversity. She considers herself a lifelong learner and is always eager to learn from her students about their cultures and traditions. Besides solving math problems, she enjoys reading, painting, writing, singing, whimsical dancing, and enjoys cooking spicy Indian food.

Nadia S Kennedy, New York City College of Technology

Nadia Stoyanova Kennedy is an Associate Professor in Mathematics Education in the Department of Mathematics and Program Director of Mathematics Education. She received bachelor's and master's degrees in Mathematics from Sofia State University, Bulgaria. Between completing her master's and doctoral degree, she was a full-time high school mathematics teacher for 15 years, a curriculum developer and a student teacher mentor. Before joining City Tech, she held a faculty position at the Department of Mathematics at Stony Brook University. She was the founding director of the New York City Men Teach Program@Citytech (NYCMT) and directed the program from 2016 to 2019.

She has published 3 textbooks, one book, edited a special journal issue, and published over 45 refereed articles and chapters in numerous mathematics education journals, anthologies and conference proceedings. She has presented at more than 66 national and international conferences. She has acted as a consultant for the International Baccalaureate Organization (IB) on curriculum, assessment, and examiner training since 2007.

Dr. Armando Dominguez Solis, New York City College of Technology, The City University of New York

Dr. Armando D. Solis is the BS Biomedical Informatics Director at City Tech and an Associate Professor, has extensive experience in supporting student success through research and advisement, with critical roles in institutional grants from the NIH (Bridges to the Baccalaureate with Brooklyn College; Big Data

Training Program with Cornell Weill) and the NSF (multiple S-STEM grants; ExLENT with Schrödinger and LaGuardia Community College). He created the BS Biomedical Informatics program in 2013 and has served as Director for majority of the years of its 10+ years of existence, a successful program that has graduated hundreds of students who have gone on to graduate and professional schools and various biotech firms across the country. He has held administrative roles such as Department Chair of Biological Sciences Department and course directors for upper-level Biomedical Informatics courses and Biochemistry. His research interests concern protein folding, and has published single-author papers about various computational investigations on protein structure. Most recently, he is pursuing questions about prebiotic evolution, and tackling issues related to the early evolution of functional proteins prior to the emergence of the first life.

Dr. Viviana Acquaviva, New York City College of Technology

Dr. Acquaviva is a machine learning expert working at the intersection of climate science and data science. She has received many research grants and has mentored over twenty-five graduate and undergraduate students. She has ˜ 60 published papers in peer-reviewed journals or peer-reviewed conference proceedings, with ˜ 10,750 citations and an h-index of 35, and has given more than 70 invited seminars and lectures and ˜60 contributed talks/posters in conferences and workshops. Her textbook "Machine Learning for Physics and Astronomy", published in 2023 by Princeton University Press, won the 2024 Chambliss Astronomical Writing award from the American Astronomical Society.

Effective Strategies to Support Student Success in an NSF S-STEM Program

Introduction

Our current NSF S-STEM grant project (#1930437) builds upon two successful S-STEM grant programs (#0849881 and #1458714) previously awarded to the School of Arts and Sciences at New York City College of Technology, CUNY, which is the designated college of technology within our university system. According to the demographic data from 2024-2025, the student body is comprised of 26% Black (non-Hispanic), 35% Hispanic, 22 % Asian, 11% White (non-Hispanic), 4% Nonresident, and 2% Other (City Tech, 2025). Improving retention and graduation rates to increase the participation of students in STEM undergraduate and graduate programs, as well as in the New York City workforce, are essential and interlinked programmatic goals. This initiative seeks to provide life-transforming educational and training opportunities for students, thereby helping to reduce socio-economic disparities within the broader community.

From Spring 2020 to Spring 2024, the project provided students with financial and multi-tiered academic support. On average, 40 scholarships were awarded each year to academically meritorious and financially disadvantaged students from programs such as Applied Mathematics, Applied Chemistry, Applied Computational Physics, Biomedical Informatics, Chemical Technology, and Computer Science, as outlined in the grant proposal. Altogether, 93 unique students benefited from these scholarships during the four-year period.

The initiative also significantly increased students' exposure to early research experiences and internships, offering valuable hands-on learning opportunities. To ensure academic success, the program provided robust one-on-one academic advisement and mentoring by team leaders, offering personalized support to students throughout their studies.

In addition to academic guidance, the project organized seminars and informal meetings with STEM researchers and professionals. These events helped expand students' professional networks and perspectives. Finally, the creation of a dedicated website not only showcased the project's work but also served as a platform for recruiting new scholars, further extending the program's reach and impact.

During one-on-one interviews, mentoring sessions, and conference visits, scholars expressed the need for more research experience, real-life programming experience, training for enhanced presentation skills, and informal/social meetings with cohorts and the leadership team. A significant number of students reported, both through surveys and verbally, the importance of inviting alumni speakers. In one-on-one meetings with mentors and group interviews, scholars emphasized the value of academic advisement, mentorship, and role models. This paper summarizes, utilizing quantitative and qualitative data, various aspects of the program and key findings of the project that have proven effective for student retention and academic success.

A qualitative study conducted through semi-structured interviews and focus groups with scholars revealed the program's multidimensional support. Scholars appreciated the financial assistance, academic guidance, and supportive STEM community. The program gave scholars opportunities

to apprentice for future STEM careers, introduced them to the research community, and helped them visualize a path toward a STEM profession. Financial support, particularly scholarships, allowed students to focus on their studies without the stress of financial instability, while reduced work hours gave them more time with family and alleviated psychological stress.

Academic support, especially through one-on-one advisement with faculty, was another key factor in the scholars' success. Personalized sessions helped students navigate course selection, explore internship opportunities, and build the confidence to seek help when needed. For many students, particularly those new to the educational system, this guidance was crucial. Faculty mentorship also played a central role in both academic and personal growth. Many students reported that faculty encouragement not only boosted their confidence but also motivated them to pursue opportunities such as applying for scholarships and engaging in research or public speaking. This mentorship fostered a supportive environment that enhanced students' sense of belonging and motivation.

Key Findings

Our grant-sponsored initiative has yielded noteworthy outcomes, reflecting the program's success in fostering academic achievement. A key accomplishment has been the vigorous recruitment of female scholars, with their representation ranging from 46% to 68% of the scholarship cohort over the grant period (Han et al, 2023).

Another achievement is the academic excellence demonstrated by our participants. Approximately 71% (seven) of the undergraduate program graduates between Fall 2023 and Spring 2024 earned either summa cum laude or magna cum laude honors—an impressive result that underscores the program's ability to support students throughout their academic journeys.

The initiative has also made significant strides in fostering research and practical experience. About 70% of the scholars surveyed reported involvement in research and/or internship activities, essential for academic growth and professional development. These experiences not only enhanced their education but also prepared them for success in their future careers within STEM.

The supported scholars' overall graduation rate and academic performance further demonstrate the program's impact. Of the 93 scholars supported, an outstanding 89 (roughly 96%) graduated with at least a 3.0 GPA, with a mean GPA of 3.596 (median 3.604, $\sigma = 0.255$, N = 56) and mean "earned credits" at college of 99.232 (median 102, $\sigma = 30.419$) for baccalaureate students and with a mean GPA of 3.596 (median 3.586, $\sigma = 0.246$, N = 33) and mean "earned credits" at college of 84.33 (median 76, $\sigma = 28.194$) for students receiving associated degree. In comparison, the students who were not supported by the program but graduated with 3.0 GPA have an average GPA of 3.372 (median 3.317, $\sigma = 0.266$, N = 147) and average "earned credits" at college of 101.578 (median 111, $\sigma = 30.838$) for baccalaureate students and mean GPA of 3.426 (median = 3.412, $\sigma = 0.292$, N = 118) and average credits earned at the college is 71.445 (median = 64.5, $\sigma = 20.243$). Slightly higher "earned credits" for scholars of associate degree programs could be due to the transfer from other degree programs for the scholarships. Eighteen Scholars (~ 20%) transferred from an associate degree to the supported baccalaureate programs.

Note that while most of our students are supported for several semesters, and we maintained steady cohorts until the scholars graduated, we report here the overall statistics of all scholars supported for at least one semester by this grant. Together, these outcomes highlight the program's success in fostering academic excellence and supporting the development of a talented pool of scholars.

In essence, this program significantly contributed to developing STEM identities. The leadership faculty role models offered guidance and encouragement, empowering students to overcome obstacles such as boosting their confidence in STEM. The peer community played a crucial role in the scholars' success. Collaborative experiences, such as study groups and STEM-related events, improved academic performance and helped students develop interpersonal skills. Peer interactions offered emotional support, formed lasting friendships, and enriched the students' educational experiences. Furthermore, networking and mentorship opportunities helped scholars better envision their future careers in STEM, strengthening their commitment to their chosen fields while gaining insights from professionals. Internships and research projects, further reinforced their identities as scientists, enhancing their skills and fostering a sense of ownership over their careers. These experiences motivated students to pursue STEM professions with renewed confidence and determination.

International and Interdisciplinary Research Opportunities Offered by the S-STEM Program

In January 2024, four Applied Mathematics and Biomedical Informatics students participated in research activities at the Indian Institute of Technology (IIT), Kharagpur, India. The current NSF grant (#1930437) fully supported the students throughout the research trip. Accompanied by the grant's principal investigator, Dr. Urmi Duttagupta, the scholars were introduced to research involving advanced chemical engineering concepts and a comprehensive exploration of theoretical and computational mathematics. The scholars worked as part of a team on four different research projects at IIT and were mentored by three Chemical Engineering PhD students.

These research experiences were part of major projects sponsored by various Indian agencies, with Dr. Swati Neogi as Principal Investigator. The projects were conducted in the Composite Applications Laboratory (CAL), which Dr. Neogi established with the sponsorship of India's Department of Science and Technology (DST). Following the intense research work, the students had the opportunity to visit villages and historical sites in West Bengal, including Khwaabgaon (Dream Catchers village), Bishnupur – known as the Land of Terracotta Temples, and Kolkata – the City of Joy.

This collaboration extended beyond the January winter session. Upon returning for the Spring 2024 semester, the students continued to be engaged in research work. One of the students used the research project initiated at IIT to fulfill the internship requirement for the Bachelor of Science in Biomedical Informatics degree, under the mentorship and supervision of Dr. Neogi, Mr. Akash Kumar Burolia, a PhD student at IIT, and Dr. Diana Samaroo, who served as a Co-PI of the grant. The student graduated in June 2024 with honors. Two of the other students also continued their respective projects and presented at the MathFest conference. It was clear that

this research opportunity had a substantial impact on both the research experiences and the professional development of these students.

In reflecting on this research opportunity, the scholars shared the following experiences:

"*This research trip provided a valuable blend of academic exploration and cultural immersion enhancing our understanding of both scientific challenges and the rich heritage of the regions visited.*"

"*Overall, this was an incredibly positive experience for me which increased my interest in research and future courses in CUNY. It's also good to know about diverse cultures and world history with my own eyes, which is a privilege only few can experience.*"

"*In the end, our journey in India wasn't just about research. It was about finding joy in exploration, discovering a new culture, and meeting people who welcomed us with open arms.*"

"*The visit to the Indian Institute of Technology, Kharagpur, India brought another layer of depth to the journey, combining old culture with modern innovation, engaging with campus mentors and students. I worked on a variety of research topics ranging from sustainable technologies to advanced computing, demonstrating the institute's dedication to addressing global challenges. Conversations with mentors were informative…The sharp contrast between ancient terracotta art and the modern research atmosphere of the Indian Institute of Technology, Kharagpur, India, captured the heart of India - a country profoundly anchored in its traditions yet swiftly developing in technology.*"

The students involved in the international research projects reflected on the research trip as a valuable blend of academic exploration and cultural immersion. They noted that the experience not only deepened their understanding of scientific challenges but also offered a unique opportunity to engage with diverse cultures and histories. The trip sparked a heightened interest in future research and academic pursuits, providing a rare chance to experience different cultures firsthand. Additionally, students worked on research topics such as sustainable technologies and advanced computing, while also engaging in discovery, exploration, and building meaningful connections.

2. Determining the "order" in which different laminate layers in a composite of carbon fiber and epoxy resin start to fail when a load acts upon it, mentored by Mr. Akash Kumar Burolia.

3. Determining a suitable material with reduced hydrogen permeability to be used as a liner for Type 4 hydrogen gas cylinders, mentored by Mr. Akash Kumar Burolia.

4. Assessing the long-term aging performance of p-phenylene terephthalamide (PPTA) and Ultra High Molecular Weight Polyethylene (UHMWPE) fibers under synergistic environmental conditions to predict the lifetime of a soft armor, mentored by Mr. Rohan M. Jadhav

References

City Tech (2025). City Tech fact sheet 2024-2025. https://www.citytech.cuny.edu/about-us/docs/facts.pdf

Han, S., Kennedy, N.S., Samaroo, D. & Duttagupta, U. (2023). Programmatic Strategies to Engage and Support Undergraduate Women in Applied Mathematics and Computer Science. PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies, DOI: 10.1080/10511970.2023.2241461.