

Assessing the Academic and Social Growth of STEM Transfer Students

Prof. Thomas Woodson, Stony Brook University

Thomas S. Woodson is an associate professor in the Department of Technology and Society at Stony Brook University. He investigates the effects of technology on inequality throughout the world and the causes/consequences of inclusive innovation. For the past several years he has studied the effectiveness of scientific funding to have broader impact, and ways to improve diversity in STEM fields. He is currently the director of the \$4 million State University of New York Louis Stokes Alliance for Minority Participation (SUNY LSAMP) and the \$1 million S-STEM Scholarship Academic and Social STEM Excellence for Transfer Students (ASSETS) programs. These NSF sponsored programs help low-income, and under-represented minority students persist and succeed in STEM majors and careers. Dr. Woodson received his B.S.E in electrical engineering from Princeton University and his Ph.D. in Public Policy for the Georgia Institute of Technology (Georgia Tech).

Ms. Rachel Faye Perlman, Stony Brook University

Rachel is a PhD candidate in the Interdepartmental Doctoral Program in Anthropological Sciences at Stony Brook University. Outside of her research, she is devoted to accessibility in STEM higher education. She has experience working with several diversity and inclusion initiatives at her university, and is currently in her second year as the graduate assistant for this paper's program.

Dr. Marianna Savoca, Stony Brook University

Marianna Savoca is both an administrator and faculty member. She teaches career development, leadership, and external relations, collaborates with faculty on research and programmatic initiatives, as well as oversees internships and practicum experiences for graduate and undergraduate students. She leads campus-wide efforts to scale career development and access to high-impact experiential education for students in all majors and degree levels. She is Co-PI on two NSF-funded projects with a focus on STEM student success and is a published author. She holds a PhD in Higher Education Leadership.

Mrs. Lauren J. Donovan, Stony Brook University

Lauren Donovan is Assistant Director for STEM Smart programs. After graduating from Stony Brook University with a BA in Anthropology, Lauren's career in higher education began in the non-profit conservation organization within the Department of Anthropology, Stony Brook University. This environment grew Lauren's proficiencies for grant proposal and research, and program development. After a decade long tenure in Anthropology, Lauren transitioned to the Department of Technology and Society. She is currently the Assistant Director of STEM Smart programs, which include programs S-STEM ASSETS, LSAMP, and NASA NY Space Grant. Lauren has had the opportunity to participate in many professional development programs, such as the first cohort of the Research Foundation Leadership Academy, and Research Foundation Mentoring Program. Lauren received her Master of Arts in Higher Education Administration from Stony Brook University in May 2017. Her current research analyzes the gender equity in higher education, with a focus of females in STEM. With her research background, Lauren is a Women in Science and Engineering (WISE) affiliated member, and instructs the course, Society and Gender in STEM.

Academic and Social STEM Excellence for Transfer Students (ASSETS) program at Stony Brook University

Introduction

Community college students represent almost half of all undergraduate students, yet only one-sixth of students who earn a bachelor's degree transferred from a community college [1]. The failure of community college transfer students to complete 4-year degrees has been attributed to a combination of academic and social adjustment at the transfer university [2]. Lack of confidence in their academic abilities, shifts in living situations, and the failure of course credits to successfully transfer factor prominently into the transfer student experience [3]. In addition, universities usually cost more than community colleges; 4-year colleges are often located in a different community from where the transfer student lives, and academic expectations are different from community colleges to universities. Moreover, many transfer students do not receive the same university orientation and enculturation as entering first-year students [3]. These factors all impact the ability of community college students to succeed at 4-year universities.

Many of the challenges faced by transfer students are further magnified when they pursue STEM majors. STEM majors are notorious for not accepting credit from other universities. Moreover, STEM degree programs, especially engineering, have more required credit hours than non-STEM fields [4].

At Stony Brook University (SBU), administrators found the grades of transfer students in core math, chemistry, and biology courses were about 0.4 points lower than students who matriculated as first year students (called, non-transfers)[5]. What makes this finding even more startling is that the grades of high achieving transfer students dropped when they entered SBU and were lower than comparable non-transfer students.

To address the academic achievement gap between non-transfer and transfer students at SBU, we started the Academic and Social STEM Excellence for Transfer Students (ASSETS) program. ASSETS recruits community college transfer students from low-income, marginalized communities and provides them with a scholarship, a 2-week math bootcamp, career coaching, and gives them a natural cohort of students to have a community on campus. ASSETS started in 2017 and has had 4 cohorts of students. This paper gives an overview of the program, challenges, and successes.

Program Overview

In 2017, SBU started the ASSETS program with the help of a National Science Foundation Scholarships in STEM grant (DUE -1643671). The 5-year \$1 million grant provides low-income STEM transfer students with a combination of scholarship, math bootcamp, and career coaching, so that they can succeed at SBU. Students are selected through a competitive application process, with particular emphasis given to economically disadvantaged and underrepresented student populations. Although students from around the country are eligible for the program, we actively advertise at community colleges in the state through the transfer office administrators. SBU's admissions office also directly contacts eligible transfer students to recruit them to the program.

We try to select as many students as possible for the program but there are some limiting factors. First, the students must be community college transfer students with a minimum of 48 credit hours from their previous institution. Originally, the applicants were required to have an associate’s degree, however we relaxed that constraint because it eliminated many transfer students that fit the spirit of the grant, but did not actually have the associate’s degree. Now the program only requires that the transfer students spent 1.5-2 years in community college. We want to ensure that ASSETS students spent a significant amount of time in community college. The program is not for transfer students with only one semester at community college or students who earned advanced community college credits while in high school. Second, the grant specifically targets STEM transfer students who plan to pursue a non-medical STEM field. If a student mentions that they want to become a medical professional (medical doctor, dentist, etc.), the student is not selected. Third, there are several other particular cases in which we were not able to accept students. For example, if the student’s transfer was delayed from the fall to the spring semester or if they could not participate in the ASSETS bootcamp, the students were put on a waitlist.

Thus far there have been 53 participants (including those students that changed to non-STEM majors or left the university, N=4) and 15 have graduated. Of the 15 students that graduated, 5 graduated with distinction. More than half of the students are women and 19% are underrepresented minorities. See table 1 for a count of the student majors.

Table 1 ASSET student majors

Major	# of students	Major	# of students
Applied Math and Stats	5	Environmental Studies	1
Astronomy	1	Geology	6
Biochemistry	5	Marine Biology	1
Biology	7	Marine Science	1
Chemical Engineering	2	Marine Vertebrate Biology	1
Chemistry	3	Mathematics	2
Civil Engineering	2	Mechanical Engineering	1
Coastal Env. Studies	1	Physics	2
Computer Science	10	Psychology	1
Electrical Engineering	1		

Program Components

As mentioned before, ASSETS has three main components: (1), scholarship, (2) math bootcamp and (3) career development. Below is a brief summary of each of these components.

(1) Scholarship

The main component of ASSETS is an academic scholarship; 60% of the \$1 million grant is used for scholarship support. From previous research and experience, we know that many community college transfer students work to pay for tuition and living expenses [4]. The ASSETS scholarship reduces the cost of attending college with the hope that students will work less, be able to focus more on their studies, and have less debt when they finish university. Each student was awarded up to \$10,000 per year for scholarship support based on

their unmet financial need as determined by SBU's financial aid office from the students' FAFSA forms. The average scholarship award is about \$2,800 per semester and most students have the scholarship for 2-3 years. SBU's in state tuition and fees is about \$7,400 per semester. After the ASSETS scholarship, the majority of the ASSETS students had all of their tuition and fees covered.

The main requirement to keep the scholarship is that the student must maintain a 2.8 GPA average. However, if students fall below that level, it is not an automatic dismissal from the program. Instead, the student continues to receive the scholarship and we work with them to bring their GPA back up. Only after multiple semesters of low grades do we take away the scholarship. Even if the student loses the scholarship, they still can participate in all the other enrichment activities.

When we evaluated the ASSETS program, the scholarship was consistently ranked as one of the most important aspects of the program, ranking the scholarship as a 4.88/5 on a Likert scale. However, the scholarship did not eliminate the need for students to work part time jobs to supplement their income. Many of the students who had jobs before the scholarship kept their jobs.

(2) Bootcamp

Prior to their first semester at SBU, accepted ASSETS students participate in our program's two-week residential summer bootcamp. The bootcamp gives students a chance to strengthen their math skills, meet the other students in their cohort, learn about campus resources, and receive specialized academic and career advising. The bootcamp is divided into two main activities: (1) math classes and (2) professional development and community-building programs.

We focused the bootcamp on math for 2 main reasons. First, math is a common skill that all STEM students need to succeed in their discipline, so by focusing on math, we can strengthen skills that cut across disciplines. Second, we discovered that many of the transfer students struggled in their math courses.

The students attended math classes during the morning portions of the bootcamp. The classes are taught by two math instructors that have degrees in math pedagogy. We also hired math teaching assistants to help the teachers in the class and participate in afternoon activities.

We offer two math classes. For students that completed Calculus 2, the math bootcamp focuses on statistics. For those who have not taken Calculus 2, students review key calculus principles (e.g., series and derivatives). At the conclusion of the math bootcamp, students give group presentations on the ways math is used in potential careers.

In the afternoons the students meet with a variety of faculty, staff and administrators across campus to learn about SBU's resources. For example, in previous years students met with librarians, Student Advising, tutoring services, Dean of Students, the Career Center, and the Undergraduate Research Advising office. Since these sessions only had 10-15 students, the small and supportive environment allowed students to ask questions relevant to their individual experiences. From our evaluation the students particularly enjoyed meeting faculty and senior administrators. For many of them, this was their first time talking to a Dean.

Additionally, the afternoons and evenings feature team-building activities which are key for developing cohesion among the ASSETS cohort. The students complete a variety of activities together, including a challenge course, a campus scavenger hunt, and a kayaking trip. They also eat meals together and have time outside of the scheduled bootcamp activities to relax. When the bootcamp is over and the semester starts, the ASSETS students have a group of friends and have a better sense of the campus community.

(3) Career Development Support

Typically transfer students enrolling as juniors do not have as much time for major and career exploration as traditional first-year students. Therefore, ASSETS's career development support prepares students for applied learning experiences more often sought by juniors and seniors, such as research and internships. In collaboration with several departments on campus (e.g., Undergraduate Research and Fellowships Advising), our programming aims to connect our students with campus resources to help with resumes, interviewing, applying for fellowships and meeting with researchers. In addition, during the spring semester ASSETS offers a 1 credit hour career planning course focusing on a systematic approach to the career planning process, including goal setting, professional communication, job market trends, and career research strategies. We also held several informal gatherings throughout the year to help provide career advice and support.

Program Challenges

Over the past 4 years, ASSETS faced many challenges. Below are a few challenges and some solutions to address those issues.

Recruitment. An initial challenge was recruiting students to participate in the program. The first cohort only had 8 students. However, as ASSETS established itself and we improved our recruitment efforts, the cohort grew. Now the program has about 20 students per cohort. We found that 12-20 students per cohort is a good number to help students bond and maximize the program's budget.

Bootcamp. Another challenge was teaching math to a diverse set of students. The transfer students come from a range of math backgrounds. Some of the students took advanced mathematics like linear algebra while other students were taking pre-calculus. The range of students meant that we had to find ways to keep all the students engaged. During the first year of ASSETS, we only had 1 math class in the bootcamp. Because most of the students never took a formal statistics class, we taught basic statistics concepts. We also supplemented the math curriculum with various math logic and puzzles. Again, logic is not taught in the calculus sequence and students with a range of math backgrounds could learn them. Once we had a larger group of students (Year 2 and on), we divided the math training into two sections: students with Calculus 2 experience and students without Calculus 2 experience. Initially, we used Calculus 2 as the dividing line to have equal size classes. However, after working with several cohorts of students, we realized that Calculus 2 is a useful demarcation because students without Calculus 2 lacked fundamental math literacy on solving problems, taking math exams, and thinking mathematically. We put extra emphasis on these skills for students who have not taken Calculus 2.

Another challenge was developing cohesion among all the students. In each cohort there was a close-knit group of students who were more outgoing and there were a set of students that

were on the periphery. It was a challenge ensuring all the students felt engaged and welcome. The best way to fix this problem was including many mandatory “fun” events. We also strategically divided the students into groups for fun events to get them interacting with each other. It is impossible, and not desirable, to eliminate groups from forming close bonds, but we want to ensure that the cliques did not overshadow the whole group.

Student engagement. A third challenge was maintaining high participation during the academic year. Students were very engaged during the math bootcamp and when classes first started. However, once the semester got busy, student engagement waned. To help with student engagement, the program offered fun activities throughout the year.

In 2020, the largest challenge for the ASSETS program was COVID 19. Due to the virus, we could not have a face-to-face bootcamp. Though the students got a similar amount of information, the interpersonal bonding greatly suffered. Students did not become friends and did not feel like they belonged to a cohort. The lack of unity carried over into the year. Students were less likely to participate in events and take advantage of all the resources.

Preliminary Outcomes

The overall outcomes of the program are still unknown. Although ASSETS is in Year 4 of the 5-year grant, transfer students typically take 2-3 years at SBU to complete their degree. As of Spring 2021, 30 of the 53 participants have been in ASSETS for two years and could be eligible to graduate (i.e., 2+ years post-transfer). Of these 30 students, 15 have graduated. When we investigated while only half of the expected students graduated, the overwhelming reason is that students are taking 2.5-3 years to graduate. We expect that in year 5 of the grant, the graduation rate will increase.

From our formative evaluations, ASSETS has been successful. The scholarship helped the students afford college and relieve a major stress of attending university. After the bootcamp, the students had a group of friends and mentors to advise them on academic and career decisions, help them navigate SBU, and support them during the challenges.

So far 15 ASSETS students have graduated from SBU. Five of these students graduated with high honors, four entered Master’s or PhD programs, and another student was awarded a Fulbright Fellowship.

Future Work

With scholarships of up to \$10,000 per student per year, it may be cost prohibitive for colleges and universities to: (a) develop a scholarship program like this one, and (b) scale this program to reach a larger cohort of students. However, many institutions can implement other aspects of ASSETS which are relatively low-cost and have been important contributions to the success of the program’s students. Small cohorts for transfer student orientation, for example, provide ample opportunities to engage in team building activities and develop close bonds with future peers. In addition, all transfer students will benefit from brief refresher courses that emphasize mathematical thinking, problem solving, and test taking skills.

The community college to 4-year institution pathway is becoming an increasingly common route to the bachelor’s degree, particularly for those in traditionally underrepresented and economically disadvantaged populations. In order to support the persistence and success of

students from diverse backgrounds in STEM fields, it is essential for more colleges and universities to develop programs which support low-income transfer students in STEM majors. Investing in this type of infrastructure at the undergraduate level will lead to a more well-rounded STEM workforce and promises to facilitate better innovations that solve global problems.

Acknowledgements:

This work was funded by the National Science Foundation's Division of Undergraduate Education Scholarships in STEM program (1643671).

References

- [1] Xu, D., Ran, F. X., Fink, J., Jenkins, D., & Dundar, A, "Collaboratively clearing the path to a baccalaureate degree: Identifying effective 2-to 4-year college transfer partnerships," *Community College Review*, vol. 46, no. 3. 2018 .
- [2] C. Lopez and S. J. Jones, "Examination of Factors that Predict Academic Adjustment and Success of Community College Transfer Students in STEM at 4-Year Institutions," *Community College Journal of Research and Practice*, vol. 41, no. 3, pp. 168–182, Mar. 2017.
- [3] C. S. Chin-Newman and S. T. Shaw, "The Anxiety of Change: How New Transfer Students Overcome Challenges," *Journal of College Admission*, no. 221, 2013, [Online]. Available: http://www.academia.edu/download/49116934/Anxiety_of_Change_final.pdf.
- [4] A. C. Dowd, "Developing Supportive STEM Community College to Four- Year College and University Transfer Ecosystems," *Community Colleges in the Evolving STEM Education Landscape: Summary of a Summit*, 2012, [Online]. Available: http://www.nap.edu/catalog.php?record_id=13399.
- [5] "Performance in Selected Introductory Biology, Chemistry, and Mathematics Courses by Entry Status," Stony Brook University, 2015.