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Synergistic Interaction of LSAMP Alliances to Improve the Graduation and Transfer of Community College Students in New Jersey United States

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The Garden State-LSAMP (GSLSAMP) alliance works collaboratively with the Northern New Jersey-Bridges to the Baccalaureate (NNJB2B) to greatly improve the graduation of community college students from underrepresented minority (URM) groups in STEM and their transfer rate to 4-years STEM programs. This is accomplished through several areas of enrichment. The two alliances sponsor joint activities to encourage a supportive community of 2-years and 4-years students. Community college students conduct research in the labs of mentoring faculty at 4-years programs where they interact with 4-years college students. A cross-campus near-peer mentoring program pairs recently transferred GSLSAMP mentors with mentees from the mentor's community college of origin that eases and facilitates the graduation and transfer of mentees. In addition, the NNJB2B has adopted five proven high impact practices from GSLSAMP for their students. The results are that the graduation rate of the NNJB2B increased an average of 24.0% annually over the first 5 years of the program and the transfer rate improved 151.0% over the 2012 baseline. Four GSLSAMP 4-years institutions were especially active in the program and experienced an average increase of 62.9% over the 2012 baseline transfers from NNJB2B community colleges.

Keywords: lsamp, community colleges, transfer rates, learning communities, synergistic interactions, underrepresented minorities

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INTRODUCTION

Students from economically disadvantaged communities often opt for community college as an entrance to higher education because they are more affordable, have more flexible scheduling and are closer to home. According to the National Center for Public Policy and Higher Education (2011), approximately 44% of low-income, underrepresented minority (URM) students enroll in community colleges as their first postsecondary institution compared to just 15% of high-income students. In comparison to 4-years colleges, community colleges enroll significantly more students from underrepresented demographic groups, including racial/ethnic minorities, low-income, first generation, and nontraditional-age college students (Juszkiewicz, 2020). These groups face significant challenges to persistence in college including lack of familiarity with higher education and its relevance, inadequate preparation for college, limited English language skills, social and cultural foreignness of university and financial concerns (Melguizo & Dowd, 2006; Alexander et al., 2007; Johnson and Cuellar Mejia, 2020). Alexander et al. (2007) found that, for working-class Hispanic students, finances were a major constraint to university, with many students working to pay

for their educations as well as to help their parents financially. In 2017, the percentages of undergraduate students enrolled in community colleges were 44% Hispanic, 35% Black and 31% White. Overall, 34% of all undergraduate students were enrolled at community colleges (Juszkiewicz, 2020).

Regardless of background, the goal of these students is overwhelmingly to transfer to a 4-years program and complete their Bachelor's degree. Approximately 80% of community college students report that they intend to earn a Bachelor's degree (Horn and Skomsvold, 2011). However, in reality only 20% earn an Associate's degree and, of those, only 29% transfer to a 4-years institution, (Jenkins and Fink, 2015; Jenkins and Fink, 2016). Just 24% of low-income community college students transfer to 4-years programs compared to 40% of non-low-income students (Juszkiewicz, 2020). Of students who entered community colleges in 2013, only 16.7% overall completed a Bachelor's degree within 6 years and the rate is 13.8% for Hispanic students and 9.9% for Black students. These figures show that a vast majority of community college students do not realize their higher education goals. According to the National Center for Education Statistics (NCES), students from marginalized racial and ethics groups accounted for 41.4% of public community college students in 2018 but only 30.8% of public university students were URM (National Center for Education Statics, 2019b). This attrition continues in the 4-years programs with only 23.6% of all Bachelor's degrees being awarded to URM students in 2017 (National Center for Education Statistics, 2019a).

In 1991, in response to a predicted critical deficit in trained STEM professionals and a lack of diversity in these fields, the National Science Foundation (NSF) initiated the Louis Stokes Alliances for Minority Participation (LSAMP) program to promote and facilitate access to careers in STEM for URM populations. The LSAMP program accomplishes its goal through several best practices based around cultivating a learning community (Tinto, 2003a) that provide academic and emotional support to participants. In New Jersey, there are two LSAMP alliances: Garden State LSAMP (GSLSAMP), initiated in 2009, and Northern New Jersey Bridges to the Baccalaureate (NNJB2B), initiated in 2014. These two consortia form a unique, synergistic collaboration to improve the success, graduation and transfer rate of URM students in STEM using innovative techniques.

It has been suggested that partnerships between universities and community colleges are crucial for enriching the flow of students, especially for URM students (Boggs, 2011; Halpern et al., 2018). Examples of such partnerships include the Tiger Gateway Program to address student college readiness gaps using a summer bridge model (Wilson and Lowry, 2017), the METS/METSTEP program to increase URM participation in Engineering (Anderson-Rowland et al., 2004, 2010, 2013), and the Undergraduate Catalytic Outreach and Research Experiences (UCORE) program that provides a 10-weeks-long summer STEM research residency (Strawn and Livelybrooks, 2012). Although some of these programs involve multiple community colleges, each only includes a single university partner and thus have limited learning communities (Hirst et al., 2014; Halpern et al., 2018).

The interaction between GSLSAMP and NNJB2B is the first attempt at synergistic collaboration between consortia of multiple community colleges and multiple universities with the goal of developing best practices to improve the transfer of URM community college graduates in STEM to 4-years programs. These best practices were developed by GSLSAMP and disseminated to NNJB2B primarily through collaborative activities. The LSAMP program relies on the development of learning communities as a primary best practice (Clewell et al., 2006). The GSLSAMP-NNJB2B collaboration forms a web of interactions that create an expanded learning community (Tinto, 2003a; Tinto 2003b) across multiple institutions at multiple levels. This expanded learning community is the key to the success of this collaboration.

The two alliances have now worked collaboratively for over 6 years, creating a pathway for URM students in STEM from community colleges to 4-years programs. This paper reports on the unique collaboration between GSLSAMP and NNJB2B and the most effective best practices to improve the success, graduation, and transfer rate of URM community college students in STEM fields.

METHODS

The Alliances

The GSLSAMP is currently comprised of seven universities and one community college including Essex County College (ECC), Fairleigh Dickinson University (FDU, private institution), Kean University (KU), Montclair State University (MSU), New Jersey Institute of Technology (NJIT, joined in 2019), Rutgers University–New Brunswick (RUNB), Rutgers University–Newark (RUN, lead institution) and William Paterson University (WPU). Bloomfield College was a member of the alliance but left before the formation of NNJB2B. New Jersey City University (NJCU) was also a member from 2009 to 2018 and is included in this analysis. All alliance members are Hispanic Serving Institutions (HSI) except RUNB, and ECC is also a Predominantly Black Institution (PBI). The GSLSAMP achieved its success by experimenting with promising practices at RUN and then disseminating the successful ones to the rest of the alliance. As a result, the number of URM graduates in STEM increased by 156% at RUN over the first 3 years and the GSLSAMP became only the second alliance in LSAMP history to double its number (up 100%) of URM graduates in STEM in less than 5 years. By 2020, the number of URM STEM undergraduate degrees awarded by GSLSAMP schools was nearly quadruple the baseline.

After first being associate members of GSLSAMP, the five community colleges of Northern New Jersey-B2B (NNJB2B) were among the first Bridges to the Baccalaureate alliances in the LSAMP program, commencing in 2014. The alliance originally included Bergen County College (BCC), Hudson County Community College (HCCC), Middlesex County College (MCC), which left the alliance in 2017, Passaic County Community College (PCCC, lead institution) and Union County College (UCC) with County College of Morris (CCM)

TABLE 1 | Programs offered each academic year by semester.

Academic Year	Semester offered		
	Fall	Spring	Summer
2015	Annual Conference	Transfer Day	Research Experiences
2016	Annual Conference	Transfer Day CCPM	Research Experiences CCPM
2017	Annual Conference	Transfer Day CCPM	Research Experiences
2018	Annual Conference	Transfer Day CCPM	Research Experiences
2019	Annual Conference CCPM	Transfer Day sySTEMic CCPM	Research Experiences
2020	Annual Conference Transfer Admissions Fair CCPM	sySTEMic/YOU GOT THIS! CCPM	Research Experiences (mostly virtual)
2021 (virtual)	Transfer Admissions Fair Speaker Series Observational Research Workshops (Winter Break)	Annual Conference Speaker Series sySTEMic CCPM	Research Experiences (virtual and in-person)

joining in 2018 for phase II of the alliance. All of the partners are HSI's and lie within the area of northern and central New Jersey served by GSLSAMP. The graduation and transfer data presented here do not include MCC or CCM.

Joint Programming

The two consortia have maintained a synergistic collaboration for more than 6 years with best practices developed by GSLSAMP being disseminated to NNJB2B largely through collaborative activities. The five most effective interventions are evaluated here. **Table 1** shows when each program was offered.

Summer Research Experiences for Community College Students

Research opportunities in faculty labs is a priority of GSLSAMP. Typically, more than 250 LSAMP scholars participate in research experiences annually. Community college students are recruited for summer research opportunities by the NNJB2B Coordinators, who screen them for interest and commitment using grades and participation in NNJB2B or GSLSAMP activities. University faculty are recruited to host community college students in their labs or field areas. The students are categorized by area of interest and matched with faculty projects. Faculty are provided with the applications of the NNJB2B scholars and conduct interviews if they choose. Once an arrangement is made, community college students are trained on research protocol and complete lab safety training depending upon the host campus. Once the students and faculty are fully prepared, students begin to conduct research in the lab overseen by faculty, post-doctoral fellows and/or graduate students.

Students placed into faculty labs are awarded research stipends ranging in amount from $1,200 to $2,000. For many students, this amount is sufficient to allow them to forego summer jobs or work fewer hours while learning STEM skills. Students must complete 120 h of research over not more than a 10-week period and submit weekly time sheets signed by both the faculty member and student in order to receive their stipends. Another condition of the stipend is that the students must present their research as a poster at the GSLSAMP/NNJB2B joint annual research conference. The submission of the abstract and preparation of the poster allows additional mentoring opportunities. Presentation of the poster allows the student to take further ownership of the research and provides valuable professional development and networking opportunities.

Research experiences were elevated to a more formal level with the development of a Research Experiences for Undergraduates (REU) at RUN, entitled Dynamic Urban Environmental Science and Sustainability (DUESS). This project leverages the connections and enrollments of the GSLSAMP and NNJB2B for recruitment. The participants are at least 50% community college students and 70% GSLSAMP and NNJB2B students.

Joint Annual Research Conference

The GSLSAMP/NNJB2B Annual STEM Research Conference is held each fall. As of 2019, this event had grown to 175 presenters and nearly 600 attendees. Due to the shutdown during AY21, the conference was pushed to spring, with 246 students attending virtual. Every student who receives a GSLSAMP or NNJB2B research stipend or participates in the DEUSS REU is required to present their work at this conference. Student researchers prepare and submit an abstract that is published in the conference program. Additionally, students create and present posters of their research helping them to build professional skills such as public oral presentation and communicating their findings to a

diverse audience. Development of the posters is done with the oversight of the research mentors. The student presenters talk to attendees and answer questions about their research which provide essential skills.

The conference also benefits students who are not presenting. Seeing the work of their peers offers students role models of what they can accomplish. By bringing together students with similar backgrounds from many different schools, the conference provides students with a STEM identity and an expanded STEM learning community. Additionally, students get to meet and speak with faculty from all the GSLSAMP institutions, providing the opportunity of forming a professional network.

Annual Transfer Admissions Event

Since the inception of NNJB2B, GSLSAMP has hosted a transfer admissions event. From 2015 through 2019, Transfer Day was held every spring at RUN, with attendance averaging around 100 students each year. Students from each of the NNJB2B schools plus those from ECC of the GSLSAMP were invited to attend. The half-day event included a series of STEM speakers, transfer admissions counselors and representatives from teacher education programs. Information was also provided on the educational requirements for various STEM careers. After the talks, a panel of 4-years GSLSAMP students who transferred from community colleges answered questions. This panel gave the community college students the opportunity to get answers from peer mentors with a related background and experience.

Transfer Day included a Transfer Admissions Fair in which the 2-years students spoke with transfer admissions representatives from each of the GSLSAMP universities. Many schools also sent departmental representatives from STEM fields to answer questions about specific requirements and credits. In October 2019, the Transfer Admissions Fair became part of the Annual Conference's afternoon programming and was held virtually in October 2020.

Peer Mentoring

The Cross-Campus Peer Mentoring (CCPM) program is intended to enhance the confidence of community college students in transferring to 4-years institutions through peer support and access to essential resources. In the CCPM program, community college students are near-peer mentored by 4-years college students, who, whenever possible, transferred from the same community college as their mentees. The CCPM program was designed to increase the transfer rate by building a larger support and learning community across 2-years and 4-years colleges. The mentor-mentee interactions and peer advising improve mentee confidence in, 1) choosing a major, 2) deciding which 4-years school(s) to apply to, and 3) understanding the steps for successful transfer to their 4-years school of choice.

The initial CCPM experiment was conducted during spring 2016, summer 2016 and spring 2017 semesters. Mentors were GSLSAMP 4-years college students who transferred from the participating NNJB2B community colleges and ECC. Mentees applied through open enrollment at their community college and during GSLSAMP/NNJB2B activities. A total of 200 mentees were recruited. Mentors received $750 and mentees received $50 for completing all requirements of the CCPM program.

The mentors attended a one-day training session. Mentor training included the transfer process, interacting with campus admissions, establishing a relationship with faculty, balancing the rigors of school with personal responsibilities, mentor responsibilities, record keeping and other issues of community college transfer. Mentors received a training manual that explained their responsibilities, effective mentoring skills, confidentiality, appropriate conduct and possible mentor-mentee group or one-on-one activities. Mentor-mentee meet and greet sessions were held at the start of each cohort for mentors to establish relationships with their mentees, and to develop a community among the participants. Mentees had the opportunity to meet their mentors, discuss their major and career goals, and socialize with students from across NNJB2B/GSLSAMP alliances.

Mentors maintained regular communication with their mentees for 10 weeks during the spring 2016 cohort (69 mentees), 4 weeks for the summer 2016 cohort (57 mentees), and 15 weeks for the spring 2017 cohort (61 mentees). Mentors and mentees were required to be in contact at least once per week for a minimum of 30 min, or an equivalent period in texting. Mentees were given a tour of the mentor's college campus, visited research labs, and met other GSLSAMP students. The mentors kept logs of interactions, including time, duration, and mode of communication, which were submitted to the GSLSAMP and NNJB2B campus coordinators.

Professional Development

Career advisement and professional development occur on each campus of the two alliances through each of the programs offered, both on-campus and across alliances. Students often only recognize STEM opportunities in medical fields, missing the role of STEM in their everyday lives. Speakers are brought in to offer students a different perspective on STEM career options and enlighten students to the possible alternate career paths. In academic year 2021, GSLSAMP and NNJB2B initiated a joint virtual Speaker Series to replace on-campus speaker sessions, which could not take place due to the COVID-19 shutdown. Workshops are offered ranging from GRE and graduate school prep to how to write a résumé, create a LinkedIn page and apply to research opportunities and REUs. These speaker sessions and workshops allow students to improve their professional skills and expand their horizons. Both the research experiences and annual conference also provide a variety of professional development opportunities to students. Two additional, related joint programs: show your STEM innovation challenge (sySTEMic) and YOU GOT THIS! (YGT!) also provide professional development.

Initiated in 2019, sySTEMic is a team STEM innovation competition intended to introduce students to the collaborative nature of STEM, provide them the chance to apply classroom knowledge and show them the opportunities for innovation and entrepreneurship in STEM. Teams of 4–7 GSLSAMP or NNJB2B students are given a real-world issue around which to innovate. Topics have included food waste in the US, plastics in the environment and lack of clean drinking water. Teams have at least 1 month to research the topic and develop an innovation

around it, with the help of a faculty mentor. Teams then present their ideas in a 5-min pitch to an audience of their peers and three judges. Each year between 40 and 60 students have participated, with many more attending the presentations.

A larger event, focused specifically on professional development, was envisioned around the sySTEMic presentations. In addition to these presentations, YGT! included a keynote address, individual résumé coaching by the RUN Career Development Center Director and staff, and transfer student panel discussion that had been part of Transfer Day. Moreover, information on summer research opportunities was added, with professors from MSU, NJIT, RUNB, and RUN in attendance, as well as the PI of every REU offered in New Jersey and the Director of University of Pennsylvania's Summer Undergraduate Internship Program, providing a valuable mentoring and networking opportunities. Time and space were also reserved for participants of the CCPM program to meet with their mentors in person. Unfortunately, this event was only held once prior to the COVID shutdown although plans are to continue it when in-person events are again allowed.

Student Evaluation of Programming

Both GSLSAMP and NNJB2B employ the SageFox Consulting Group as their evaluator, allowing comparison across alliances and programming. Students who attend any GSLSAMP/NNJB2B joint program or event are asked to complete assessment surveys. A standardized survey was developed to make comparison across events and across years possible. In brief, students provide their school, demographic information, the impact of the event/program on their educational and career aspirations, the best part of the programming and possible improvements. Students are asked what the highest level of education they intend to attain both pre- and post-event/program.

To evaluate the impact of the CCPM program, formative evaluations were administered to the mentees in spring 2016 and summer 2016, a benchmark evaluation was administered in spring 2017, and summative evaluations were administered all three semesters. In addition to requesting demographic information, these evaluations included self-assessments of students' confidence in their ability to successfully transfer to a 4-years school. Additionally, spring 2016 and summer 2016 mentees were monitored to determine the number of students that graduated and transferred to a 4-years university.

Graduation and Transfers-Out Data

Graduation and transfer-out data are measures of the success of NNJB2B, which is required to reported these data annually to NSF. The data are obtained from each school's institutional research office and compiled by the NNJB2B Program Director for each academic year. For the years 2012 (baseline), 2015, 2016, 2017 and 2018, alliance data includes BCC, HCCC, PCCC and UCC. For years 2019 and 2020, BCC left the alliance and CCM joined. Since MCC left the alliance mid-phase, its data are not included.

Graduation data were obtained for NNJB2B (**Supplementary Table S1**) were compared to data for all public New Jersey 2-years colleges (NJCC, n = 19) and for all public 2-years colleges in the United States (USCC, n = 924). These data were obtained from the Integrated Postsecondary Education Data System (IPEDS) of the U.S. Department of Education (https://nces.ed.gov/ipeds/use-the-data). Data submission to IPEDS is required for any institution that participates in any federal financial assistance program, with data collected annually in Fall, Winter and Spring. All IPEDS gradation data were obtained from "Graduation Rate" in "Survey Data" for URM students awarded Associates degrees in NSF-approved STEM majors, by Classification of Instructional Programs (CIP, https://www.lsamp.org/help/help_stem_cip.cfm), during the academic years 2012 (baseline) and 2015-2019. The 2020 data were not yet available on the IPEDS site.

The Transfers-Out data from IPEDS were not filterable by major so data for NNJB2B were those reported to NSF for URM students in STEM majors (**Supplementary Table S2**). These were compared to the transfers-out data for NJCC and USCC for URM students in all majors obtained from "Completions" in "Survey Data" on the IPEDS site.

Transfers-In Data

To assess the impact of the NNJB2B on transfers into the seven GSLSAMP universities, each was asked to provide institutional data for 2012 and from 2014 to 2018, broken down by race/ethnicity, with the following criteria (**Supplementary Table S3**):

1) New Undergraduate, Degree-Seeking Transfer Students From BCC, HCCC, PCCC and UCC
2) enrolled in a STEM field for their first or second major (not minor) using NSF STEM categories
3) Full or Part-Time Enrollment

The data on transfers between NNJB2B and GSLSAMP were compared to the IPEDS data for URM STEM students who transferred into non-religious New Jersey 4-years colleges and universities (NJUniv, n = 30). as well as into non-religious US 4-years colleges and universities (USUniv, n = 1,429). IPEDS data were obtained from "Fall Enrollment" in "Survey Data" available through the public website (https://nces.ed.gov/ipeds/use-the-data). These data were obtained for 2012, 2014, 2016 and 2018 because major field of study data are only available for even years. These data are not yet available for 2020 on the IPEDS site.

RESULTS

Students who attend GSLSAMP and NNJB2B programs and events provide evaluations of the programming. These evaluations are collected via surveys administered since 2016 by SageFox Consulting Group the external evaluator of GSLSAMP and NNJB2B. This commonality in evaluator facilitates comparison across events and years. When each program was offered is shown in **Table 1**.

Research Experiences for Community College Students

External evaluation shows that research experiences are the powerful tool in encouraging NNJB2B community college students to transfer to a 4-years program. 93% of responding

NNJB2B students opined that research experiences made them interested in continuing to do research and 71% said it made them want to continue to pursue higher education in STEM. Using a 4-point Likert scale, where 4.0 is "benefited to a great extent", students assessed research experiences at 3.8, 3.6 and 4.0 for 2016 (n = 161), 2017 (n = 91) and 2018 (n = 81), respectively.

Some students provided written comments describing the main benefit of their research experience. Statements included:

The fact that I could spend my summer working in a lab with a professor of my choosing was my dream becoming reality (2016)

Being able to enter undergraduate research and develop a strong transfer plan (2016)

The main benefit of my whole research experience was the amount of exposure I received in Rutgers University. I interned there from Summer 2016 until the end of Spring 2017, accomplishing many independent tasks such as creating and presenting my own poster and research at two different conferences. I am also looking forwards to publishing my own academic paper and have seen the appeal of the research world, changing my goals from attending a veterinarian school to enrolling into a graduate school in a specialized field under the wide umbrella of Biology (2017)

The paid research gave me the opportunity to get real life experience and to [learn] outside of the classroom. It also allowed me to gain a lot of knowledge (2017)

Starting research earlier than most other undergraduate students, being able to pay for my own tuition with stipend and entering professional sciences (2017)

I learned how to conduct research and help me to apply to other competitive research opportunities. Furthermore, it helps me to get a variety of scholarships (2018)

Some of the benefits [of B2B-supported research] are getting paid to do work while acquiring knowledge that pertain (sic) to my field of study, networking with faculty and other students, and it helps us develop a sense of what happens in a work environment (2018)

GSLSAMP/NNJB2B Annual STEM Research Conference

The Annual STEM Research Conference has been held each October since the inception of GSLSAMP and has included NNJB2B since 2014. The student surveys consistently show the very valuable aspects of the event. For 2015, 2016, 2017 and 2018, two of the highest ranked aspects, on a 3-point Likert scale, were: 1) receiving feedback on their posters (2.69 (n = 55), 2.15 (n = 55), 2.74 (n = 106), 2.71 (n = 62), and 2.66 (n = 84) for 2015, 2016, 2017, 2018 and 2021, respectively, on a 3.0 Likert scale); and 2) seeing other students' posters (2.78 (n = 89), 2.66 (n = 123), 2.82 (n = 167), 2.70 (n = 90) and 2.72 (n = 84), respectively). In 2019 (n = 171), a 4.0 Likert scale was used with students rating presenting their research at 3.41 and seeing others' posters at 3.51. In 2019, the average rating of the conference overall was 4.55 (n = 122) with 5.0 indicating Excellent. These opinions can be seen clearly in the comments of some students:

[The best thing about the conference this year was] the encouragement I received. It helps me realize that I, too, can be successful (2015)

[The best thing was] getting experience and connections in the field I'm getting my degree in. Getting presentation experience to prepare me for future jobs (2015)

The program really encouraged me to pursue my goals of becoming a physicist. I had the opportunity to talk to experts on my field and [it] help[ed] me answer my doubts (2016)

The best thing was that many of the faculty were enthusiastic about offering help and interested in staying in touch (2018)

I had a really deep conversation with one of the poster presenters and she was a senior. I am a sophomore, and she really guide me towards applying for research through LSAMP (2018)

It was amazing to see the hard work and dedication the students put into their research. I want to be part of that research community of great thinkers (2019)

It was mostly valuable to me because for the first time I felt like I belonged among this group. The way my peers' faces lightened, talking about their interests was absolutely rewarding (2019)

[The keynote address] helped me realize that all of us have struggled at some point and experienced imposter syndrome (2021)

Transfer Day and Transfer Admissions Fair

Transfer Day created a pipeline from the 2-years programs of NNJB2B to the 4-years programs of GSLSAMP. Student evaluations were administered each year and responses numbered 45 in 2017, 28 in 2018, and 36 in 2019. In each of these years, on a 5-point Likert scale in which 5 is very valuable and one is not valuable at all, the event was considered very valuable with scores of 4.6, 4.8 and 4.8, respectively (n = 45, 28 and 36, as mentioned above). Although the Transfer Admissions Fair was held virtually in October 2020, with 41 students attending, the survey response rate was very low (n = 5) so is not included here.

In 2017, 2018 and 2019, the post-event survey found that the majority of respondents had 30 or more credits (82, 64 and 74%, respectively) and nearly all indicated they intended to transfer to a 4-years program (98, 93 and 93%, respectively).

Students reported the most cited barrier to transferring as cost. In 2017, 2018 and 2019, respectively, 87, 86, and 81% of student survey respondents reported that finances would make it difficult to for them to transfer to a 4-years program. GPA was the next most common obstacle cited (31, 25 and 22% in 2017, 2018 and 2019, respectively) but not nearly to the extent of finances. When further asked what information or service would be helpful to them in preparing to transfer, student consistently indicated mentorship as the most important (78, 86 and 69% in 2017, 2018 and 2019, respectively) followed closely by financial workshops (76, 71 and 64%, respectively) and help with academic skills (62, 68 and 67%, respectively).

Students found the transfer admissions fair and the transfer student panel discussion to be the most impactful. These were repeatedly mentioned as the most valuable thing learned and the best part of the event. A sample of the written statements include:

Listening to the mentor panel. It's always great to hear from those who are just like you (2017)

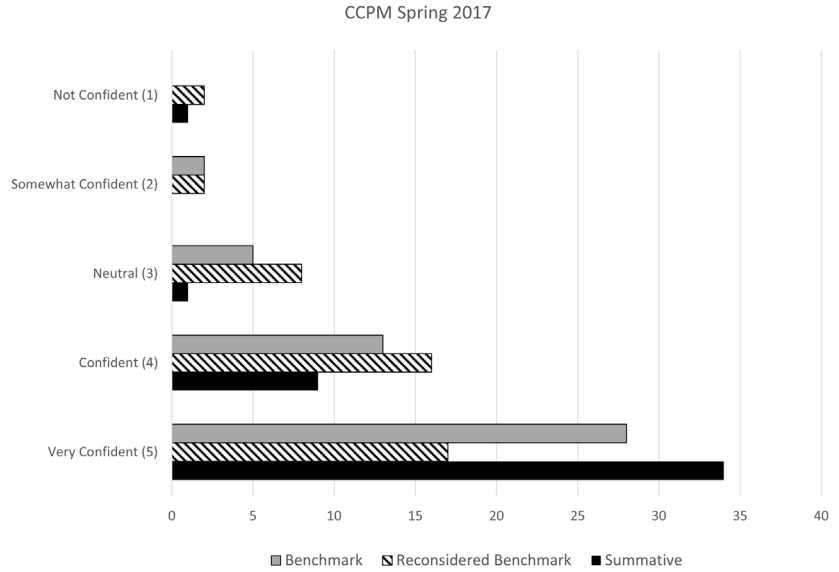

FIGURE 1 | CCPM Spring 2017 Cohort Survey Responses.

There is so much opportunity out there and I need to be a part of that (2017)

Feeling there's hope and it's not that difficult to transfer and there's help along the way (2017)

The most valuable thing I learned at the Transfer Day Event was to take advantage of opportunities (2018)

That I was able to see students that have succeeded, so that show [s] me that I can do it too (2018)

I learned that Ph.D. programs are more flexible than what I believed them to be (2019)

My experience with things like guilt, imposter syndrome, and family responsibilities have made me feel very isolated from peers my age, but [the keynote] address made me feel seen, understood, and hopeful about the future (2019)

Cross-Campus Peer Mentoring (CCPM)

As described by Smart and Gates (2018), formative evaluations were administered in spring 2016 and summer 2016. The spring 2016 formative data found that 53% of 69 mentees who completed the program felt confident in transferring. In comparison, summative evaluations at the end of spring 2016 showed that 92% of mentees felt confident in transferring, an increase of 39%. The summer 2016 formative evaluation found that 62.1% of the 57 mentees were confident in transferring in comparison to 89.1% of mentees feeling confident in transferring in the summative evaluation. This is an approximate increase of 27%. In spring 2017, benchmark evaluations showed that 73% of 61 mentees reported confidence in transferring to a 4-years college whereas 95.5% of mentees were confident in transferring in summative evaluations (**Figure 1**).

Pairing mentees with near-peer mentors who shared common experiences played a critical role in this program. Evaluations showed that the mentees felt that the top benefits of CCPM included, 1) working with a mentor who shared the same experience, 2) developing a strong understanding of the transfer process and 3) gaining knowledge about STEM academic programs and majors.

Spring 2016 and summer 2016 mentees were monitored to determine the number of students to graduate and transfer a 4-years university. By 2018, 97.6% of the Spring 2016 mentees had transferred to a 4-years institution and of those 62.3% graduated. Similarly, 94.5% of the Summer 2016 mentees had transferred to a 4-years institution and of those 64.9% graduated (Smart and Gates, 2018). This is 60.9–64.0% greater than the 2016 national average transfer-with-award rate of 33.6% and 47.5–50.6% greater than the 2016 New Jersey public community college average transfer-with-award rate of 47.0% (Shapiro et al., 2017). Additionally, the rate of transfer of participants of CCPM was 44.4-41.3% greater than the 53.2% of NNJB2B graduates who transferred in 2016 (Smart and Gates, 2018). These results shows that CCPM is a best practice in enhancing student confidence in transferring.

sySTEMic/YOU GOT THIS (YGT!)

In a survey of the 2019 sySTEMic participants, respondents (n = 29) indicated that, on a 3-point Likert scale where three is "very valuable," the event was assessed as very valuable for showing students creating a plan of action (2.8), researching a solution (2.8), working with a team of students (2.9) and pitching the solution (2.8). Getting a better idea of entrepreneurship was also seen as valuable, with an average rating of 2.6. Both sySTEMic team members and students in the audience were asked to assess the sySTEMic presentations. In 2019 (n = 36), they were given a 4.5 on a 5-point Likert scale (5 = very valuable) and in 2020 (n = 54), a 4.7. When students were asked the most valuable thing learned from the presentations, several indicated sySTEMic had made a profound impact.

Being able to innovate an idea and bring seven minds together.

Being a part of a team and being supported by faculty.

TABLE 2 | Degree plans before and after YGT!.

Degree	All respondents (n = 54)		Community college (n = 33)		Four-year school (n = 21)	
	Before	After	Before	After	Before	After
Associate's	7%	4%	12%	6%	-	-
Bachelor's	24%	13%	24%	9%	24%	19%
Master's or MD	44%	43%	39%	42%	52%	43%
PhD	24%	37%	24%	36%	24%	38%

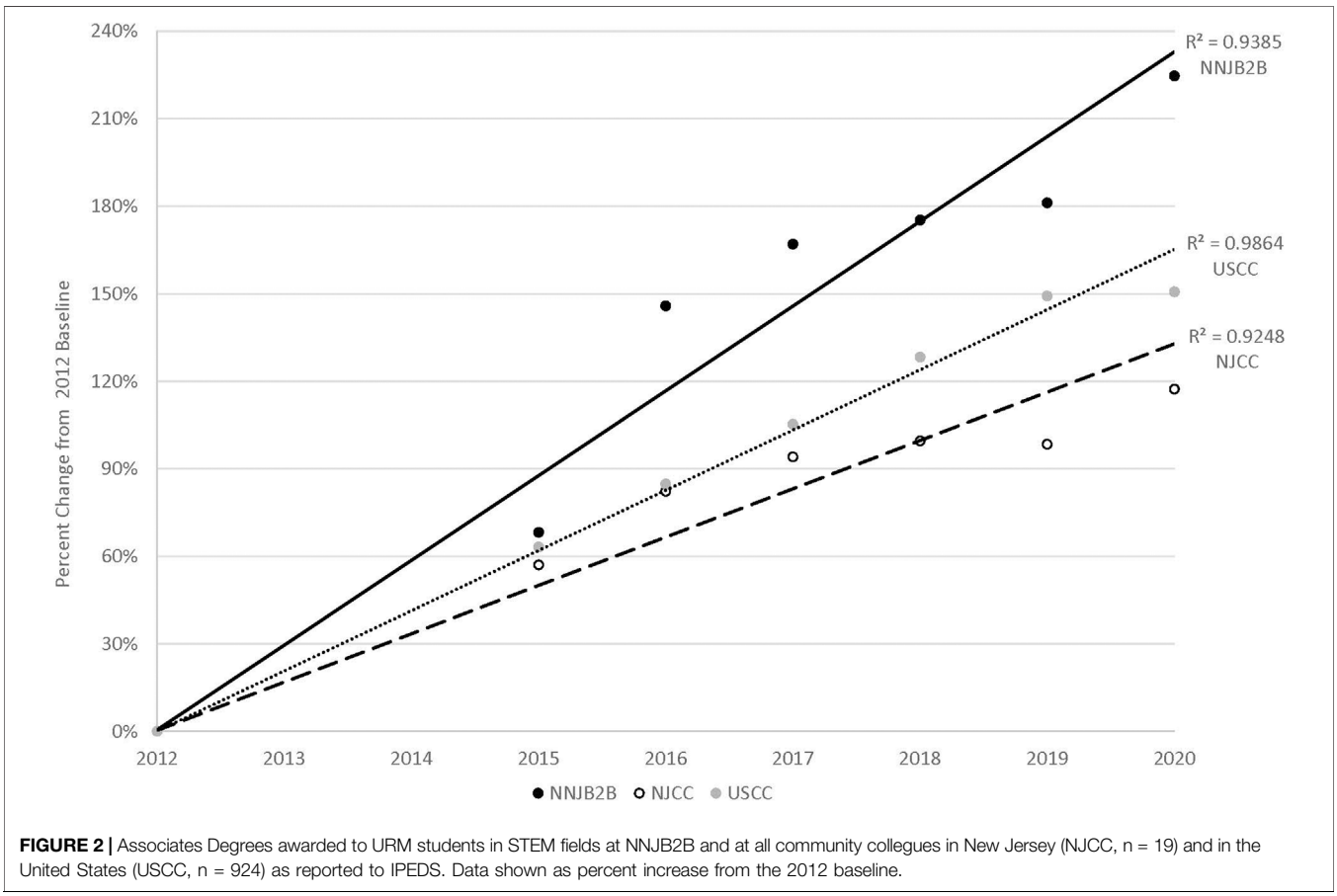

FIGURE 2 | Associates Degrees awarded to URM students in STEM fields at NNJB2B and at all community collegues in New Jersey (NJCC, n = 19) and in the United States (USCC, n = 924) as reported to IPEDS. Data shown as percent increase from the 2012 baseline.

The ability to innovate and combine creativity with science.

Creating a project; there was a lot of work, ideas, teamwork, and fun.

Everything in this world can be a research topic and can be made better.

[I] found ways in which I could apply my major, computer science, into the field of biology and biochemistry.

This is the first time that I work with an interdisciplinary group and I learned that our backgrounds, knowledge and experiences are powerful weapons to impact the world.

Of the other offerings at YGT!, all were seen as very valuable by the survey respondents (n = 54), with nearly 89% seeing value in the resume guidance (4.7 rating on a 5.0 scale), 94% seeing value in speaking to professors about research opportunities (4.8 rating) and 96% expressing value in the event overall (4.7 rating). Additionally, 50% of the respondents met with their CCPM mentors and 31% indicated they were considering new academic or career options as a result of YGT! (**Table 2**).

NNJB2B Graduation and Transfers-Out

For the years 2012-2018, only four of the original five community colleges of NNJB2B were included in this analysis: BCC, HCCC, PCCC and UCC, while all four phase II colleges were included for 2019 and 2020 (CCM, HCCC, PCCC, UCC). In the NNJB2B grant proposal, data from 2012 were used as a baseline. Data from each year after funding were normalized to these figures and expressed as a percent change from this baseline.

In 2015, Year one of NNJB2B, the number of URM STEM graduates was at 68.2% above the 2012 baseline. This upward trend continued, with the number of URM STEM graduates reaching 145.9, 167.1 and 175.3% over the 2012 baseline in 2016, 2017 and 2018, respectively. By 2020, the number of URM STEM

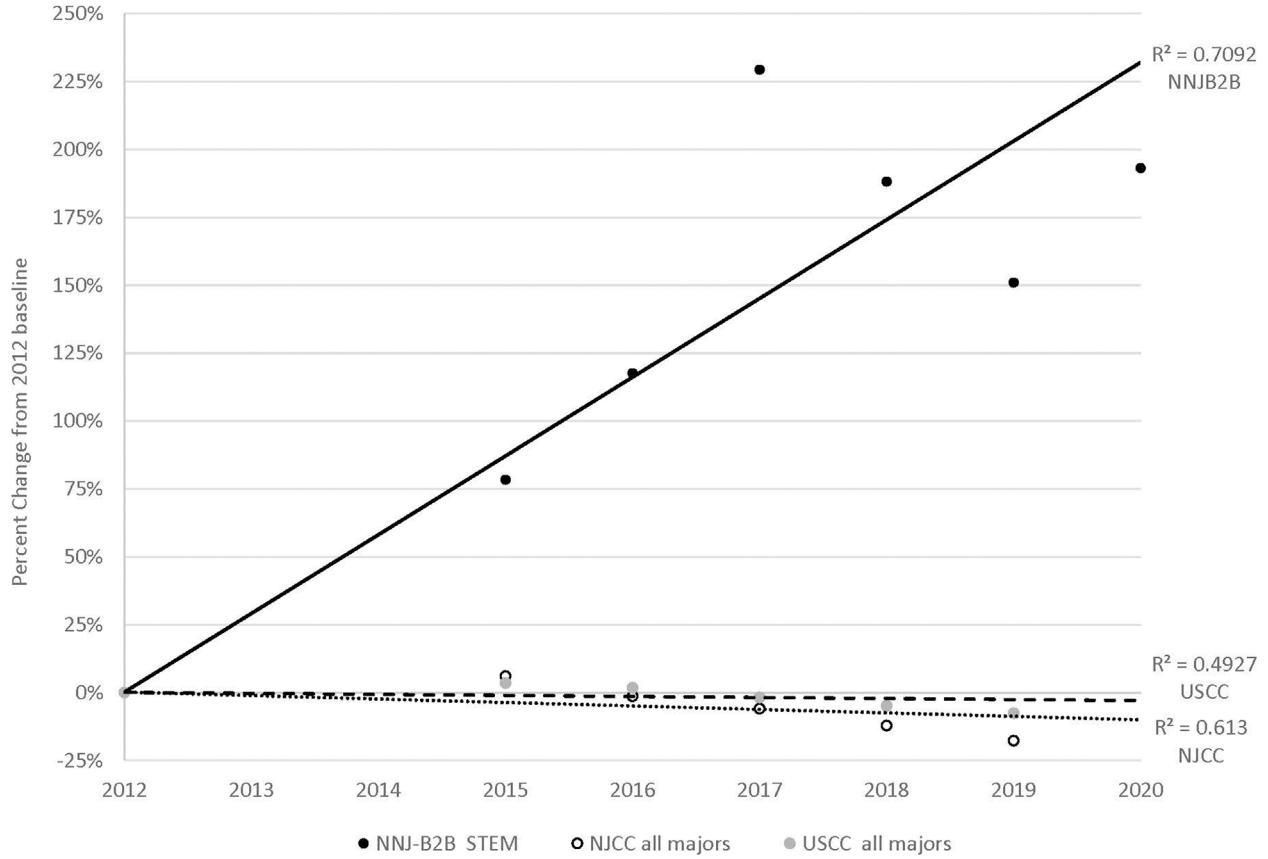

FIGURE 3 | Comparison of URM transfers out in STEM majors from the NNJB2B schools and in all majors from all community colleges in New Jersey (NJCC, n = 19) and in the United States (USCC, n = 924) as reported to IPEDS. Data shown as percent change from the 2021 baseline. (IPEDS data for "Transfers-Out not available for 2020.)

graduates from the NNJB2B schools was 225% above the 2012 baseline, nearly double the increase for all New Jersey public community colleges (NJCC, n = 19) of 117% and half again as great as the increase for all United States public community colleges (USCC, n = 924) of 151% (**Figure 2**). As an annual percent change, the number of NNJB2B URM STEM graduates increase, on average, 24% each year, substantially higher than the average increases for NJCC (15%) and USCC (18%).

Since the inception of NNJB2B, the number of graduated students who transfer-out to 4-years programs has increased to over 150% above the 2012 baseline, reaching a high of 229% over the baseline in 2017. This significantly exceeds the transfers-out from all NJCC, which experienced an overall decrease of nearly 18% in transfers-with-award from 2012 to 2019. The average for all public 2-years colleges in the US (USCC) closely followed the NJCC trend (**Figure 3**), with a reduction in transfers-out of nearly 8%. It is important to note that NNJB2B data includes only URM students in STEM fields whereas NJCC and USCC data includes URM students in all majors at all public 2-years schools.

NNJB2B experienced an average annual increase in transfers-out of 31% compared to the prior year. During this same period, the average annual change in transfers-with-award for NJCC decreased (−4% annually, on average). This trend was also occurred for USCC, with an average decrease in transfers-with-award of 1% each year.

GSLSAMP Transfers-In

From 2012 to 2018, GSLSAMP universities experienced a significant increase in URM STEM transfers-in from NNJB2B schools (57%). However, not all of the GSLSAMP universities participated in the programming to the same extent. Several did not provide CCPM mentors, host NNJB2B research experiences, provide faculty speakers or send representatives to joint events. As a result, there were differences in their success in building a pipeline with the NNJB2B alliance. Four universities were particularly involved in this programming, including FDU, KU, MSU and RUN, all consistently providing peer mentors, student ambassadors, faculty speakers, research opportunities and admissions representatives. As a result, these institutions experienced the greatest increase in NNJB2B transfers-in, with an increase of 63% over the 2012 baseline. During the same period, NJ public and non-religious, not-for-profit private universities (NJUniv, n = 30) experienced an increase of 30% above the 2012 baseline and US public and non-religious, not-for-profit private

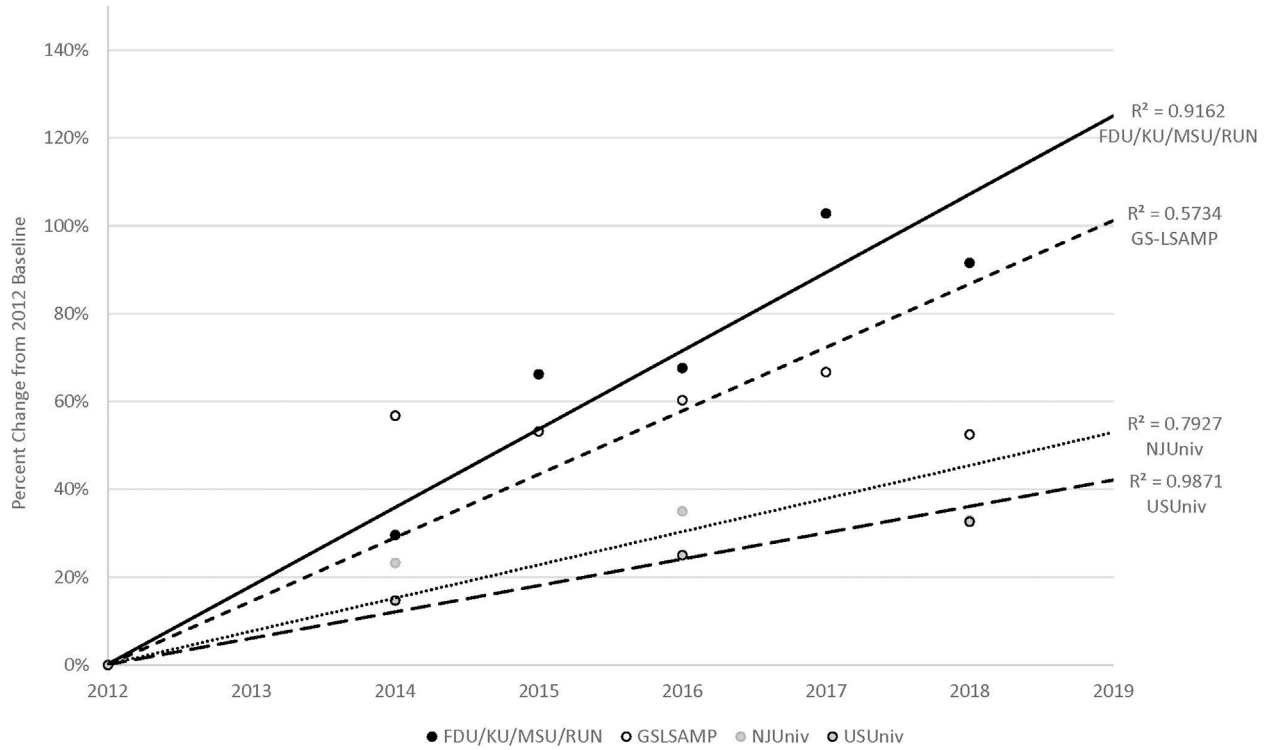

FIGURE 4 | URM STEM Transfer-In students from NNJB2B to four of the GSLSAMP schools (Fairleigh Dickinson University, Kean University, Montclair State University and Rutgers University-Newark) versus URM STEM Transfer-In students from all public 2-year schools to all non-religious 4-year schools in New Jersey (NJUniv, n = 30) and in the United States (USUniv, n = 1429) as reported to IPEDS. Data shown as percent increase from the 2012 baseline, (IPEDS data for field of study are only available for even years only.)

universities (USUniv, n = 1,429) experienced an increase of 24% above the 2012 baseline (**Figure 4**). These transfer-in numbers refer to URM students in STEM majors only. This means that participation in cross alliance collaborative programming increased transfers-in of URM community college graduates in STEM by more than 25% over the state and national averages. The percent change in these URM STEM transfers-in from NNJB2B to GSLSAMP increased an average of 18% biannually while transfers-in from NNJB2B to the FDU, KU, MSU, RUN participatory group increased an average of 24% biannually. In comparison, URM STEM transfers-in to NJUniv and USUniv each increased by only 10% biannually, on average.

DISCUSSION

The vertical transfer from 2-years to 4-years programs serves as a vital pathway to upward mobility for many URM students (Jenkins and Fink, 2015). Community colleges serve as "a key gateway" for URM students into higher education, with nearly half of all Hispanic and African American college students enrolled in them (Crisp and Nuñez, 2014). Solid relationships between community colleges and universities provide students with opportunities for academic and social integration (Townsend and Wilson, 2006; Jenkins and Fink, 2016). There are many examples of programs between 4-years and 2-years colleges and universities that enhance the graduation and transfer rate of the community college students (see, for example, Yomtov et al., 2017; Halpern et al., 2018). However, the relationship between the GSLSAMP and NNJB2B involves the synergistic collaboration between two alliances to improve the success of URM community college students on a regional, rather than institutional, scale. The events and programming were developed based on experimentation and dissemination within the project coupled with research-based best practices. This method has realized significant results.

The main approach to the interacting consortia is to develop an extended learning community (Tinto, 2003a; Tinto 2003b). The LSAMP program relies on the development of learning communities as a primary best practice (Clewell et al., 2006). These learning communities are primarily within single institutions. Collaborations between 2-years and 4-years programs involve limited learning communities across the two institutions (Hirst et al., 2014; Halpern et al., 2018) or a few community colleges and one university (Anderson-Rowland et al., 2004, 2010, 2013; Strawn and Livelybrooks, 2012). However, the GSLSAMP-NNJB2B collaboration is far more extensive, forming a web of interactions that create an expanded learning community across multiple institutions at multiple levels. This expanded learning community is the key to making this collaboration synergistic. All participating students and institutions benefit.

The success of the synergistic collaboration between GSLSAMP and NNJB2B is documented in the markedly improved graduation, transfers-out and transfers-in rates. The number of URM STEM students graduating from NNJB2B schools has been increasing by nearly 30% annually, almost double the NJCC rate and more than double USCC rate. Of the NNJB2B graduates, nearly 35% more transferred to 4-years programs each year. This is in sharp contrast to the transfer rate for all majors in both NJCC and USCC, which are declining. GSLSAMP institutions had a substantial increase in URM STEM transfers-in from NNJB2B during this collaboration. Compared to URM STEM transfers-in from all sources to NJUniv and USUniv, the annual percent increase was more than double. This shows that not only is the joint programming effective, the two alliances have built a pipeline for URM STEM students from community college to universities.

Another explanation for the overwhelming success of the collaboration of these consortia is that the programming forms a closed loop, with each program directing students back to others, thereby reenforcing participation. For example, YGT! can point students to many other opportunities. A student can find research opportunities and receive faculty mentoring and professional skills development. This then leads to the annual conference, which provides additional professional skills, networking opportunities and admissions information, leading to transfer or graduate school. Another student at YGT! might hear about CCPM and sign up to participate, which will increase that student's confidence in transfer and open the possibility of research and all the benefits just mentioned. Yet another student at YGT! might be presenting a sySTEMic innovation which can lead them to other professional development and/or research opportunities, leading to more faculty mentoring, the annual conference, the admissions fair and transfer.

Through the collaboration, NNJB2B students are exposed to the best practices for academic and social support of the GSLSAMP. They are also given the opportunity to have an introduction to a 4-years campus, establish peer and faculty mentor relationships, build their professional skills, and expand their potential in STEM. Both NNJB2B and GSLSAMP students conduct and present research at the joint annual conference, providing them with professional development skills. Additionally, being exposed to their peers' work provides both researcher and non-researcher students with mentors and role models for what they can accomplish, thereby showing students they have a place in STEM. By bringing together students with similar backgrounds but from many different schools, the annual research conference exemplifies the expanded STEM learning community.

Providing research experiences is a recognized best practice and a primary focus of the GSLSAMP/NNJB2B collaboration. Research opportunities promote students' scholarly development and independence and provide personalized education as well as connections with faculty. This has been found to be especially important to URM students across all academic disciplines and at a wide variety of institutions (Elgren and Hensel, 2006). Early research experiences have been shown to improve retention and students can develop personal and professional skills through multiyear research programs (Thiry et al., 2012; Carrero-Martinez, 2011; Grabowski et al., 2008). This also provides the opportunity to mentor newer students in the lab which has been correlated to persistence in research careers (Chang et al., 2014). Alexander et al. (2007) found that finances were often a barrier for Hispanic students who wished to continue their educations. As noted in the student comments, for students who must generate income over the summer, either to pay for their schooling or to assist their families, research stipends can provide this income, in part or in whole, while allowing them to gain valuable STEM skills and build their STEM identities.

Peer mentoring has been found to alleviate social pressures, provide an environment that addresses challenges of URM students, ease student transition into the college environment, and promote coping skills and resiliency (Lisberg and Woods, 2018). Mentoring within a single campus has proven to support both graduation and transfer rates (Yomtov et al., 2017). Additionally, mentoring of high school students by college business majors was found to increase the high school students perceived level of college success and their level of comfort on a college campus (Luczuk and Kalbag, 2018). However, CCPM shows the impact of peer mentoring across 2-years and 4-years institutions (Smart and Gates, 2018). CCPM is a transformative model centered on theoretical premises of motivational constructs to enhance student confidence and self-efficacy. Based on Bandura (1977), CCPM mentors help to build mentee identity as a student capable of transferring. CCPM not only provides mentees with a roadmap for transferring, but also allows students to explore the institution to which they are considering transfer. Based on Bandura (1986), "modeling," is an effective technique to teach general rules and strategies for dealing with different situations. Pairing 2-years student mentees with 4-years student mentors who share common major(s) and life experiences, including transferring themselves, plays a critical role in this program. Peer mentors are key in CCPM because they demonstrate that transferring to and succeeding in a university setting is a realistic and attainable goal.

Multiple studies show that professional development is transformative in URM STEM education and student success, both at the undergraduate and graduate levels (National Research Council, 2011; Moreira et al., 2019). Neiles and Mertz (2020) define professional skills as non-technical skills important to being an effective scientist, including resume writing and networking, problem solving and big picture thinking, scientific identity development, initiative, communication skills, and interpersonal skills such as teamwork and leadership development. Every one of the enrichments described here have an aspect of professional development, including initiative, teamwork and STEM identity development and networking in research experiences, communication skills, networking and STEM identity development in the annual conference, leadership and communication skills development in CCPM, and networking, resume writing and STEM identity development in Transfer Day. Wright et al. (2019) also included entrepreneurship as an important part of STEM professional

development. The sySTEMic and YGT! events cover this aspect of professional development as well as every single aspect other aspect mentioned above while also including both peer and faculty mentoring components.

The National Research Council (2011) identified areas that must be addressed to increase the success of URM students in STEM fields, including summer research programs and experiences, professional development, academic support, and social integration and mentoring. All of these areas are addressed in the collaborative programming of GSLSAMP and NNJB2B. This cross-alliance programming is greatly facilitated by the population density and proximity of alliance institutions in northern and central New Jersey. Replication of the synergism described here may be limited elsewhere by proximity. However, given the magnitude of the results, implementation on any scale would likely be beneficial. With the COVID-19 pandemic, student retention is even more critical. Johnson and Cuellar Mejia, 2020 state that the number of students transferring may plummet citing a survey by Education Trust West, which found that 75 percent of California students were worried about staying on track due to the virus. Now, more than ever, URM STEM students need support programs like those described here.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by ArtSci Institutional Review Board, Rutgers University - Newark. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AG contributed to conception and design of the study. CSM collected the data, performed the statistical analysis. and wrote the first draft of the manuscript. AG wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2021.679865/full#supplementary-material.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

SE niche agreement- The handling editor is currently co-organizing a Research Topic with one of the authors AG.