

An Approach Towards the Integration of International Research Experiences for Underrepresented Students in Sweden, the Netherlands, and Austria

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Abstract

The New York City Louis Stokes Alliance for Minority Participation (NYC LSAMP) at the City University of New York (CUNY) has, since its inception in November 1992, been at the forefront of a concentrated effort to substantially increase the number of underrepresented minority students who pursue and graduate with Baccalaureate Degrees in Science, Technology, Engineering and Mathematics (STEM). Since its inception in November 1992, over 14,000 baccalaureate degrees have been awarded to underrepresented minority students at CUNY. The NYC LSAMP has been successful in establishing international collaborative partnerships in Sweden, the Netherlands, Brazil, Austria, Morocco and Colombia.

The multi-pronged approach consists of 1) collaborating with existing programs within the NSF and other federal agencies, 2) working collaboratively with a core of mentors/faculty who have international collaborations, 3) working closely with Departments, Institutes and Centers at CUNY who have international agreements, significant international research focus, and 4) working collaboratively with other Alliances, all of which have some developed program activities in international research.

By targeting participants of the LSAMP program in CUNY and nationally, the reported model will allow the United States to benefit from the local CUNY and national networks of over 350 colleges and universities that comprise the LSAMP program. At CUNY (and nationally), LSAMP programs are well poised to participate in international programs, and for Scholars to acquire training in an international collaborative environment, thereby contributing towards the development of a globally competent scientific and engineering workforce. From 2008 - 2016 over 170 NYC LSAMP Scholars have participated in International Research Experiences in 24 different countries.

This paper will emphasize the elements of the approach and integration into the LSAMP program operations with a focus on collaborations between NYC Alliance and three universities in Sweden (Royal Institute of Technology (KTH)), the Netherlands (Maastricht University) and Austria (TU- Graz and University of Graz). A total of fifty six (56) students participated from 2008 to 2016. Each collaborating site possessed unique training opportunities. At the Royal Institute of Technology the collaboration with an NSF funded IRE project, students were engaged in research primarily in the chemical engineering field. At Maastricht University, students were engaged in neuroscience anchored in one department with an on-site coordinator matriculated in a dual degree doctoral program at the CUNY Graduate Center and Maastricht University. A multi-disciplinary approach was applied in Austria with TU-Graz hosting the engineering students and the students in the life sciences were hosted by the University of Graz.

Introduction

The Open Doors report published by the Institute of International Education, the leading not-for-profit educational and cultural exchange organization in the United States has shown that over the last decade, (2004/5 to 2014/15), a fifty-two percent (52%) increase in the number of US studying abroad (broadly defined) and only a ten percent (10%) increase in the number of minorities studying abroad in the same period. Similarly over the same period, STEM majors going abroad showed an increase of about eight percent (7.6%). All minority students and STEM students accounted for 27% and 24% respectively, in 2014/2015¹. The importance and benefits of STEM students having an international experience has been well documented^{2, 3}. Additionally, higher education is moving forward with embracing the concept of educating engineers as a global citizen⁴.

The NYC Alliance committed to integrating international activities officially launched in 2008 at the Annual Urban University Conference Series, with the theme of Explorations and Discovery. In 2014, the Annual Global CUNY Conference was inaugurated and is held during the International Studies Week serves as a Research Colloquium and Expo, focused on highlighting projects and programs underway across the university, which have an international focus, and allows for the active participation/inclusion of STEM students⁵. LSAMP Scholars in the last eight years participated in research experiences in England, Sweden, Poland, Scotland, Spain, Italy, Germany, Austria, France, the Netherlands, Japan, China, Singapore, Australia, Vietnam, Sri Lanka, Honduras, Colombia, Costa Rica, Ecuador, Mexico, Brazil, Jamaica, Dominican Republic, St. Kitts, Ethiopia, Togo, Ghana, South Africa and Morocco⁶.

In this paper we will summarize our approach to integrating an international research (IR) experience for minority students in STEM in Sweden, the Netherlands, and Austria from 2008 to present.

NYC Alliance European Host Site Programs Overview

Graz, Austria - The Marshall Plan scholarship, funded by the Austrian Marshall Plan Foundation. It is an academic exchange program established to finance scholarships and fellowships for academic exchange between Austria and the U.S., with a special focus on universities of applied sciences, such as University of Graz (Uni Graz) and technical universities like Technical University of Graz (TU Graz). The Marshall Plan Foundation offers up to 1,000 scholarships for American and Austrian students with funding of up to € 10,000,- (at a minimum of € 3000,- 6000) for at least three months.

Stockholm, Sweden - The CCNY-KTH exchange program has supported international summer research experiences for City College of New York (CCNY) students at the Royal Institute of Technology (KTH) and KTH students at CCNY for the past eight years. The program has provided undergraduate and graduate CCNY/CUNY students with an international research experience in the collaborative research environment of several divisions at KTH. It has also provided summer research experiences for over 40 KTH students at CCNY. The research activities at KTH have mainly been centered at three KTH schools; the School of Chemical

Science and Engineering, the School of Biotechnology, and School of Industrial Engineering and Management.

Maastricht, Netherlands - At Maastricht University (MU), students are engaged in Neuroscience topics including the neural correlates of depression, Alzheimer’s disease, Drug Abuse, Epigenetics. Students learn techniques such as Microscopy, Immunohistochemistry and Stereology. The School for Mental Health and Neuroscience (MHeNS) has its niche in the complex interplay between basic brain mechanisms, brain/neurocognitive function and psychopathology, with emphasis on prevalent psychiatric, neuropsychiatric and neurological conditions. The strength of MHeNS lies in the translational aspects of fundamental neuroscience towards applied neurodegenerative and neurological neuropsychiatric strategies.

Program Model

Study abroad courses that are faculty led and short term are seen as the major vehicles for students to integrate an international experience in their curriculum. The opposite is true for the NYC LSAMP model, which has a term length of 8 weeks or more typically in the summer. A summary of the program elements at each university site is shown in Table 1. The eleven core elements of the program were deemed an integral component of the success. For example, the faculty led designation for the KTH program is linked to the career award of the faculty. TU-Graz/Univ. Graz program is also faculty led, but is based in CUNY at the City College. Exchange agreements with reciprocity also add strength to the relationship. We see the KTH and TU-Graz/Univ. Graz programs being quite similar in program elements. Both rely on a strong working relationship with the international/study abroad office at the two sites and depart from the National Science Foundation (NSF) model typically used for REU programs⁷. The MU program did not require this type of relationship. We utilized the role of an embedded site coordinator (LSAMP Doctoral candidate) to serve as a liaison to the MHeNS program researchers and administrative structures in the school.

Table 1: Program Elements at Research Site

Program Elements	KTH	MU	TU/U Graz
Site Coordinator		x	
CUNY Faculty Led	x		x
International Office	x		x
Reciprocal Program	x		x
Laboratory Bench Fee		x	
University Support	x		
Student Exchange Agreement	x		x
NSF Support	x	x	x
Fellowship funding		x	x
Undergraduate participation	x	x	x
Graduate participation	x	x	x

It should be noted that the three locations (Sweden, the Netherlands and Austria) are not in the top 20 destinations of US students studying abroad in 2014/2015¹. Additionally, the group is one hundred (100%) minority (as defined by the NSF), and one hundred (100%) STEM students, with the undergraduate and graduate participants being 53% and 47% respectively. In comparison to the reported US average of 87% graduate participants and 12% undergraduate participants and the standard NSF REU program supporting roughly 33% minority students¹.

Student Feedback

An eight-question survey was designed and distributed online to the fifty-five (55) participants at the three European based sites. The three questions targeted 1) the reasons for participating in the IR program, 2) the goals of the students for participating and if the goals were met, and 3) the importance of the IR to career and academic goals. The survey had a response rate of 50% (28 participants).

Table 2, below, shows the response to Question 1, students' goals for participation in an international research program. Only 25% indicated that they participated to increase their ability to communicate in another language, compared to 78.6% indicated the goal was to enhance their resume and 82% to obtain a greater understanding of different cultures. The two leading goals of the survey participants were to conduct research in an international environment (92.9%), and to increase their technical and scientific capabilities (92.9%).

Table 2. **Question 1** of the IR Survey

Please select all that apply for your goals for the participation in the International Research Program:	Response Percent
To travel	64.3%
To experience new places	71.4%
To enhance resume	78.6%
To increase job or graduate school opportunities	60.7%
To increase my ability to communicate in a foreign language	25.0%
To obtain a greater understanding of different cultures	82.1%
To increase self-confidence	50.0%
To conduct research/work in an international environment	92.9%
To complete an international research project	60.7%
To increase my technical and scientific capabilities in my chosen career field	92.9%

Table 3, below has the average results from, **Question 2**: Please rate how well the program goals were met in your opinion which was based on a five point Likert scale. The ability to communicate in a foreign language was rated the lowest average of 2.92. The ability to speak a foreign language also rated low on the students' goal to participate in an IR program. The ability to enhance their resume, graduate school and job opportunities scored the highest (4.77) along with the ability to conduct research in an international environment was the second highest (4.68). Additionally, 1) 74% of survey participants rated the increase in technical and scientific capabilities, 2) 81% of survey participants rated increase in greater understanding of different

cultures, and 3) 85% rated the increase in self-confidence and conducting research in an international environment as a 4.0 (very well) or better.

Table 3. **Question 2** of the IR Survey

Question 2: Please rate how well the program goals were met in your opinion. Likert Scale (1: not well to 5: extremely well)	Rating Average (Standard Deviation)
To travel and see new places	4.65 (0.56)
To enhance resume, increase job, graduate school and job opportunities	4.77 (0.51)
To increase my ability to communicate in a foreign language	2.92 (1.56)
To obtain a greater understanding of different cultures	4.31 (0.84)
To increase self-confidence	4.37 (0.74)
To conduct research/work in an international environment	4.68 (0.75)
To complete an international research project	4.38 (0.92)
To increase my technical and scientific capabilities in my chosen career field	4.28 (0.98)

Table 4 below, shows the results from Question 3 of the IR survey. Overall, respondents demonstrated strong consistency in their responses to the areas measured. For the fourteen (14) areas explored, eight (8) of the areas were rated Agree or Strongly Agree by 90% to 100% of participants. Question item nos. 4, 12, 13, and 14 were among the highest by the respondents, while question item no. 5 (knowledge of a foreign language) rated the lowest. This is not surprising as, 89% of survey participants Agreed or Strongly Agreed that their understanding of diversity and their ability to work as a member of a team as increasing. Similarly, 96% of survey participants Agreed or Strongly Agreed that thinking critically, integrating scientific knowledge and the ability to communicate effectively across cultures were increased.

Table 4. **Question 3** of the IR Survey

Question Item No.	Question 3: Please rate your level agreement to the program increasing the following statements. The program increased my:	% Participants who Agree	% Participants who Strongly Agree	% Participants who Agree or Strongly Agree
1	knowledge of the host country/site	36%	57%	93%
2	knowledge of world geography and history	43%	39%	82%
3	understanding of diversity and my ability to work as a member of a team	39%	50%	89%
4	appreciation for multiple perspectives	39%	57%	96%
5	knowledge of a foreign language	50%	14%	64%
6	my interest in participating in other International/Global programs and possibly working abroad	32%	61%	93%
7	awareness of issues of significant importance to the country/host site	50%	39%	89%

8	awareness of ethnic and cultural differences	43%	50%	93%
9	awareness of my own identity and culture	54%	32%	86%
10	opportunity to use my previous knowledge and training in a new arena	39%	54%	93%
11	scientific and technical abilities in the STEM field	36%	54%	89%
12	ability to think critically about a scientific or technical challenge and integrate knowledge	43%	54%	96%
13	ability to communicate effectively interact with people from other cultures	39%	61%	100%
14	ability to adapt unfamiliar settings and practices	29%	71%	100%

Discussion and Conclusions

From 2011 to 2016, forty seven (47) students from Uni Graz and TU-Graz have participated in the two-week seminar course (reciprocal program for Austrian students). From 2011 to 2016, twenty (20) CUNY students have conducted research (8 to 12 weeks) at TU-Graz and Uni Graz. Of the twenty students (20) students, nine (9) were awarded the Marshall scholarship. This activity is seen as extremely important in providing leveraged support, as well as a valuable network of students in Graz for the participating students.

From 2008-2016 the participants at the three European sites, seven (13%) have completed the doctoral degrees and twenty-five (45%) are currently enrolled in doctoral programs and two in Medical Degree programs (Table 5 and 6). Two of the program participants completed their doctoral degree at one of the three international sites. Of students who participated while undergraduates 52% are now enrolled or have completed the doctoral degree.

Table 5: IR Participants Program Degree Outcomes

Scholar Academic Attainment	KTH	MU	TU/U Graz
Total No. of Scholars	25	16	14
BA/BS	2	1	1
MS/MA	5	3	1
Ph.D. completion	3	2	2
Ph.D. (International)	(1)	1	-
MD	1	1	-
Current Doctoral	12	6	7
Current MA/MS	1		1
Unknown	1	2	2

Table 6: Institutions of Current Doctoral Candidates

Doctoral Institution	Number of Participants Attending
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CUNY Graduate Center	6
SUNY Stony Brook, Buffalo, Downstate	3
Rutgers University	2
University of Michigan	1
Weil Cornell	1
UC Los Angeles, Santa Barbara, Irvine	3
Stanford	1
University of Rochester	1
University of South Florida	1
Rensselaer Polytechnic	1
UMass Amherst	1
Pennsylvania State University	2
Indiana University	1
New Jersey Institute of Technology	1

The NYC LSAMP program with a close working collaborative relationship across five universities, (City University of New York, Royal Institute of Technology, Maastricht University, University of Graz and Technical University of Graz), has been able to leverage financial resources, existing programming, and an international research network to successfully integrate the high impact activity of International Research into the NYC LSAMP program operation. Examined outcomes are in-keeping with a recent study⁸. Participants report high levels of satisfaction with the program, viewing the activity as an important component of their professional, educational and academic experience and advancement in the workforce and in graduate school. We hope to increase survey response rates by making it a required task for the end of the program completion. LSAMP participants value the opportunity to work in an international environment, increasing their technical and scientific capabilities while integrating scientific knowledge and increasing the ability to communicate effectively across cultures. The ability to adapt to unfamiliar settings and practices was also seen by participants as a valued outcome of the experience, and is extremely important to academic and professional advancement. This is borne out by the high graduate school attendance rate of participants and the progression to doctoral study (58%).

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