ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #45383

NSF S-STEM Funded iAM Program: Lessons Learned Implementing a Collaborative STEM Workshop for Community College and University Partners

Prof. Margaret A Hunter, Hofstra University

Margaret Hunter,Ph.D., is an Associate Professor and Associate Chair of Engineering at Hofstra University in the Fred DeMatteir School of Engineering and Appplied Science. She has been teaching in the Civil Engineering program for 25 years. Her educational research focuses on broadening the participation in enigineering. This has included both formal and informal learning activites in pre-college, developing a course framework to aid faculty at 2 year institutions to encourage participation by women in STEM and currently involved in methods to improve retention in engineering.

Dr. Lynn A. Albers, Hofstra University

Dr. Lynn Albers is an Assistant Professor in Mechanical Engineering of the Fred DeMatteis School of Engineering and Applied Science at Hofstra University. Her previous academic contribution was as one of the founding five faculty/staff at Campbell University, helping the newly formed School of Engineering grow and establish roots in the community. A proponent of Hands-On Activities in the classroom and during out-of-school time programs, she believes that they complement any teaching style thereby reaching all learning styles. She earned her doctorate in Mechanical Engineering from North Carolina State University specializing in thermal sciences where her dissertation research spanned three colleges and focused on Engineering Education. Her passions include but are not limited to Engineering Education, Energy Engineering and Conservation, and K-20 STEM Outreach. Prior to matriculating at NCSU, she worked at the North Carolina Solar Center developing a passion for wind and solar energy research while learning renewable energy policy. She combined these passions with K-20 STEM Outreach while a National Science Foundation Fellow with the GK-12 Outreach Program at NCSU where she began Energy Clubs, an out-of-school-time program for third, fourth and fifth graders to introduce them to renewable energy.

Jessica Santangelo, Hofstra University
Prof. Jacqueline Lee, Nassau Community College

Professor Jacqueline Lee is a Professor Emerita at Nassau Community College. She received her B.S. in Animal Science from Cornell University and her M.S. in Animal Industries from the Pennsylvania State University. Professor Lee's current research interests focus on improving the college experience for STEM students at community colleges.

Catherine Weinstein
Scott T Lefurgy, Hofstra University
Sean A Roberts, Nassau Community College
Suzanne Trabucco, Nassau Community College
Kristin Weingartner, Hofstra University

NSF S-STEM Funded iAM Program: Lessons Learned Implementing a Collaborative STEM Workshop for Community College and University Partners

Abstract

In alignment with the NSF Scholarships in Science, Technology, Engineering and Mathematics Program (S-STEM) [1], a Two-Year Community College, Nassau Community College (NCC) and four-year university, Hofstra University (HU) are within a five-mile radius of each other and are collaborating. The objective is to recruit academically talented low-income students through two pipelines, retain them through transparency of the hidden curriculum, and see them through to graduation in a STEM field from HU [2]. The Integrated and Achievement Mentoring (iAM) Program is a Track 3 (multi-institution) funded program built on the theoretical framework of legitimate peripheral participation [3] with an emphasis on inclusivity, community, and belonging [4]. To date, the Program has increased Scholar retention, academic performance, and engagement with student support services relative to peers [5].

As part of the Program, an annual faculty workshop was designed to catalyze and sustain collaborations between NCC and HU STEM faculty. The workshop consisted of interactive modules to facilitate directed discussions and produce deliverables. We will share the lessons learned, obstacles overcome, and the outcomes of the collaborative process of hosting this type of workshop. The paper documents the process used to identify workshop outcomes and design activities to achieve those outcomes. It outlines specific modules utilized in the workshop including Design Thinking, curriculum alignment, idea emergence, and coalescing into sustainable Working Groups. It further addresses our approach to answer the following questions associated with the workshop: 1) What are the critical processes required to create and sustain pedagogical collaboration across institutions? 2) To what extent does the Program influence a) curricula and pedagogy; b) communication and collaboration across institutions? A summary of initial results will be shared.

Goal Relevant to the Workshop

One of the three major goals of the Program is to strengthen curricular pathways between NCC and HU. Both NCC and HU recruit annually to establish their cohorts of scholars. NCC recruits in the spring for summer start in a research program, and HU recruits in January for a spring (February) semester start. To ensure the smooth transition of NCC scholars to HU between years 2 and 3 in order to complete their four year degree in STEM, the program has established an annual workshop to bring the faculty and administrators together from both NCC and HU. The workshop was designed to engage faculty in collaborations to create a curriculum map of content, skills, and pedagogical approaches that is revisited and updated annually. The inaugural workshop was held in May of 2023 at HU and the second annual workshop was held in May of 2024 at NCC.

General Format and Models for the Workshop

The workshop planning team was made up of the PIs and one Co-PI (or senior personnel) from each institution. They met weekly starting three months prior to the selected workshop date. The PI from HU attended the first couple of weeks and then as needed to review material developed. The PI for NCC attended all of the planning meetings in the second year since it was hosted by NCC. The workshop date was set for after the end of the spring semester for both institutions and before the summer session for NCC. An invitation was sent out one to two months prior to the workshop.

The general format of the workshop developed for both years included three parts: an ice breaker, activities related to curriculum mapping across institutions, and developing future collaborations. The workshop design included an overarching goal for the day followed by objectives for each part complete with worksheets and deliverables. The parts were constructed to maximize the interactions between institutions by matching attendees to colleagues at the other institution. To increase engagement and networking, the attendees were assigned new matches for each part of the workshop. The matches were assigned according to discipline for the curriculum mapping. The session consisted of active participation with the PI teams as facilitators and/or participants depending on need. Facilitators actively circulated the room to answer questions and guide the participants.

At the conclusion, the external evaluator conducted a post workshop survey with the questions: "What did you find most valuable about today?" and "What should we change to improve your experience?"

The Inaugural Workshop Hosted by Hofstra University

The goals for the inaugural workshop were: to catalyze collaborations across institutions and generate a collective vision for the next five years. Both faculty and Collegiate Science and Technology Entry Program (CSTEP) [6] personnel were invited to the first year of the workshop.

Ice Breaker

Using an empathy map (Appendix A) for guidance, the objectives of the ice breaker were to connect with at least one new person and be able to describe their experiences. Thus, the attendees were paired with someone who was not in their discipline or institution. Pairs were determined prior to the workshop after registration had closed. The completed empathy map was the deliverable and several pairs shared their discoveries with the whole group. The reason for the empathy map was to understand the experience the other person had at their institution with the goal of HU faculty understanding the experiences at NCC and ensuring that the voices of NCC faculty would be heard and respected.

The steps for conducting the ice breaker activity are listed below.

- Interview your partner
    - Write down who they are, what they do, and why they are here today.
    - Include expectations for the day.
    - Fill in the circle with their answers.
- Take 5 minutes to create questions that will help learn more about your partner
    - Develop four questions.
    - Suggested topics for the questions are institution, culture, research, and student experience.
- Interview the person using these questions
- Volunteer to share to the whole group

Curriculum Mapping

The next part was curriculum mapping for faculty, and service identification and use for the CSTEP personnel. The goal for the faculty was to build the foundation for curricular collaboration. This was done by identifying similarities and differences with respect to topics included in relevant and/or equivalent courses and types of assessment approaches used in these courses.

Attendees were placed in groups by discipline. Prior to the event, organizers contacted attendees to get syllabi for a series of courses in each discipline that was either taught at both schools or was a prerequisite for courses at the HU. Syllabi, course summaries, worksheets and articulation agreements were distributed to each group. Course summary tables included the HU course and equivalent NCC course with the title, description, credits, lab component, modality and required materials and readings. The worksheets (Appendix B) contained prompts, questions, and guidelines.

The CSTEP attendees were given maps and worksheets to identify student services and the interaction of CSTEP with these services and STEM faculty with the following objectives:

- promote collaboration across institutions,
- document existing student services and their relationships to CSTEP, and
- identify opportunities for STEM faculty and CSTEP to collaborate.

All groups summarized their information on sticky easel pads which were then placed around the room so that attendees could walk around and observe the findings of each of the groups. The sheets were collected as the deliverables for the session.

Design Thinking and Vision for Future Collaborations

The vision for the future of the collaboration between institutions was brainstormed using the Stanford d.School design thinking process [7], [8]. The objectives were to use the design thinking

process to generate a collective vision for continuing collaboration across institutions. The design thinking process includes five steps; empathize, define, ideate, prototype, and test. The attendees were divided into pairs and asked to act as a consultant and interview their partner with the following prompt, “How would you redesign the curricular collaboration experience for your partner?” Each person then interviewed their partner to gain insight to their needs. A second round of interviews was conducted to dig deeper into the ideas developed in the first round. After the interview, the individuals used their notes to define an actionable problem statement based on the needs and insights collected in the interviews. The attendees then ideated by sketching five radical ways to solve their partner’s needs. The ideas were then shared with their partner to get feedback. The individuals then reflected and generated a sketch of a big idea solution to the need. The individuals then built their prototype of the solution. Finally, the solution was tested by sharing with their partner and getting new ideas, feedback about what worked, and what could be improved. The process was completed in timed sessions with craft materials supplied for the prototype construction. (Figure 1)

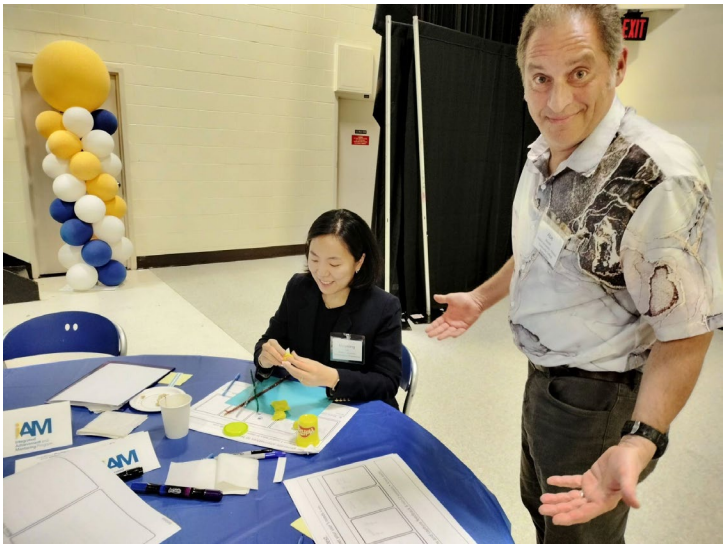

Figure 1: Dr. Minjeong Suh and Dr. Alfredo Mellace engaged in the Design Thinking process

Attendees were then assigned a larger group to collate the ideas from the design thinking process and were asked to:

1. Write your ideas and challenges, one per small sticky pad.
2. Compare your stickies at your table and group similar stickies together in themes.
3. Bring your theme-grouped stickies to a large sticky.
4. Label the large sticky with the theme.
5. Gather similarly themed large stickies together.
6. Gallery walk with little dots to indicate the ideas/challenges you are most excited about addressing.

The results of the information in the gallery walk were collected and put into a spreadsheet to find common themes. The themes are presented in the results section.

Real-time Adjustments

The organizers demonstrated great agility to reshuffle assigned groups due to absences or delays using an organization chart. On the day, the activity was altered due to time constraints, the assessment piece was reduced, and the revised prompt was added to the second portion of the curriculum mapping activity. (Appendix B)

Results from the Inaugural Year

The workshop attendance included 39 people with the following breakdown:

Role	HU	NCC
PI team	6	3
Faculty	11	10
Advisory Board	4	0
CSTEP Personnel	3	2

There were discussions and challenges that were not captured in the deliverables. The major themes from the design thinking activity were: time, students have different needs stemming from different backgrounds and/or majors, professional development, collaboration, curriculum uniformity, funding, technology, student challenges and struggles, institutional struggles, administrative support, communication, extracurricular activities, gathering more information, pedagogical solutions, and feedback.

The top eight ideas were:

1. Provide credit to participants, money or service,
2. Faculty workshops,
3. Full and part time faculty on the same page,
4. Create relationships with high schools and colleagues across institutions,
5. Extracurricular research opportunities at HU for NCC students,
6. Large consortia of institutions for curricular alignment,
7. Help students transition from passive to active learners, and
8. Develop a survey for NCC students about the transfer experience to HU.

Information gathered through the survey indicated that the attendees like the connection and collaboration with colleagues at another institution while learning about the curriculum and

challenges at each other's institutions. Some selected quotes from attendees' responses to "What did you find most valuable about today?":

"To learn that the problems I saw in the classroom, specifically students not availing themselves of support, seemed to be a universal problem and one which needed addressing. (It's not just me/my course.)"

"The collaborative meeting among faculty, CSTEP, advisement, and admissions to understand the logistics of the curriculum, transfer, and students' challenges."

"Meeting new faculty and administrators and finding out how we can collaborate."

The response to the question, "What could we change to improve your experience?" included a shorter workshop, more time with faculty in their own discipline, longer icebreaker to meet more people, and more deliverables to take with them.

Second Annual Workshop Hosted by Nassau Community College

The goal for year two was to improve the student transfer experience by ensuring students were prepared for upper level courses with both content knowledge and skills and by making sure the course objectives, activities, assessments and instructional strategies were aligned. An additional goal was to catalyze collaborations across institutions by creating working groups.

Ice Breaker

The ice breaker objectives were to learn to produce a concept map [9], connect with faculty from other institutions or departments, and gain an understanding of our NCC/HU students. This was accomplished by creating a concept map to identify the top three barriers, opportunities, similarities, and differences that students face between NCC and HU.

The attendees were assigned two to three person groups of mixed disciplines and institutions. They were tasked to produce a concept map of their undergraduate students with respect to barriers and struggles to degree completion. They were given a big sticky and two different colored pens so that challenges associated with the HU, NCC and both could be identified. The deliverable for the ice breaker was a concept map and new connections.

Curriculum Mapping

The goal for the curriculum mapping and concept mapping was to build the foundation for curricular collaboration. In 2023, the focus was on the topics covered by each institution in select STEM courses. In 2024, the focus was on the topics that students struggled with and why, which were used to develop a discussion of the related pedagogical opportunities and challenges. The

process followed by the discipline teams was to review material from the previous year and select topics that students struggled with which were then used to create a concept map on a big sticky. The deliverable was a concept map of opportunities and challenges around the selected topics that were placed along the wall to provide a gallery walk for attendees to observe.

To gather information discussed that may not be captured by the deliverables, a blank sheet of easel paper was placed on the table and labeled parking lot. The goal of the parking lot was to use the space to record institutional constraints and barriers learned about through the collaboration workshops.

Roundtable Discussions and Working Groups

In the afternoon, roundtable discussions were conducted in groups of 5 to 6 attendees. The objective of the roundtable discussions was to use the student struggles identified in the morning to generate a discussion for continuing collaboration across institutions. The following themes were addressed: Administration, Policies; Student How to College Skills (Metacognition, Hidden Curriculum, Confidence); Pedagogical Approaches and Access to Faculty Development; Transfer Pathways, Articulation Agreements; Access to UG Research.

The groups were arranged ahead of time and a scribe or notetaker was assigned to record each topic discussed separately on a small sticky to categorize on a big sticky. After the roundtable discussions, attendees selected one of the themes as a working group. Information on each topic was collected and distributed to the appropriate working group. The working groups then developed a list of goals, selected a motivator and chief, and set a date for the next meeting. The groups were encouraged to meet during the next year to work on their goals. Google folders were set up for each working group with the information collected in the roundtable discussion and a contact list of emails. Contact information was sent out in the summer to the working group leaders and a check in by email was conducted in September when the academic year began.

Results from Year Two

The workshop had an attendance of 34 people with the following breakdown:

Role	HU	NCC
PI team	4	2
Faculty	12	16

Information gathered through the survey indicated the attendees like the collaboration and networking. One attendee wrote confirming this that, “Collaborating with colleagues and articulating ideas about teaching and meeting the challenges of teaching students today.”

There is always room for improvement, and several attendees wrote that the morning session could be shortened, more detailed structure of discussions would be helpful, and more time set aside to tour the facilities.

Conclusions

Developing the collaborative STEM workshop is part of the second major goal of the iAM Program to strengthen curricular pathways between Nassau Community College and Hofstra University. The inaugural workshop in 2023 and second annual in 2024 were successful at bringing together the STEM faculty from both institutions, promoting new and strengthening existing collaborations among biology, chemistry, engineering, geology, and math faculty, and setting a positive, collaborative rapport. These workshops mark the beginning of the process to streamline the transition for students from Nassau Community College to Hofstra University and empower faculty to create change in and beyond the classroom.

The iAM Program has entered its third year and will continue to host and support the evolution of the annual workshop until the conclusion of the grant. The results discussed are for the first two years of the collaboration workshop. Overall, attendees indicated a very positive experience from the workshops. The organizers have found that the planning time is adequate and team membership works well for the development of the workshop materials. The lessons learned: be flexible at the time of the workshop to make adjustments as needed, use the PI teams at both institutions the day of the workshop to help facilitate or participate as needed, communication between the planning team and the PIs is important, have a method to capture discussions that are not directly a part of the activity, use active learning techniques for workshop sessions, collect feedback, and adjust future workshops accordingly.

We are in an iterative process for developing these workshops into a model that can be easily adopted by other Two-Year Community College and Four-Year University partners. We will continue to compile lessons learned and develop best practices that can be passed on to other institutional pairs as a guide for strengthening curricular pathways.

References

[1] "NSF scholarships in science, Technology, Engineering, and Mathematics Program (S-STEM)," NSF, https://new.nsf.gov/funding/opportunities/s-stem-nsf-scholarships-science-technology-engineering-mathematics (accessed Oct. 15, 2024).

[2] Albers, L. A., & Santangelo, J., & Hunter, M. A., & Vaccaro, J. C., & Lefurgy, S. T., & Lee, J., & Agarwal, R. (2024, June), *Board 338: NSF S-STEM: A Community College and University Partnership to Support STEM Student Success; Achievements and Challenges in the First Year of Implementation* Paper presented at 2024 ASEE Annual Conference & Exposition, Portland, Oregon. 10.18260/1-2--46919

[3] J. Lave and E. Wenger, *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press, 1991.

[4] Santangelo, Jessica, et al. "An Integrated Achievement and Mentoring (IAM) Model to Promote STEM Student Retention and Success." Education Sciences, vol. 12, no. 12, Nov. 2022, p. 843, https://doi.org/10.3390/educsci12120843.

[5] Santangelo, J., & Albers, L. A., & Hunter, M. A., & Weingartner, K., & Elijah, R., & Cohen, R., & Lefurgy, S. T., & Agarwal, R., & Filippi, L. (2023, June), *Board 213: An Expanded Integrated Achievement and Mentoring (iAM) Program to Promote Access to STEM Professions* Paper presented at 2023 ASEE Annual Conference & Exposition, Baltimore , Maryland. 10.18260/1-2--42630

[6] "Collegiate science and technology entry program (CSTEP)," New York State Education Department, https://www.nysed.gov/postsecondary-services/collegiate-science-and-technology-entry-program-cstep (accessed Oct. 6, 2024).

[7] Stanford d.school, https://dschool.stanford.edu/ (accessed Apr. 13, 2023).

[8] "Design thinking crash course video," Vimeo, https://vimeo.com/180433845 (accessed Apr. 13, 2023).

[9] C. Bodnar and E. Barrella, "'Master' Entrepreneurial Mindset Concept Map, Card #1018," Engineering Unleashed, https://engineeringunleashed.com/ (accessed Apr. 19, 2024).

Appendix A: Empathy Map Worksheet

Appendix B - Curriculum Collaboration Workshop

Our goal is to answer the following questions:

(1) To what extent do students exit our introductory [insert discipline here] courses having been exposed to the same topics*?

(2) To what extent are there differences between the intro [discipline] courses at NCC and HU? Why do those differences exist?

(3) Which topics* do faculty identify as "must have" topics in the intro courses. Are there differences between what NCC and HU faculty view as "must have" topics? Why do those differences exist?

*If you are working on the lab portion of a course, rather than listing topics, list skills.

Part 1: Topics and Skills

List topics covered in the introductory courses at NCC and HU using the syllabi and your knowledge of the course(s). Use a big sticky note (or two) with information organized in a table or a Venn diagram.

Table 1: Example table to put on a big sticky to map differences and similarities between equivalent introductory courses at NCC and HU.

Course Numbers			
NCC and **HU Topics/Skills in Common**	**Significant differences?**	**Reasons for being different?**	**Notes**

Part 2: Assessment and Pedagogy

Our goal is to answer the following questions:

(1) To what extent are students in our introductory [discipline] courses exposed to similar assessment types and classroom or laboratory experiences?

(2) To what extent are there differences between the introductory [discipline] assessment types and classroom or laboratory experiences at NCC and HU? Why do those differences exist?

Table 2: Example table to put on a big sticky to map differences and similarities between assessment types and classroom or laboratory experiences in equivalent introductory courses at NCC and HU.

Example	**NCC**	**HU**	**Significant difference?**	**Reason for being different?**	**Notes**
How are students assessed (i.e., exams, essays, projects, etc.) and with what frequency?					
Grading policies (e.g., is there a curve or another system used?)					
Classroom experiences					
Lab experiences					

Revised Prompt for Part 2

Goal: Use this work as the baseline / foundation for future work. At the minimum: Record on a sticky easel pad two pieces to guide our continued work as a group:

1. The most important part of your conversation

   What do you see as priorities to target to positively impact the student experience

2. Challenges you identified that students may face transferring to HU

   Ex: NCC circuits course does not include some topics required as pre-req knowledge for HU upper level electrical engineering courses.

Appendix C - CSTEP Collaboration Workshop

Objectives:

Promote collaboration across institutions.
Document existing student services and their relationships to CSTEP.
Identify opportunities for STEM faculty and CSTEP to collaborate.

(1) Use the campus maps to indicate where each service is physically located.

(2) On a big sticky, complete a table like this example table:

Student Service	How students access the service (Note: how easy/convenient is it to access the service)	Does/how does your CSTEP program integrate with that service

(3) Discuss among your group and capture on a big sticky note:

A. What interactions does your CSTEP program have with faculty in different majors? For example, summer programs, presentations during the academic year, etc?	
B. Which STEM majors you want more information about or activities to engage students?	
C. What would be most helpful to support students in NCC CSTEP to successfully transfer to HU?	
D. What should the (name) Program keep in mind with respect to supporting STEM student success at NCC and HU?	
E. How would you like to see the (name) Program interact with CSTEP?	