Broadening Participation through a Community-Building Approach in STEM: Carleton College's Cohort Program Components and Evaluation

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What Led Us to Develop These Programs?

• Awareness of need for change on campus:
  – Observations from faculty and staff
  – Students let us know how things were going
• Success of other cohort programs on campus including TRiO, POSSE, and Mellon Mays
• Examples of cohort program success at other institutions, especially Meyerhoff Scholars (UMBC) and Biology Scholars Program (UCB).
Our Program Model

Persistence in Science and Math

Academic Success

Drive to Succeed in STEM
Support for Learning
Sense of Belonging

A customization of Jolly’s ECC trilogy
• Engagement (that which draws the learner to study)
• Capacity (the knowledge that is necessary to advance)
• Continuity (a system that offers resources necessary for advancement)

Our STEM Cohort Programs

**Focusing on Cultivating Scientists (FOCUS)**

- Incoming first-year students (12 – 15 per year)
- Embedded in curriculum
  - First-year seminar
  - Two-Year-long colloquium
- Provides information about opportunities and connections to students
  - Work-study
  - Peer-mentoring
  - Connections within STEM
- Started in 2007

**Carleton Summer Science Fellows (SSF)**

- Rising sophomores and juniors (4 – 5 per year)
- Summer-research focused
- Funding for 2 summers
  - On-campus mentors
  - Off-campus mentors or REUs
- Cohort activities during the academic year
  - Research socialization
  - Poster presentation practice
  - Lab visits
- Started in 2008

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Who Are Our Students? (Classes of 2015 – 2018)

>80% of FOCUS Students Are STEM Majors*

*A Class of 2018 has not declared their majors, in accordance with College policy.
Evaluation Methods

- Science and Math Attitudinal Surveys – URSSA and others
- Formative Surveys – Check-In and others
- SURE pre-reflection plus Carleton specific questions on help-seeking and barriers
- Interviews
- Observations
- Demographic and Registrar Data
Evaluation Based on Program Model

Persistence in Science and Math

Academic Success

Drive to Succeed in STEM
Support for Learning
Sense of Belonging

Investigate barriers to student learning
Identify what supports and contributes to...
Sense of Belonging

Average First-Year Pre-responses (Cohorts 2013-2017), n = 74

Average Senior Post-responses (Cohorts 2011-2014), n = 26

7 point Likert Scale
1 = low, 7 = high

- I feel comfortable in approaching faculty members when I need help.
- I have confidence in my ability to get involved with student study groups.
- I have a sense of belonging at Carleton.
- I have a sense of belonging in the Carleton science and math departments.
The “out of place” feeling described is not confined to URM students. It was reported at statistically similar levels by all students doing summer research on campus in STEM (URSSA Survey) as well as by the larger “College” community (results were independent of class year).

This is clearly an institution-level issue, and solutions which address this feeling among cohort students should benefit all students.
### Identified Barriers by Year in Program

- **Difficulty with time management**
- **Difficulty developing productive strategies for studying**
- **Lacking good faculty mentorship and/or advising**
- **Lacking friends with the same academic interests**
- **Think (or worried that others think) you are unprepared for math/science classes**
- **Feeling isolated**
- **Feeling like you don’t belong**
- **Financial need/concern**

#### Identified Barriers by Year:

- **FOCUS/CSSF First Year Check-In (2015-2017), n = 40**
- **FOCUS/CSSF Second Year Check-In (2014-2016), n = 26**
- **FOCUS/CSSF Third Year Check-In (2013-2015), n = 23**
- **FOCUS/CSSF Fourth Year Check-In (2012-2014), n = 17**

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[Bar Chart](chart_url)
Think (or worried that others think) you are unprepared for math/science class = 61%

Worried that others think you are unprepared for math/science class = 50%

These are the top two barriers selected by students in Spring 2015.
Students’ Supports for Learning – How to Overcome Barriers to Learning

Academic Success

Drive to Succeed:
- Introduction to a wide variety of STEM fields, potential careers, and professional practices
- Participation in research

Support for Learning:
- Seeking out help from staff, faculty, peers, and support centers
- Taking STEM courses early
- Studying with peers
- Participation in research

Sense of Belonging:
- Social events, seminars, and curriculum that encourages comfort with faculty
- Shared courses, research, mentors, or social experiences with peers
Some Conclusions

• Faculty and peer mentorship continue to be critical components to students connecting with the math and science community.

• FOCUS and CSSF students show a very high interest in and enjoyment of math and science and have increasing confidence in science and math abilities from first to fourth years at Carleton.

• Research/research-like experiences
  – the experience that has most contributed to building confidence in FOCUS students' ability to pursue a major in math or science
  – faculty and advisors, specific courses, and study abroad also described as critical incidents.
Lessons Learned From BSP

• Listen to your students. Develop the program that they need to be successful in your institution.

• Make it abundantly clear that the program is about the students and not merely to fulfill an institutional goal.

• Create a community that is big enough to support all students and small enough to remain personal.

• Have high expectations for students and then help them figure out how to define and reach their goals.
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Student Voices
About Belonging, Support, and Engagement in STEM

“I feel like I am more a part of the science community, as well as more knowledgeable about science at Carleton than I would be otherwise” (Freshman FOCUS survey, Spring 2011).

“I have decided to major in chemistry and I know a lot of the science professors because of FOCUS. I have a lot of friends from within FOCUS” (Sophomore FOCUS survey, Spring 2011).

“FOCUS is very diverse and there is a sense of unity” (Freshman FOCUS survey, Spring 2011).

“I am very grateful to be a member of FOCUS... Through FOCUS, I learnt various skills such as using excel (and) writing a lab report. In addition to that I got a lot of advice from my teachers and peers” (Freshman FOCUS survey, Spring 2011).

“FOCUS has benefitted me greatly in my career and experiences at Carleton. Without the support, I would not be where I am” (Sophomore FOCUS survey, Spring 2011).
FOCUS Cohort Activities

**Required Two-Year FOCUS Colloquium**
- Excel Skills
- Academic Civic Engagement Project
- Cohort Building Activities
- Library Skills
- Modeling Numerical Data
- Student Panels about Research
- Writing Lab Reports
- Designing Lab Experiments
- Meeting Multiple STEM Faculty
- Writing a Resume (with Career Center)

**Required First-Term Argument and Inquiry Seminar on STEM Topic**
- 2008 and 2011: Brain, Mind, and Behavior
- 2009: Nano-science and Nanotechnology
- 2010: Air Pollution and Human Health
- 2012: Geology in the Field

**Research Project in the Community (Sophomore Colloquium)**
- 4 Hour/Week Work Study Option*
- Opportunities to Attend Regional and National Meetings*
- Significant Role in Recruiting the Next Cohort*

**Pre-Registration for STEM Courses in Fall/Winter of First Year**
- 4 Hour/Week Work Study Option*
- Opportunities to Attend Regional and National Meetings*
- Significant Role in Recruiting the Next Cohort*
- Working with Peer-Mentors in All STEM Courses*

*Available to students in all class years.

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Carleton College
Summer Science Fellows Program

**Cohort Activities**
- Elevator Talk Before Research Starts (Spring), Based on Literature
- Hallway Talk After Research Experience (Fall)
- Cohort Building Activities
- Communication Skills in Science
- Invited Speakers (Alums, PIs)
- Applying to REU Programs
- Field Trips to Labs
- How to Ask for Letters of Recommendation
- How to Write a Personal Statement
- How to Think About a Career Trajectory in Science/Math
- What is a Postdoc?

**Summer Research Experiences with Stipend Support from Carleton College**
- 2 Summers of Research Stipend for Use at Carleton or Another Institution
- Poster Presentations at Carleton College All-Science Poster Session
- Funding to Present Research at Regional or National Conference

**Community Outreach Activities**
- Recruiting Applicants for Summer Science Fellows Program on Campus
- Mentoring New Summer Science Fellows
- Work With Under-represented Middle and High School Students from Local Community