

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

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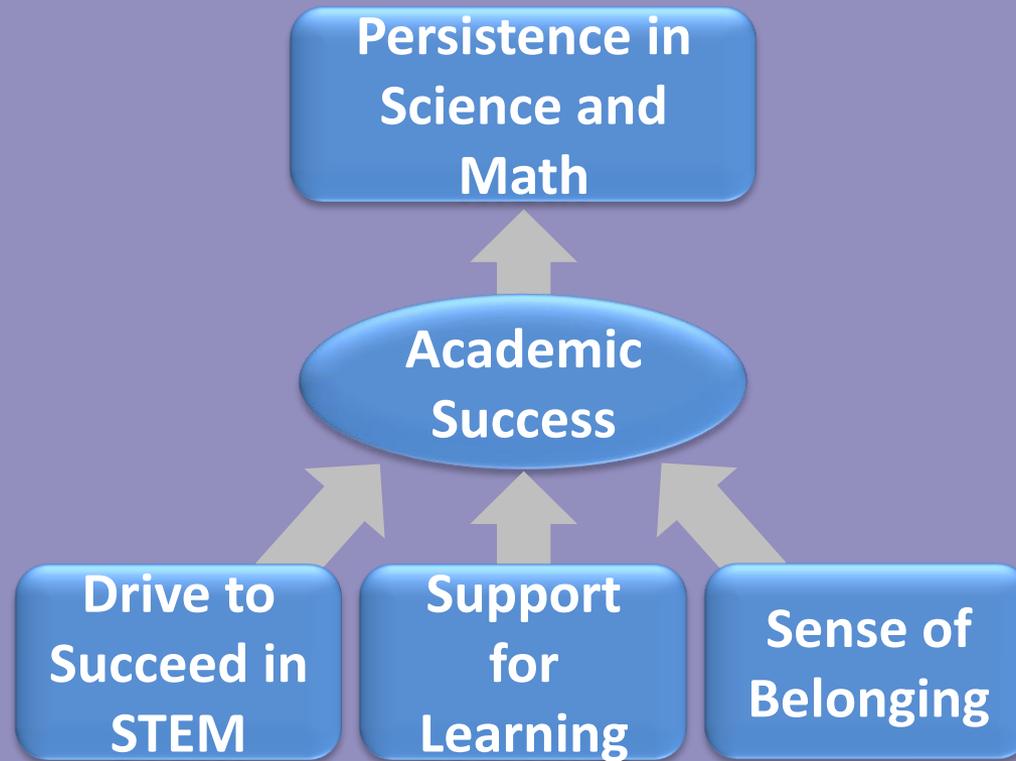


Carleton College

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



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)

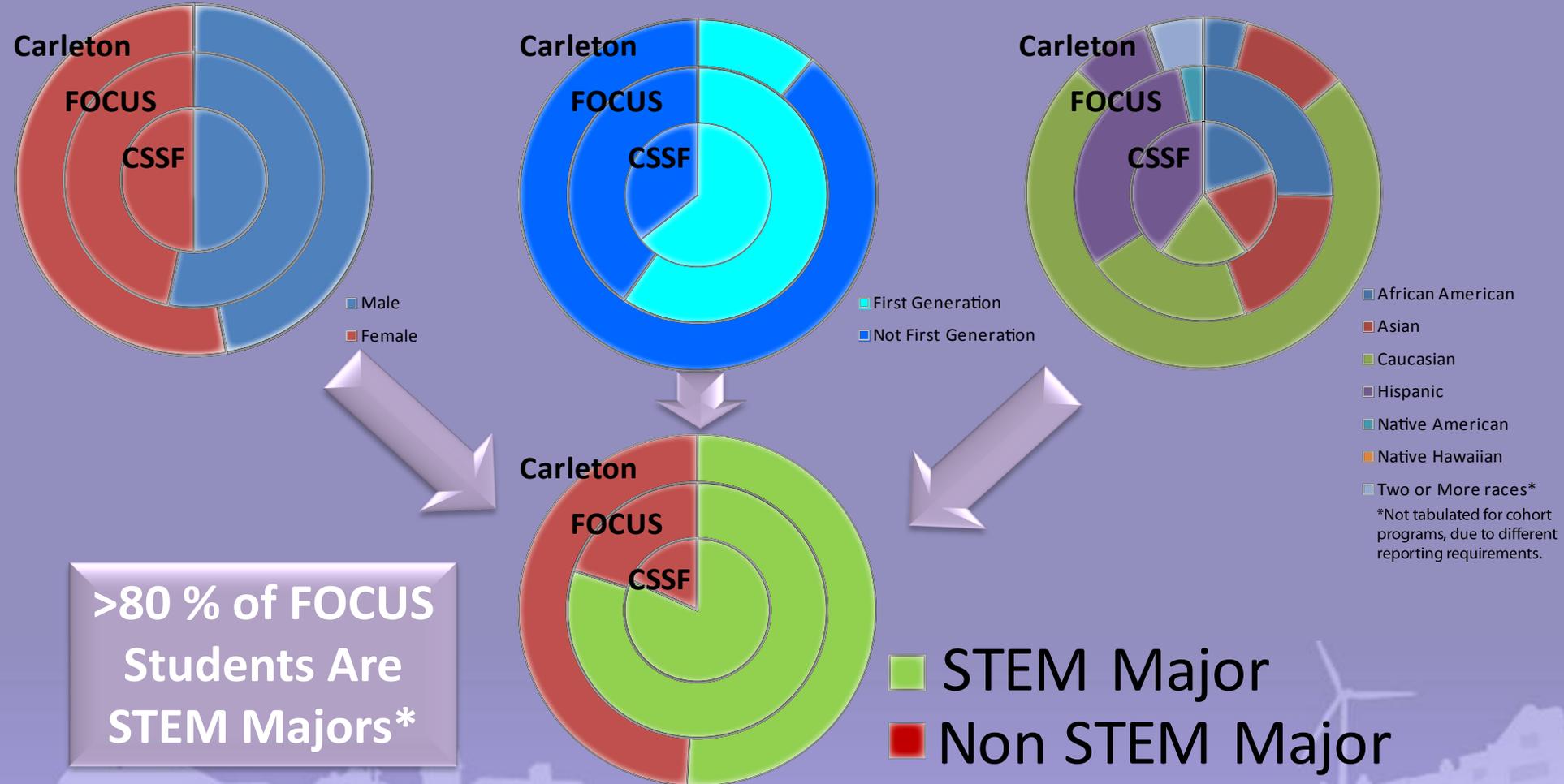
- Incoming first-year students (12 – 15 per year)
- Embedded in curriculum
 - First-year seminar
 - Two-Year-long colloquium
- Provides information about opportunities and connections to students
 - Work-study
 - Peer-mentoring
 - Connections within STEM
- Started in 2007

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

Funding from HHMI, NSF (S-STEM and LSAMP), and Carleton College

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



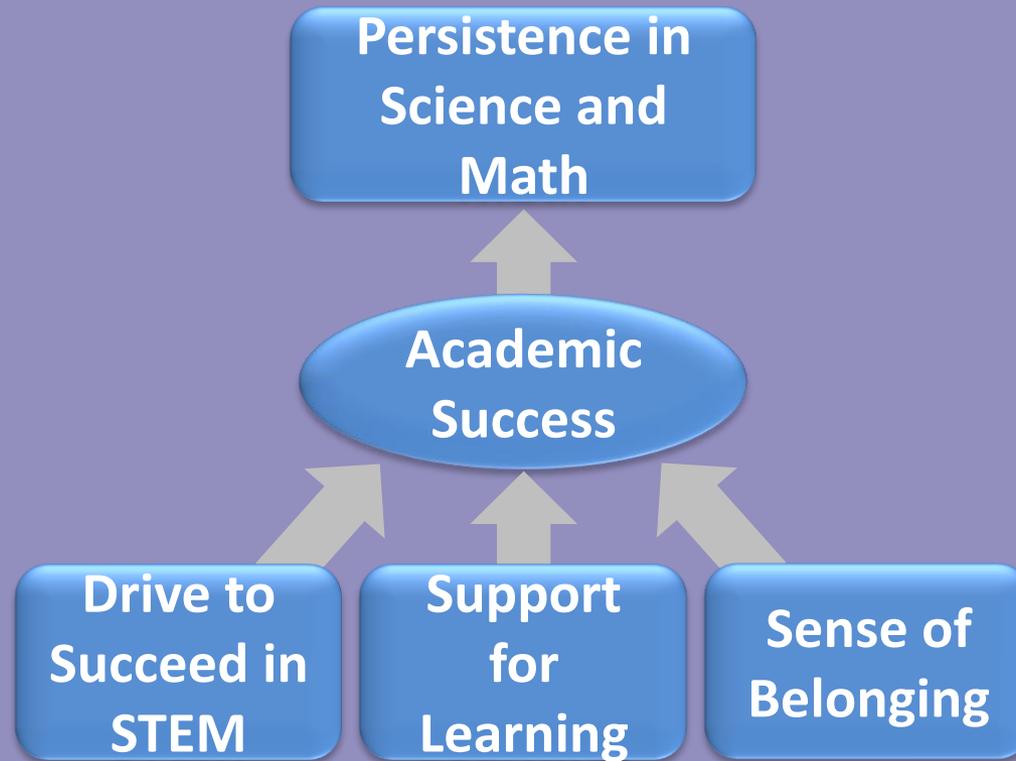
**>80 % of FOCUS
Students Are
STEM Majors***

*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

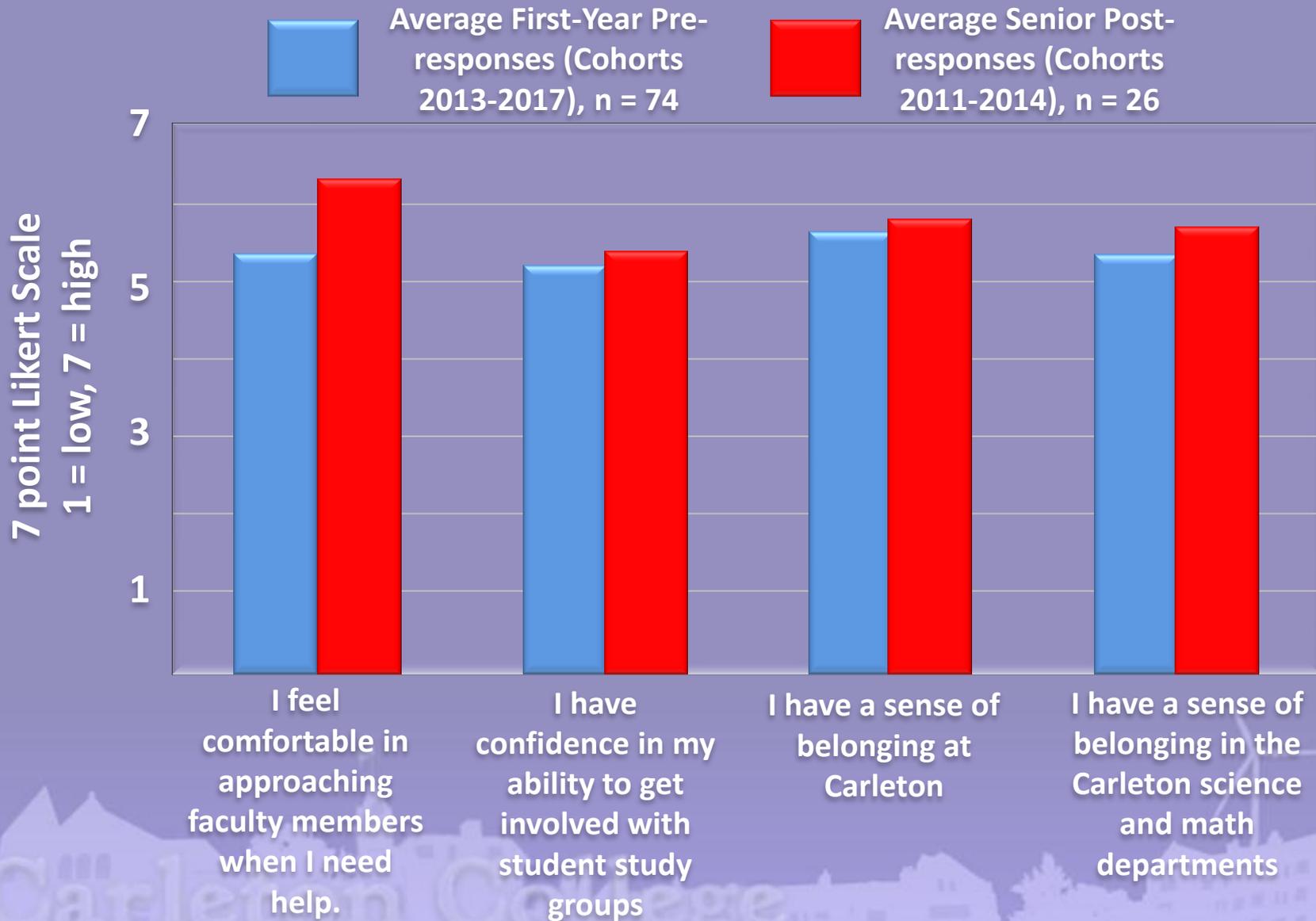
Evaluation Based on Program Model



Investigate
barriers to
student learning

Identify what
supports and
contributes to....

Sense of Belonging



Students' Barriers to Learning

Belonging

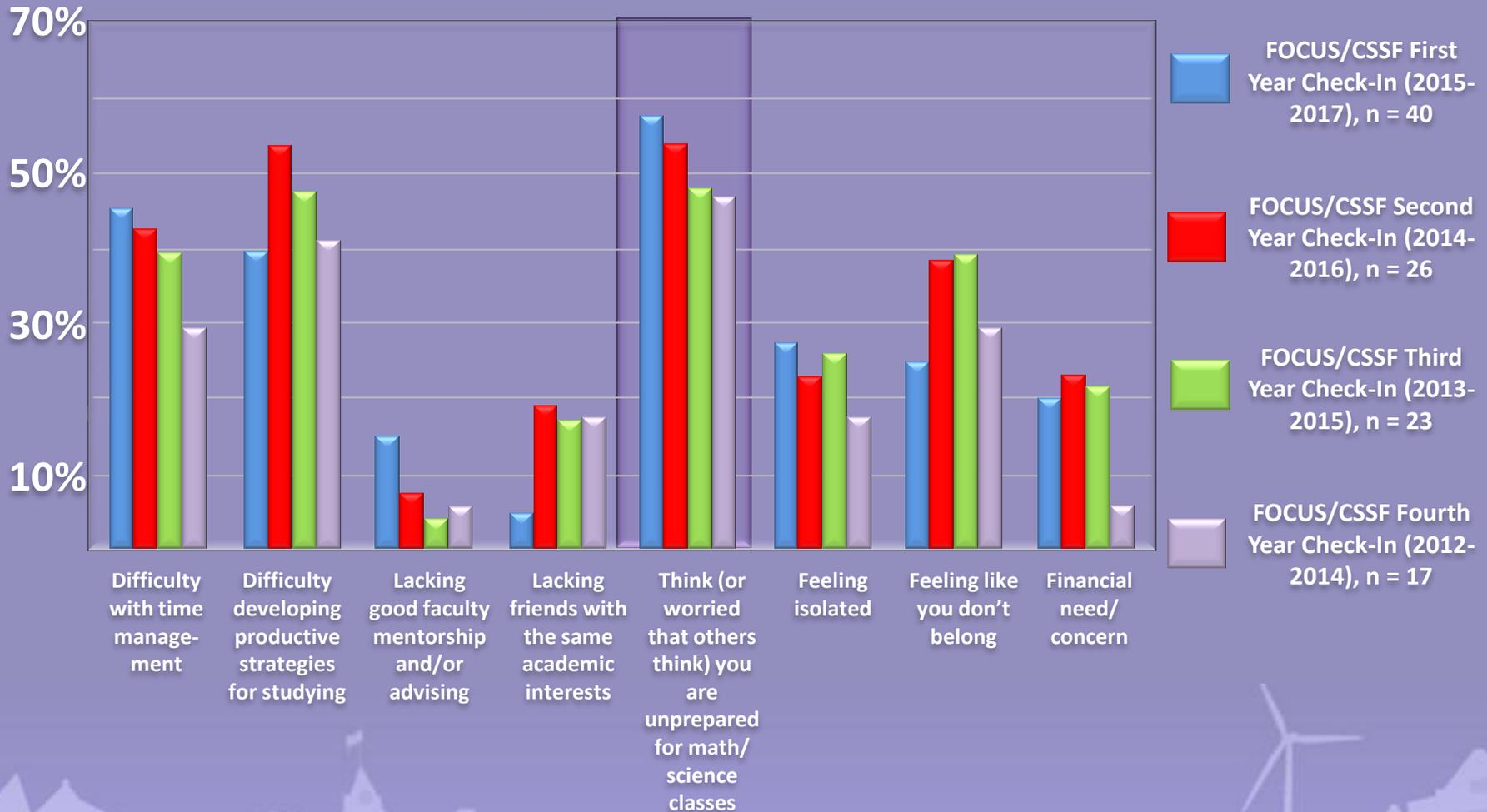
Mentorship and
Advising

Time
Management
and Studying

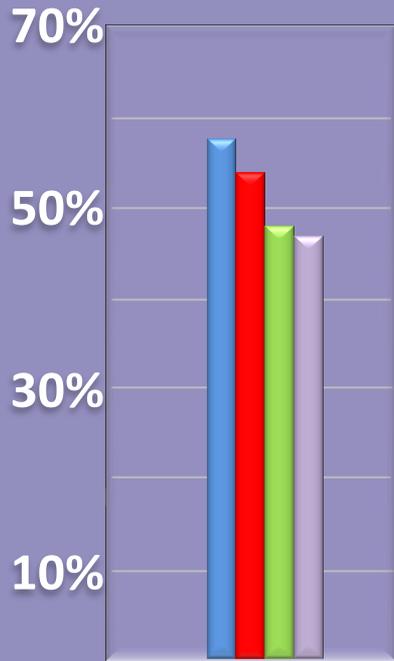
Feeling
Underprepared

- 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



Sense of Being Underprepared



Think (or worried that others think) you are unprepared for math/science classes

Think that you are underprepared for math/science class = 61%

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

These are the top two barriers selected by students in Spring 2015.

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

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

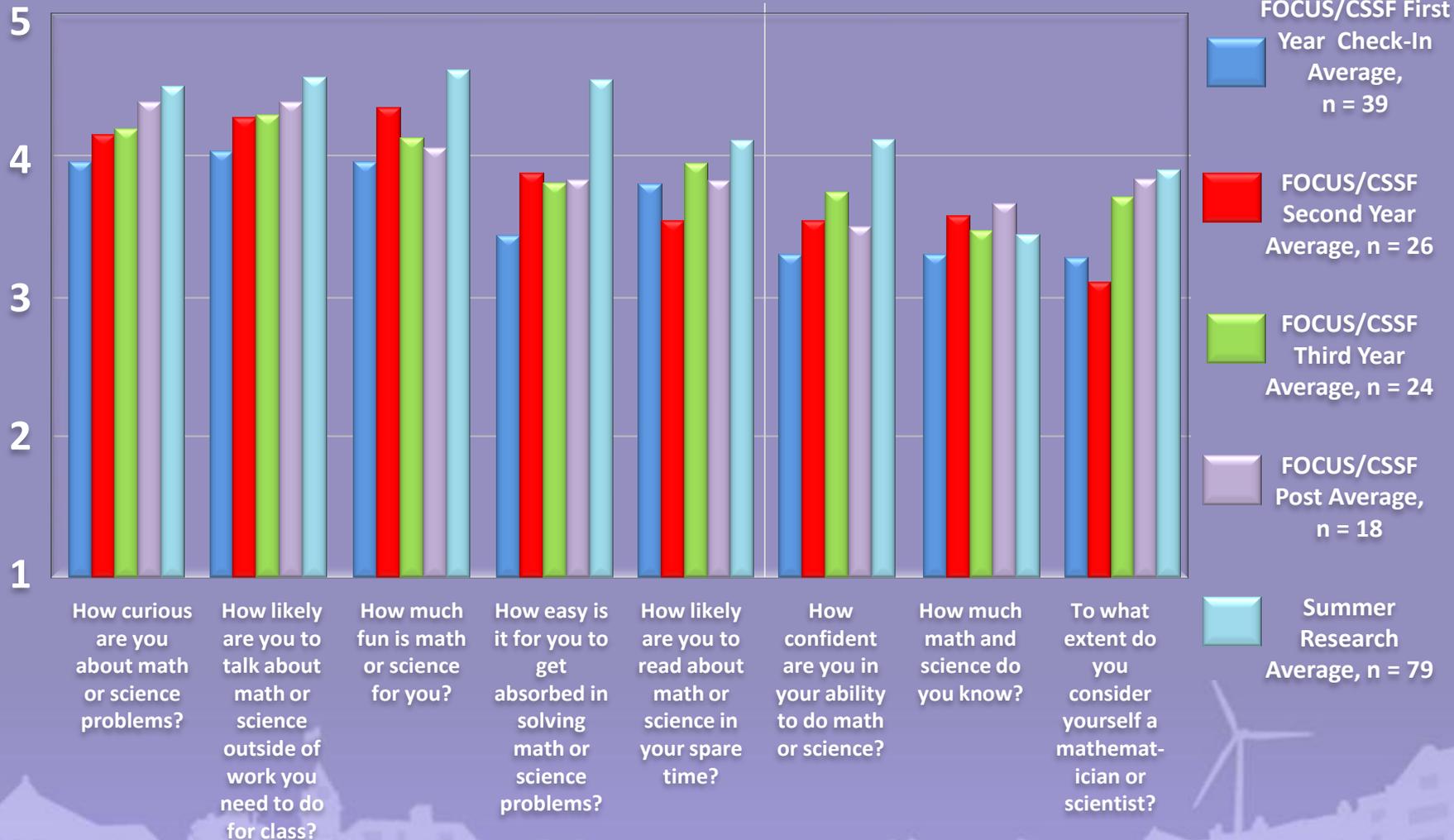
Shared courses, research, mentors, or social experiences with peers

STEM Identity Questions

Curiosity and Enjoyment Questions

Confidence Questions

Average Response to STEM Identity Questions (5 = high, 1 = low)



Some Conclusions

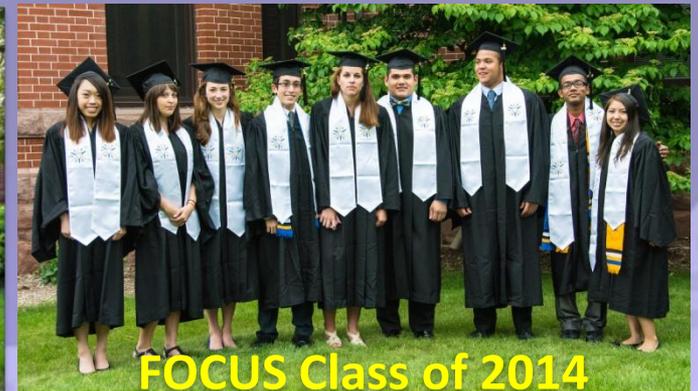
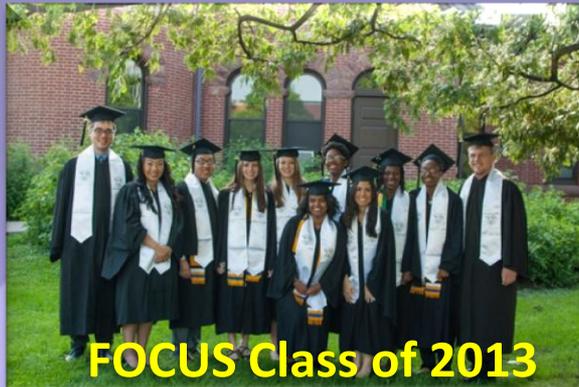
- Faculty and peer mentorship continue to be critical components to students connecting with the math and science community.
- FOCUS and CSSF students show a very high interest in and enjoyment of math and science and have increasing confidence in science and math abilities from first to fourth years 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).

A silhouette of a college campus is shown against a blue sky. The buildings are in the foreground, and a wind turbine is visible on the right side. The text "Carleton College" is overlaid on the bottom left of the image.

Carleton College

FOCUS Cohort Activities

Required Two-Year FOCUS Colloquium

Excel Skills

Academic Civic Engagement Project

Cohort Building Activities

Oral Presentations

Library Skills

Modeling Numerical Data

Choosing Classes

Student Panels about Research

Writing Lab Reports

Strategies for Faculty Office Hours

Designing Lab Experiments

Writing a STEM Biography Of Faculty

Writing a Resume (with Career Center)

Meeting Multiple STEM Faculty

Required First-Term Argument and Inquiry Seminar on STEM Topic

2007, 2013: Science, Technology, and Public Policy

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

STEM-rich Academic Advising*

Mentoring FOCUS Peers in STEM Courses (Paid)*

Working with Peer-Mentors in All STEM Courses*



*Available to students in all class years.

Summer Science Fellows Program

Cohort Activities

Elevator Talk Before Research Starts (Spring), Based on Literature

Hallway Talk After Research Experience (Fall)

Cohort Building Activities

How to Talk With Research Mentors

How to Ask for Letters of Recommendation

Communication Skills in Science

Discussions About What to Expect in First Summer of Research

Invited Speakers (Alums, PIs)

How to Write a Personal Statement

Applying to REU Programs

How to Think About a Career Trajectory in Science/Math

What is a Postdoc?

Field Trips to Labs

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