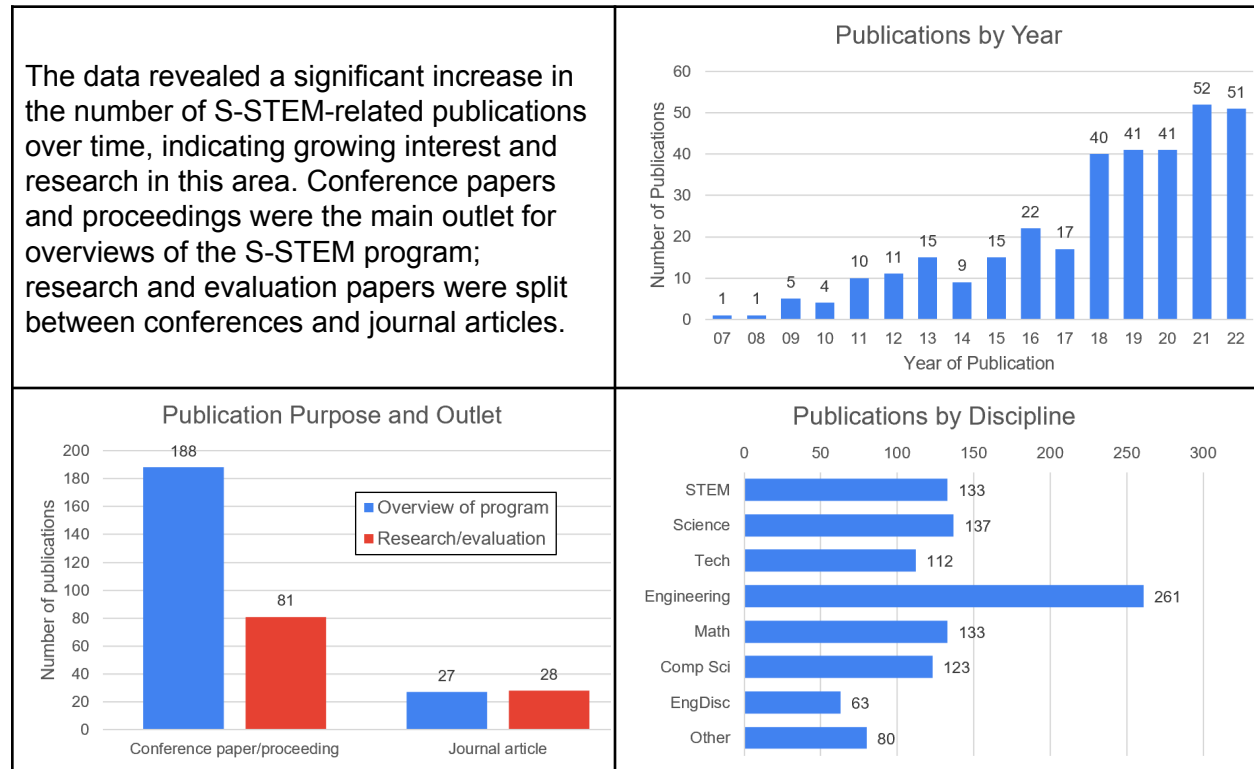# Systematic Literature Review:
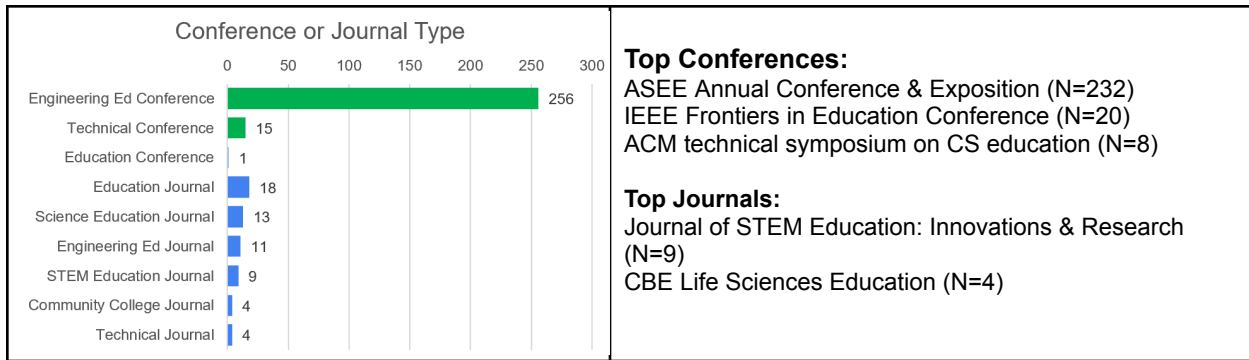## S-STEM Programs in Engineering and Computer Science

ROPES Hub, October 2024

## Background:

In collaboration with the staff at Virginia Tech Libraries, we conducted a systematic literature review (SLR) to examine publications related to the S-STEM program since it began in 1998, with a focus on engineering and computer science. We used a comprehensive search strategy that included relevant terms and award numbers. This initial search yielded 12,952 potential matches. After screening the titles and abstracts, we performed a full-text review on 643 items. From these, 335 publications met our inclusion criteria, and we extracted relevant information from these selected works.

## Characteristics of the publications:

The data revealed a significant increase in the number of S-STEM-related publications over time, indicating growing interest and research in this area. Conference papers and proceedings were the main outlet for overviews of the S-STEM program; research and evaluation papers were split between conferences and journal articles.



Publications by Year



Publication Purpose and Outlet



Publications by Discipline

## Conference or Journal Type

| Type | Count |
|---|---|
| Engineering Ed Conference | 256 |
| Technical Conference | 15 |
| Education Conference | 1 |
| Education Journal | 18 |
| Science Education Journal | 13 |
| Engineering Ed Journal | 11 |
| STEM Education Journal | 9 |
| Community College Journal | 4 |
| Technical Journal | 4 |

**Top Conferences:**
ASEE Annual Conference & Exposition (N=232)
IEEE Frontiers in Education Conference (N=20)
ACM technical symposium on CS education (N=8)

**Top Journals:**
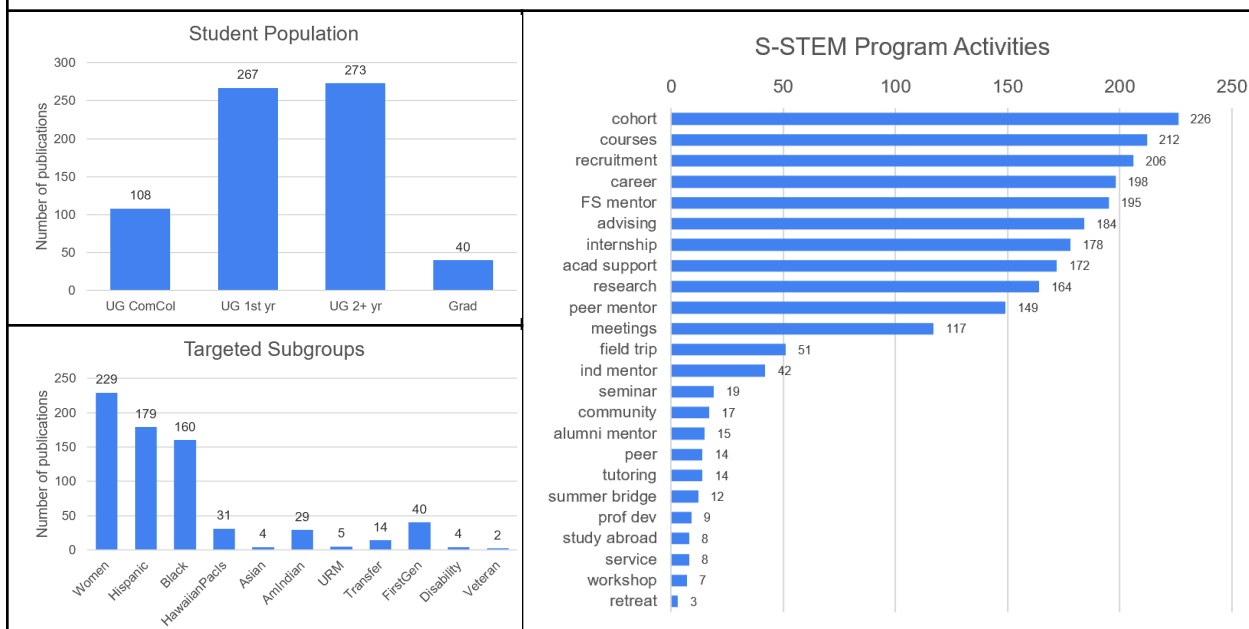Journal of STEM Education: Innovations & Research (N=9)
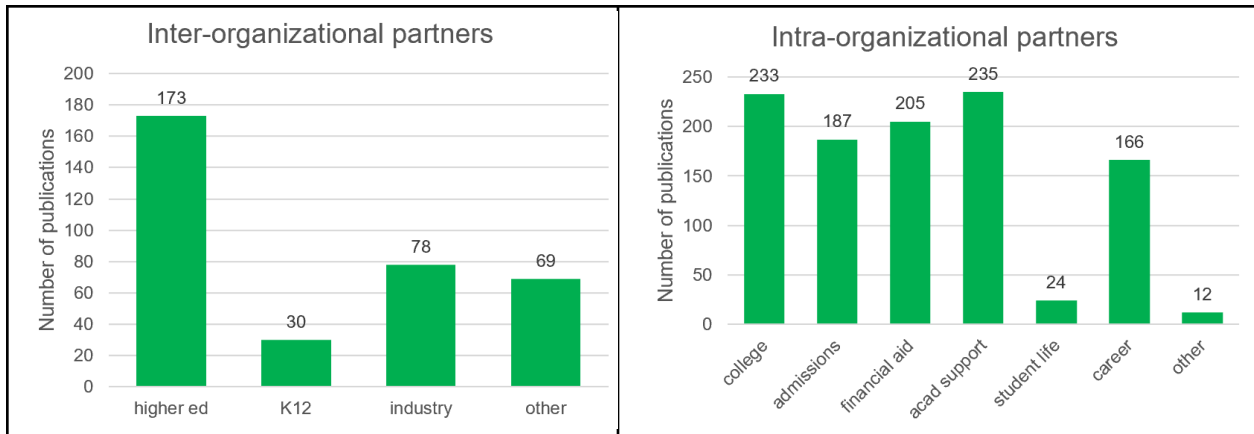CBE Life Sciences Education (N=4)

## S-STEM program characteristics:

Most of the publications in our review focused on undergraduate students. Besides targeting low-income students, many of the S-STEM programs also aimed to attract female, Hispanic, and Black students. These programs included a variety of activities, with cohort-building activities, specialized courses for S-STEM students, and recruitment events being the most common. On average, each program offered 6.7 different activities.

### Student Population

| Population | Number of publications |
|---|---|
| UG ComCol | 108 |
| UG 1st yr | 267 |
| UG 2+ yr | 273 |
| Grad | 40 |

### S-STEM Program Activities

| Activity | Count |
|---|---|
| cohort | 226 |
| courses | 212 |
| recruitment | 206 |
| career | 198 |
| FS mentor | 195 |
| advising | 184 |
| internship | 178 |
| acad support | 172 |
| research | 164 |
| peer mentor | 149 |
| meetings | 117 |
| field trip | 51 |
| ind mentor | 42 |
| seminar | 19 |
| community | 17 |
| alumni mentor | 15 |
| peer | 14 |
| tutoring | 14 |
| summer bridge | 12 |
| prof dev | 9 |
| study abroad | 8 |
| service | 8 |
| workshop | 7 |
| retreat | 3 |

### Targeted Subgroups

| Subgroup | Number of publications |
|---|---|
| Women | 229 |
| Hispanic | 179 |
| Black | 160 |
| HawaiianPacIs | 31 |
| Asian | 4 |
| AmIndian | 29 |
| URM | 5 |
| Transfer | 14 |
| FirstGen | 40 |
| Disability | 4 |
| Veteran | 2 |

## Partnerships:

Partnerships played a crucial role in these S-STEM programs. Twenty-two percent of the publications focused specifically on partnerships, and 98% mentioned at least one partnership. Other higher-education institutions were the most common inter-organizational partners. Additionally, the programs often included intra-organizational partnerships across various areas of the college or university. On average, each publication referenced 4.4 partnerships.

## Inter-organizational partners

Number of publications

| higher ed | K12 | industry | other |
|-----------|-----|----------|-------|
| 173 | 30 | 78 | 69 |

## Intra-organizational partners

Number of publications

| college | admissions | financial aid | acad support | student life | career | other |
|---------|------------|---------------|--------------|--------------|--------|-------|
| 233 | 187 | 205 | 235 | 24 | 166 | 12 |

# Characteristics of partnering institutions:

For each publication, we identified the higher ed institutions that were involved in the partnership, yielding 450 institutions (some schools were involved in multiple publications, and many publications included multiple schools). We linked each school to IPEDS data, in order to provide an overview of the general characteristics of these institutions.

## Sector

Public_2yr, 88, 20%
Private_4yr, 69, 15%
Public_4yr, 290, 65%

## Region

SEast, 111
SWest, 92
West, 58
GrLakes, 68
Plains, 25
NewEngland, 14
MidEast, 53
Rockies, 20
Oth… 7

## Institution size

Number of schools

| under 1000 | 1000-5000 | 5000-10,000 | 10,000-20,000 | above 20,000 |
|------------|-----------|-------------|---------------|--------------|
| 3 | 95 | 70 | 84 | 194 |

Number of students at institution

## Count by % of students on Pell Grants

Number of schools

| [0, 5] | (5, 10] | (10, 15] | (15, 20] | (20, 25] | (25, 30] | (30, 35] | (35, 40] | (40, 45] | (45, 50] | (50, 55] | (55, 60] | (60, 65] | (65, 70] |
|--------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 4 | 5 | 37 | 78 | 71 | 79 | 72 | 37 | 19 | 20 | 4 | 10 | 10 | 4 |

Percentage of students receiving Pell Grants

## HBCU or Land Grant status

Number of schools

| | HBCU | Land Grant |
|------|------|------------|
| yes | 12 | 93 |
| no | 436 | 355 |

## Data and framework used in research/evaluation publications:

For the 111 papers focused on research or evaluation, the most commonly reported data types were from surveys and student interviews. Relatively few of these papers identified a theoretical framework, but student-focused theories dominated the list.

### Data Types

| Data Type | Count |
|---|---|
| surveys | 80 |
| student interviews | 62 |
| focus groups | 38 |
| student reflections | 27 |
| counts | 10 |
| faculty interviews | 6 |

### Theoretical Framework

| Framework | Count |
|---|---|
| Identity | 16 |
| Motivation | 10 |
| Belonging | 4 |
| Student Involvement | 4 |
| Social Cognitive | 2 |
| Change | 1 |
| Learning | 1 |
| Program | 1 |
| System | 1 |