

Department of Defense

DoDSTEM

Science • Technology • Engineering • Mathematics



YEAR IN REVIEW: FY 2019

DECEMBER 2021

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The Federal STEM Education Strategic Plan states that the pace of innovation is accelerating globally and, with it, the competition for scientific and technical talent. It further notes that now more than ever, the innovation capacity of the United States will depend on an effective and inclusive STEM education system¹. A readily accessible, highly technical and diverse STEM talent pool is essential to the success of the Department of Defense (DoD) and a national security imperative. As the largest employer of Federal scientists and engineers across the Federal agencies, with 47% of the Federal STEM workforce employed at DoD facilities², the Department is committed to developing the Nation's STEM talent.

The DoD employs a comprehensive approach to develop STEM talent with K-12, postsecondary, and workforce STEM education and talent development efforts, known as DoD STEM³. The Office of the Undersecretary of Defense for Research and Engineering (OUSD(R&E)) provides policy and oversight to DoD STEM education and workforce development programs, activities, and outreach efforts across the Components⁴. The mission of DoD STEM is to inspire, cultivate, and develop exceptional STEM talent through a continuum of opportunities to enrich our current and future DoD workforce poised to tackle evolving defense technological challenges. DoD STEM activities support this mission by providing authentic learning experiences through a variety of education and outreach initiatives in the form of scholarships, internships, enrichment activities, competitions, mentorships, and more by leveraging partners from industry, academia, and other government organizations with a shared STEM mission. This Year in Review is a snapshot of DoD STEM's programming in fiscal year 2019 (FY 2019) and will be followed by a full report on the impact of those activities, the individual contributions of each Component, and how DoD STEM programming addresses national challenges in STEM education.

1. Each component brings unique contributions to the overall DoD STEM Strategy.

Making progress toward accomplishing the DoD STEM mission and, ultimately, the DoD mission, requires collaboration across the Department. The Components and the Department implemented and executed programs that reach across all age groups and incorporate a range of programs and types of activities. The Components include Army, Department of Navy (DON), Air Force, Department of Defense Education Activity (DoDEA), and Fourth Estate Agencies (for FY 2019 reporting purposes, these include Missile Defense Agency (MDA), Defense Threat Reduction Agency (DTRA), and National Geospatial Agency (NGA)). The Department runs programs through multiple Offices, including the Office of the Assistant Secretary of Defense for Manpower & Reserve Affairs (OASD(M&RA)) and the Office of the Undersecretary of Defense for Research and Engineering (OUSD(R&E)).

1. <https://dodstem-assets.dodstem.us/files/2018-23-Federal-STEM-Education-Strategic-Plan.pdf>

2. Based on Office of Personnel Management FedScope Data, June 2019 (<https://www.fedscope.opm.gov/>)

3. dodstem.us

4. Components: The Office of the Secretary of Defense (OSD), the Military Departments, the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities within DoD.

Table 1. Components Contribution to Implementing DoD STEM Strategy.

		Army	DON	Air Force	Tri-Services ⁵	DoDEA	DTRA	MDA	NGA	OASD (M&RA) ⁶	OUSD (R&E)
Participant(s)/ Audience(s)	K-5	✓	✓			✓		✓		✓	✓
	Middle School	✓	✓	✓		✓	✓			✓	✓
	High School	✓	✓	✓	✓	✓	✓				✓
	Undergraduate	✓	✓	✓			✓		✓		✓
	Graduate		✓						✓		✓
	Teachers	✓	✓			✓	✓	✓		✓	✓
	Underserved & Underrepresented	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Military-Connected	✓	✓	✓		✓	✓	✓	✓	✓	✓
Activity Type(s)	Outreach	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Awareness	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Hands-On Activity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Scholarship/ Fellowship				✓				✓		✓
	Internship	✓	✓	✓			✓	✓	✓		✓
	Competition/ Reward/ Recognition	✓	✓	✓	✓	✓		✓	✓		✓
	Teacher Training	✓	✓	✓		✓	✓	✓			✓

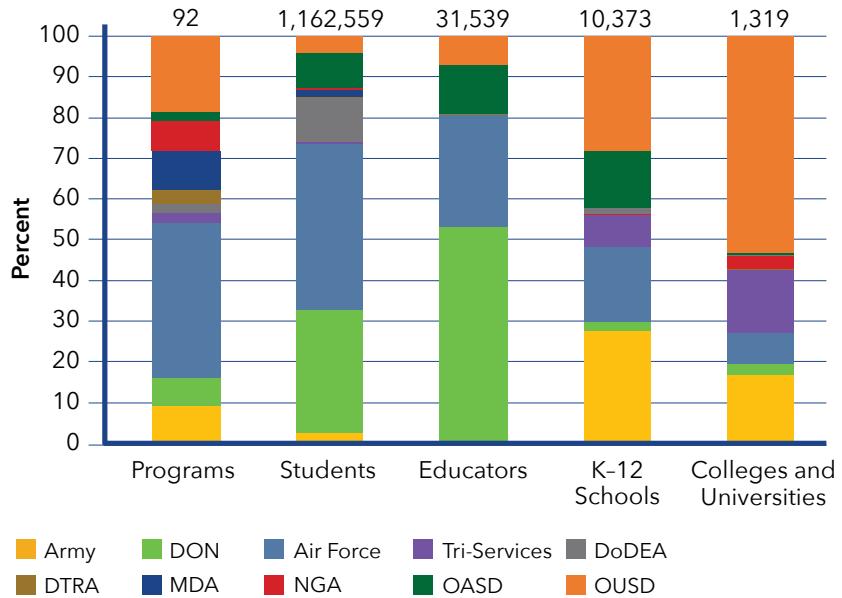
2. DoD STEM education and outreach activities impact a significant number of students, educators, and educational institutions.

During FY 2019, DoD offered a broad range of STEM programs and activities. The Department ran a collective 92 programs serving 1,162,559 students and 31,539 educators. Additionally, programs engaged 10,373 K-12 schools and 1,319 colleges and universities. STEM programming occurred in all 50 states plus Puerto Rico, the District of Columbia, and the international DoDEA regions. Of all programs reporting, 39% reported the number of students served disaggregated by grade band. Of these, the vast majority target students in PreK-12 (99.62%). However, postsecondary programming was also provided, reaching community college, undergraduate, and graduate students.

5. For FY 2019, this reflects the Junior Science & Humanities Symposia Program (JSHS), an AEOP pre-collegiate science, technology, engineering, and mathematics (STEM) research competition for high school students. JSHS is co-sponsored by the Army, Navy and Air Force.

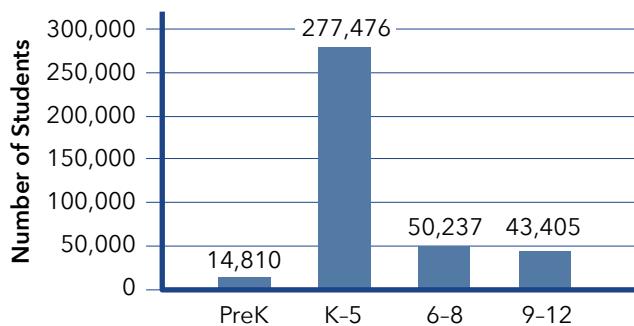
6. For FY 2019, this reflects DoD STARBASE, a premier educational program, sponsored by the Office of the Assistant Secretary of Defense for Manpower and Reserve Affairs. At DoD STARBASE students participate in challenging "hands-on, minds-on" activities in Science, Technology, Engineering, and Math (STEM).

DoD STEM Programs and Participants by Component

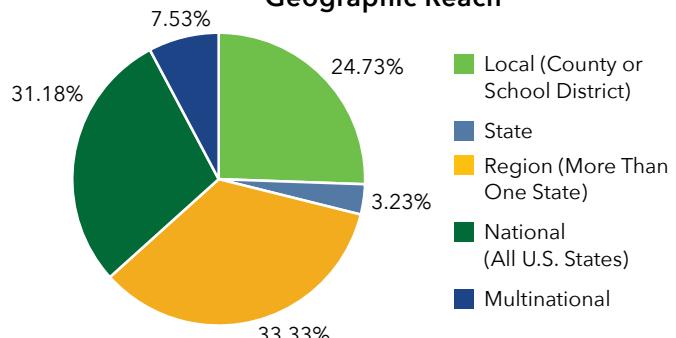


92 PROGRAMS SERVING
1.16M STUDENTS,
31.5k EDUCATORS,
10k K-12 SCHOOLS, AND
1.3k COLLEGES AND UNIVERSITIES

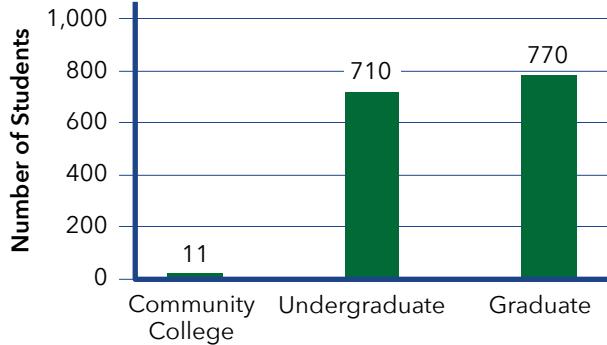
Number of PreK-12 Students



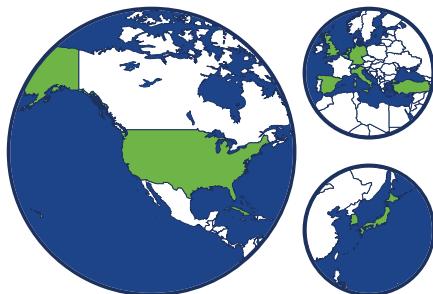
Geographic Reach



Number of Postsecondary Students



Programming in All 50 States, the District of Columbia, and the United States Territories of Puerto Rico and Guam



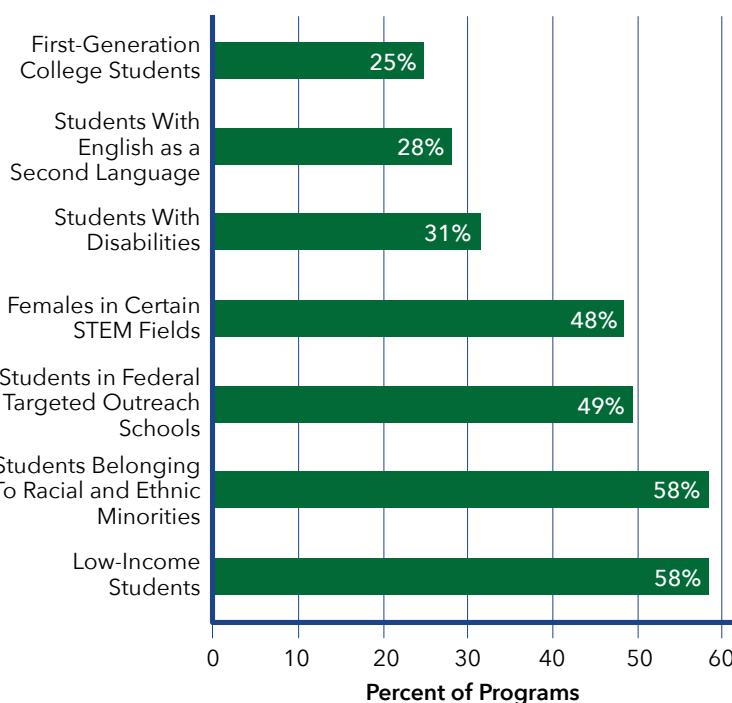
Several International Programs Also Reach the DoD Education Activity Regions of the Americas, Europe and the Pacific

3. Seventy percent (70%) of DoD STEM Programming targets underserved and underrepresented populations.

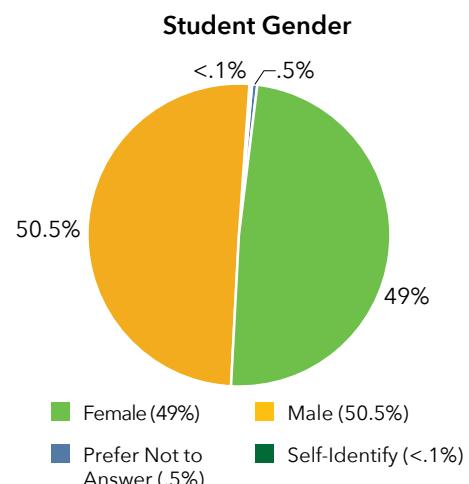
DoD is committed to diversity, equity, inclusion, and accessibility to underserved and underrepresented populations, defined in the 2021-2025 DoD STEM Strategic Plan as: military children; military-connected children; low-income students; racial and ethnic minorities that are underrepresented in STEM; individuals with disabilities; individuals with English as a second language or English language learners; first-generation college students; students in rural, frontier, or other federally targeted schools, such as title 1 schools; and females in STEM fields where they remain underrepresented⁷. As stated earlier, it is important for STEM education and outreach programs and activities to address issues of diversity and their potential impact on the DoD STEM workforce because:

- Underrepresented minorities make up 17 percent of the DoD STEM workforce⁸.
- The U.S. population is projected to be more than 40 percent minority in upcoming years⁹.
- Strategically executed STEM programming can improve access and equity for women and underrepresented and underserved students. This can improve DoD's ability to develop a STEM-literate citizenry with the potential for bolstering the future DoD STEM workforce, which will in turn better serve an increasingly diverse population of men and women in uniform, and their children, while improving end-products of research.

Percent of DoD STEM Programs That Serve Underserved and Underrepresented Students



67,893
MILITARY-CONNECTED
STUDENTS SERVED



7. https://dodstem-assets.dodstem.us/files/DoD_STEM_Strategic_Plan_2021.pdf

8. Defense Civilian Personnel Data System

9. <https://www.census.gov/content/dam/Census/library/publications/2020/demo/p25-1144.pdf>

4. DoD STEM programs are tailored to a variety of participants and needs through diverse program types, settings, durations, and platforms.

DoD STEM provides a mix of activity types, showing the breadth of programs offered and demonstrating the diversity of student learners that programs are able to reach. While educational programs use different types of conceptualizations, such as Bloom's Taxonomy, as frameworks for categorizing educational goals and objectives¹⁰, at this portfolio level of analysis, three factors contribute to understanding the level of student engagement: (1) program type, (2) program objectives, and (3) program descriptors: setting, duration, and platform. The variety of program types, setting, duration, and platform directly align to the FY 2021-2025 DoD STEM Strategic Plan Goals of:

- **Goal 1.0: INSPIRE** community engagement in DoD STEM education programs and activities to provide meaningful STEM learning opportunities for students and educators.
- **Goal 2.0: ATTRACT** the Nation's and DoD's current and future STEM workforce through multiple pathways to educational and career opportunities.

Program Types

Hands-On Activity: any instructional approach involving activity and direct experience with natural phenomena or any educational experience that actively involves students in manipulating objects to gain knowledge or understanding; doing science as opposed to simply hearing or reading about it.

Awareness: activities that promote interest in and cognizance of STEM opportunities or programs that specifically promote/ increase familiarity with DoD. This includes expanding awareness through marketing efforts.

Outreach: activities that support formal or classroom-based education, as well as informal education that occurs outside the classroom; especially providing services to people who might not otherwise have access to those services.

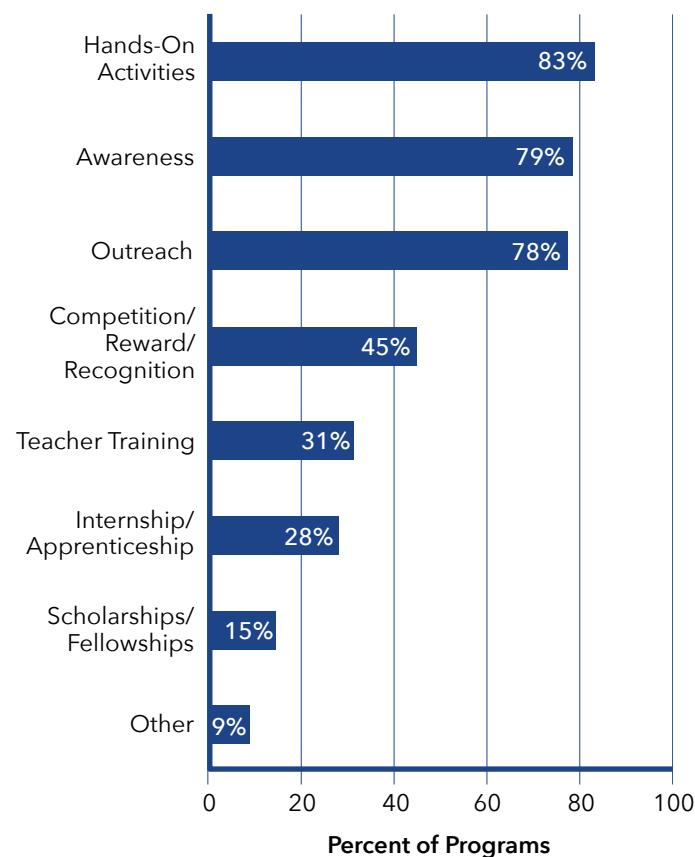
Competition/ Reward/ Recognition: students may compete in activities for recognition or rewards (e.g., scholarship, check).

Teacher Training: educators, usually K-12, are the target group for workshops, training, or other activities to boost their knowledge and ability in STEM to bring it to their students.

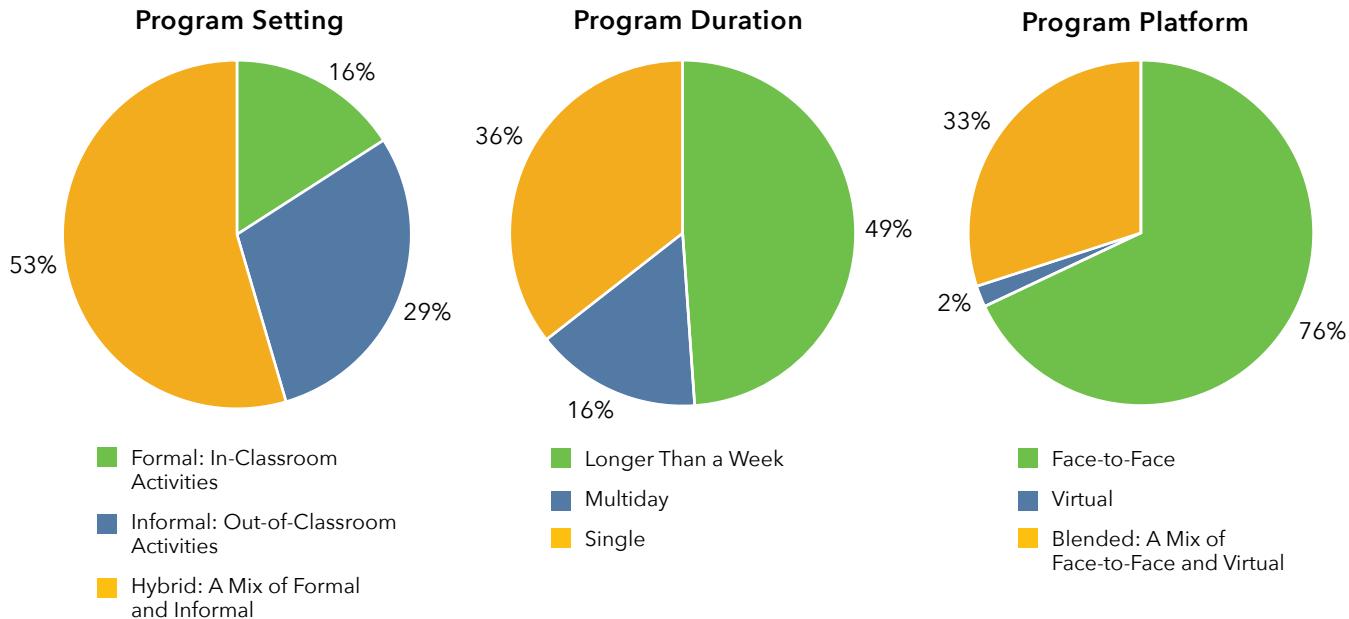
Internship/ Apprenticeship: students generally work with mentors in a research environment where they gain experience and skills on a temporary basis (e.g., summer, holidays, part-time).

Scholarships/ Fellowships: help students pursue higher education through a type of financial aid; may involve service in return.

DoD STEM Program Type



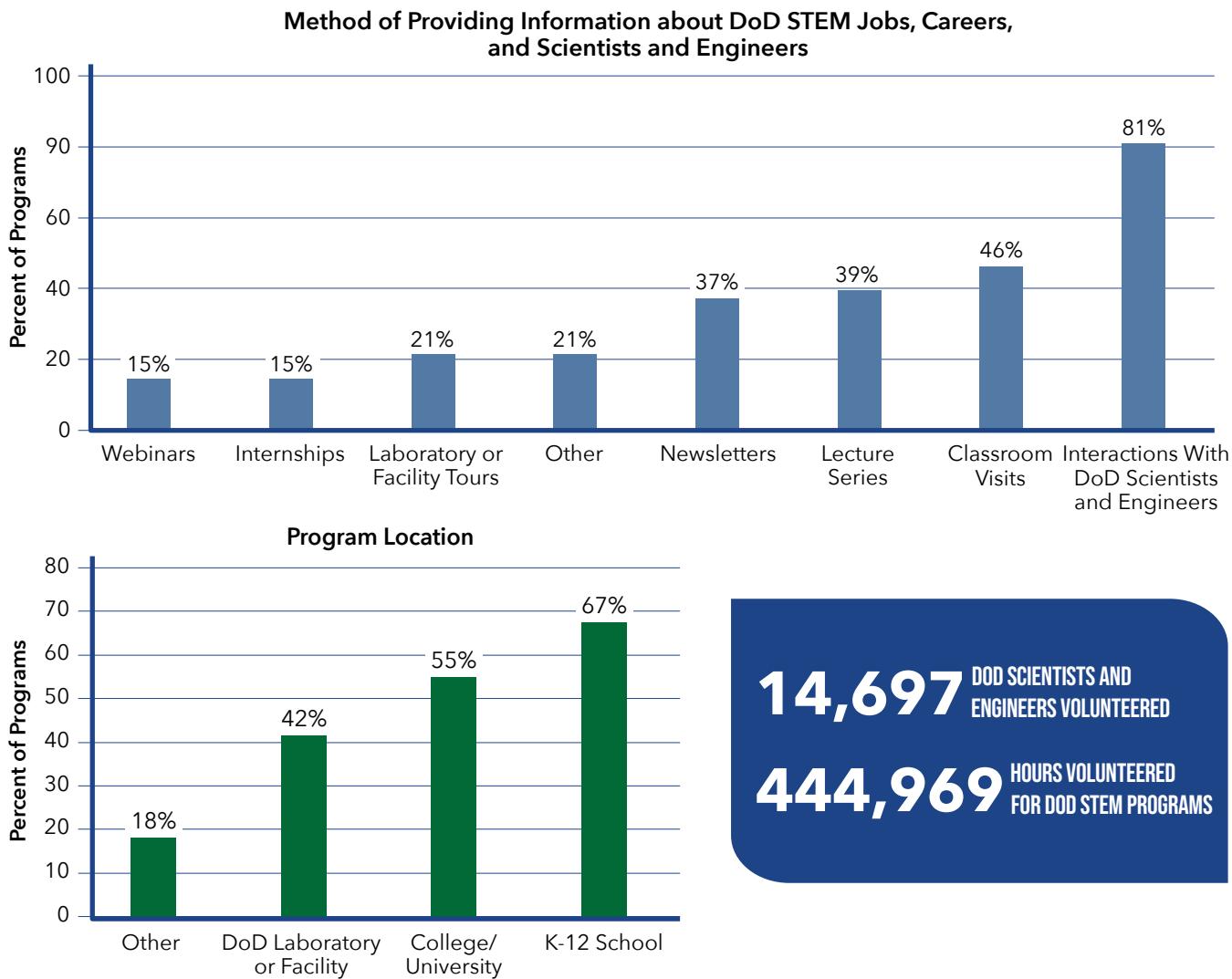
10. Anderson, Lorin W., and Benjamin Samuel Bloom. A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Longman, 2001.



5. DoD STEM programs and activities demonstrate connectivity to the DoD STEM workforce.

The largest asset that the Department has when it comes to STEM programming are the scientists and engineers working on technologies to better defend the Nation and equip the men and women in uniform. As the largest employer of scientists and engineers in the country, DoD STEM programs have the opportunity to connect the future generation of STEM professionals to the DoD STEM workforce. Additionally, the FY 2021-2025 DoD STEM Strategic Plan places a large emphasis on engaging S&Es and DoD facilities in STEM education and outreach activities:

- **Objective 1.2:** Enhance DoD STEM education program and activity experiences by leveraging DoD's unique resources.
- **Objective 1.3:** Empower DoD STEM professionals across DoD, especially those within the defense enterprise, to participate in STEM education and outreach activities.
- **Objective 2.1:** Sustain engagement of DoD professionals in STEM fields in workforce development programs, activities, and outreach.
- **Objective 2.4:** Encourage DoD STEM professionals to participate in mentoring activities and other opportunities to engage with the future DoD STEM workforce.



6. DoD STEM programs have increased reporting on evaluation and assessment metrics from FY 2018 to FY 2019.

Across all categories, DoD STEM saw increased reporting from FY 2018 to FY 2019. It should be noted that many STEM programs are unable to capture demographic data due to a variety of factors including, but not limited to, participants being minors, local and federal statutes, and program types. For example, if a program takes place in a classroom, the organization cannot collect information on individual students. While demographic data can be inferred from that of the school population, it would not be specific to the classrooms targeted. However, other programs can collect demographic data through sign-up information or exit surveys. DoD STEM is working towards the goal of enabling programs that can collect data to be able to execute the collection and reporting processes accurately. On a portfolio level, DoD STEM makes public evaluation reports such as this available publically on the Our Impact page of the dodstem.us website¹¹.

11. <https://dodstem.us/about/impact>

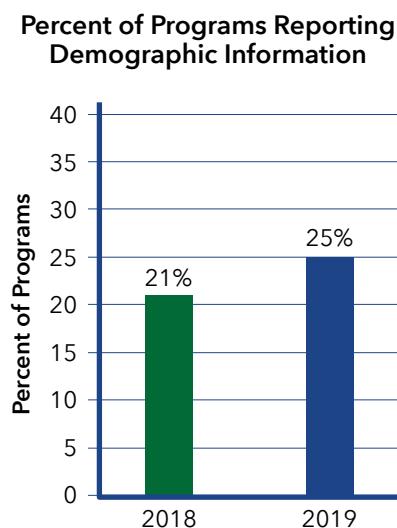
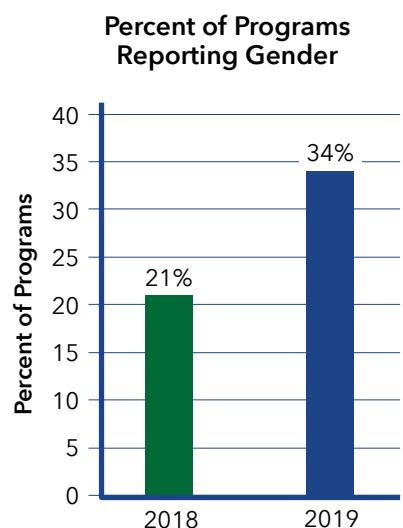
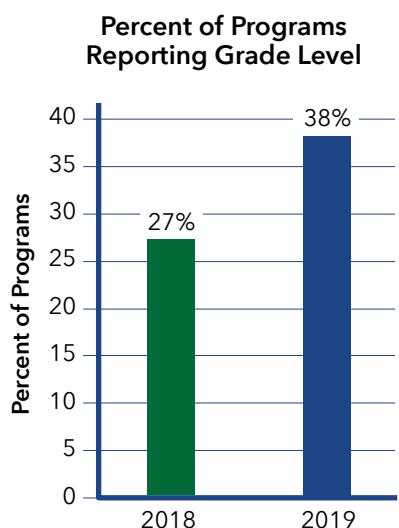


Table 2. DoD Components Utilize Several Different Evaluation and Assessment Methods.

Component	Evaluation Method					
	Attitude Surveys	Focus Groups	Third Party Evaluation	Participation Records	Knowledge Assessments	Other
Army	✓	✓	✓	✓	✓	✓
DON	✓			✓	✓	
Air Force	✓		✓	✓	✓	✓
Tri-Services	✓	✓	✓	✓	✓	
DoDEA			✓		✓	
DTRA	✓	✓	✓	✓	✓	
MDA	✓			✓	✓	
NGA		✓	✓	✓	✓	✓
OASD (M&RA)	✓		✓	✓	✓	
OUSD(R&E)	✓		✓	✓	✓	

As part of the continued development of the Evaluation and Assessment Capability for DoD STEM, this report focuses on data for FY 2019 only. Data for FY 2017-2018 can be found in the *DoD STEM Education and Outreach Portfolio Overview: Descriptive Analysis for Fiscal Year 2017-2018*¹². Additional reporting on DoD STEM evaluation and assessment efforts are regularly updated on the DoD STEM Our Impact page¹³. In accordance with the goal of increasing transparency and accountability, additional comprehensive data for both FY 2019 and trends across years will be published in future reports. In conclusion, in FY 2019, DoD STEM programming reached a vast number of participants through a diverse offering of programs and opportunities and continues to increase program evaluation and reporting efforts across the Department.

12. <http://dodstem-assets.dodstem.us/files/DoD-STEM-Education-and-Outreach-Portfolio-Overview-FY2017-18.pdf>

13. <https://dodstem.us/about/impact/>