Army Educational Outreach Program

Gains in the Education of Mathematics & Science
2014 Annual Program Evaluation Report

ARMY EDUCATIONAL OUTREACH PROGRAM

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Executive Summary

GEMS, administered by the American Society for Engineering Education (ASEE), is a non-residential summer STEM enrichment program for elementary, middle, and high school students hosted at Army laboratories on site or in close coordination off site with the area Army laboratories. GEMS is driven by the overarching mission: to interest youth in STEM through a hands-on Army laboratory experience that utilizes inquiry-based learning and Near Peer mentoring. Although they operate under a shared mission, GEMS sites are free to include different topics in their curricula that highlight the mission of the laboratory and may set, in addition to the overall program goals, individual laboratory goals. Instead of having a specific model and curriculum forced on individual sites, they are able to design curricula (using the hands-on, experiment-based model) and procedures that make sense considering the specialties of their facility and available resources. GEMS programs run from one to four weeks in length.

In 2014, GEMS provided outreach to 2,095 students and 92 Near-Peer Mentors at 12 different sites. The number of GEMS students in 2014 represents about a 3% increase in enrollment over the 2,038 student participants in 2013. Consistent with historical data, many of the GEMS sites received applications from more qualified students than they could serve.

This report documents the evaluation of the FY14 GEMS program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The assessment strategy for GEMS included questionnaires for students and mentors, 5 focus groups with students and 4 with mentors, and an annual program report compiled by ASEE.

2014 GEMS Fast Facts	
Description	STEM Enrichment Activity - at Army laboratories, hands-on
Participant Population	5th-12th grade students (secondary audience: college undergraduate Near-Peer Mentors, teachers)
No. of Applicants	3,343
No. of Students	2,095
Placement Rate	63%
No. of Adults (incl. NPM, RT, S&Es)	390
No. of Near-Peer Mentors (NPM)	92
No. of Resource Teachers (RT)	52
No. of Army S&Es	246
No. of Army Research Laboratories	13[†]
No. of K-12 Teachers	52
No. of K-12 Schools	755
No. of K-12 Schools – Title I	126
No. of Colleges/Universities	28
No. of HBCU/MSIs	3
No. of DoDEA Students	15

No. of DoDEA Teachers	1
Total Cost	$994,139
Stipend Cost	$727,676
Supplies & Equipment (GEMS sites)	$116,999
Administrative Cost to ASEE	$149,464
Cost Per Student Participant	$475

†*The United States Army Medical Research Institute of Chemical Defense (USAMRICD) collaborates with the US Army Research Laboratory (ARL-APG) to host GEMS at Aberdeen Proving Grounds*

The student questionnaire response rate of 91% and corresponding margin of error of ±0.7% provide strong evidence that the questionnaire results are generalizable to the population of participants. In contrast, the response rate for the mentor survey was only 26%. Because of the small number of responses to the mentor survey, caution is warranted when interpreting these data, as the responses may not be representative of the mentor populations participating in the GEMS program.

Summary of Findings

The FY14 evaluation of GEMS collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in the following table.

2014 GEMS Evaluation Findings	
Participant Profiles	
GEMS student participation in evaluation yields high level of confidence in the findings.	• The student questionnaire response rate of 91% and corresponding margin of error of ±0.7% provide strong evidence that the questionnaire results are generalizable to the population of participants.
	• Additional evaluation data contribute to the overall narrative of GEMS's efforts and impact, and highlight areas for future exploration in programming and evaluation, though findings from these data are not intended to be generalized to all GEMS sites and participants.
GEMS serves students of historically underrepresented and underserved populations.	• GEMS attracted participation from female students—a population that is historically underrepresented in engineering fields; student questionnaire respondents included more females (55%) than males (44%).
	• GEMS provided outreach to students from historically underrepresented and underserved minority race/ethnicity and low-income groups. Student questionnaire respondents included minority students identifying as Black or African American (22%), Hispanic or Latino (7%), and American Indian or Alaskan Native (1%). A small proportion (12%) of students reported qualifying for free or reduced-price lunch.

	• GEMS served students across a range of school contexts. Most student questionnaire respondents attended public schools (80%) in suburban settings (68%).
GEMS engages a fairly diverse group of adult participants as STEM mentors.	• GEMS mentor participants, based on questionnaire data, included almost two times as many males than females (64% vs. 33%). Although the majority of mentors identified themselves as white (68%), 9% of questionnaire respondents identified as Hispanic or Latino and 8% identified as Black or African American. Forty-one percent of the mentor group reported being a scientist, engineer, or mathematician in training, 24% were teachers, and 31% specified an "other" occupation such as an education student or college/university student.
Actionable Program Evaluation	
GEMS is marketed to schools and teachers serving historically underserved groups.	• ASEE and GEMS sites employed multiple strategies to disseminate information about the GEMS program. Email blasts were sent to over 4,000 teachers, guidance counselors, and principals in areas near participating GEMS labs. Promotional materials, e.g., AEOP brochures, were mailed to requesting teachers. Outreach efforts via social media were also coordinated with Virginia Tech and a cross-promotional outreach effort was organized with eCYBERMISSION. In addition, outreach efforts targeted historically underrepresented and underserved populations through events such as: Event it. Build it. Career Expo at the Society of Women Engineers Conference; Hispanic Association for Colleges and Universities Conference; DCPS Event at ASEE Headquarters; and 2014 ASEE Annual Conference.
	• Students most frequently learned about the local GEMS program, other than from past participation, from an immediate family member (25%) or family friend (25%).
GEMS students are motivated to participate by learning opportunities provided by GEMS.	• Students were most frequently motivated to participate in GEMS this year because of their desire to learn something new or interesting (95%), interest in STEM (94%), and learn in ways that are not possible in school (90%). Large proportions also wanted the opportunity to use advance laboratory technology (87%), have fun (85%), and expand their laboratory or research skills (83%).
GEMS engages students in meaningful STEM learning, through team-based and hands-on activities.	• Most students (73-85%) report learning about STEM topics, careers, cutting-edge research, and applications of STEM to real-life situations; communicating with other students about STEM; and interacting with STEM professionals on most days or every day of their GEMS experience.
	• Most students had opportunities to engage in a variety of STEM practices during their GEMS experience. For example, 92% of responding students indicated working as part of a team on most days or every day; 90% reported participating in hands-on activities, 83% reported practicing laboratory/field techniques, procedures, and tools; and 81% reported building/simulating something on most days or every day.

	• Students reported greater opportunities to learn about STEM and greater engagement in STEM practices in their GEMS experience than they typically have in school.
	• Large proportions of mentors report using strategies to help make learning activities relevant to students, support the needs of diverse learners, develop students' collaboration and interpersonal skills, and engage students in "authentic" STEM activities.
GEMS promotes AEOP initiatives and Army STEM careers available at Army research laboratories.	• About three-fourths of the responding mentors indicated discussing at least one AEOP other than GEMS with students, most commonly SEAP (49%) and CQL (35%). Other programs discussed with students by about a quarter of responding mentors were HSAP (27%), WPBDC (27%), REAP (25%), eCYBERMISSION (24%), SMART (24%), and URAP (24%).
	• Mentors found the participation in GEMS, program managers or site coordinators, invited speakers or career events, and AEOP instructional supplies as most useful in exposing students to other AEOP programs. A large proportion of mentors have no experience with a number of other resources for exposing student to AEOP and DoD careers (AEOP website, brochure, ASEE website, AEOP social media) or did not find them useful.
	• Nearly all of the responding mentors reported asking students about their educational and career interests and sharing their own experiences, attitudes, and values about STEM. Many also provided guidance to students, either about educational pathways that would prepare them for a STEM career or recommending extracurricular programs that align with their educational goals.
	• Nearly all students reported learning about at least one STEM job/career, and the majority (66%) reported learning about five or more. Similarly, 84% of students reported learning about at least one DoD STEM job/career, though only about a third reported learning about many different STEM jobs/careers in the DoD.
The GEMS experience is valued by students and mentors.	• The majority of students indicated being somewhat or very much satisfied with most program features, including the stipend, instruction and mentorship, and availability of program topics. Most students also commented on their overall satisfaction with the program, most often describing areas where they learned, the quality of the mentors, and their enjoyment with the program.
	• About half of GEMS students suggested improvements to the program's content including proposing additional topics, or increasing the amount of time on topics already addressed. A similar number of students (46%) made suggestions for the format of the program activities, most frequently suggesting more labs and hands-on activities.

	• The majority of mentors indicated being somewhat or very much satisfied with most program features, including the location, support of instruction and mentorship, and invited speakers or career events. Nearly all responding mentors indicated having a positive experience. Further, many commented on the quality of the experience for students and that they enjoyed seeing students excited about learning.
Outcomes Evaluation	
GEMS had positive impacts on students' STEM knowledge and competencies.	• A majority of students reported large or extreme gains on their knowledge of how professionals work on real problems in STEM, what everyday research work is like in STEM, a STEM topic or field in depth, the research processes, ethics, and rules for conduct in STEM, and research conducted in a STEM topic or field. These impacts were identified across all student groups.
	• Many students also reported impacts on their abilities to do STEM, including such things as applying knowledge, logic, and creativity to propose solutions that can be tested; carrying out procedures for an investigation and record data accurately; considering different ways to analyze or interpret data when answering a question; making a model to represent the key features and functions of an object, process, or system; and supporting a scientific explanation or engineering solution with relevant scientific, mathematical, and/or engineering knowledge.
GEMS had positive impacts on students' 21st Century Skills.	• A large majority of students reported large or extreme gains in a number of 21st Century Skills, such as their ability to work collaboratively with a team, communicate effectively with others, sense of being part of a community, including others' perspectives when making decisions, and building relationships with professionals in a STEM field.
GEMS positively impacted students' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many students reported a large or extreme gain on their ability to think creatively about a STEM project or activity (67%), their confidence to do well in future STEM courses (69%), feelings of preparedness for more challenging STEM activities (68%), sense of accomplishing something in STEM (68%), and confidence to contribute to STEM (66%). In addition, 61% reported building academic credentials in STEM, increasing interest in a new STEM topic or field (60%), and clarifying a STEM career path (51%).
	• Students also reported on the likelihood that they would engage in additional STEM activities outside of school. A majority of students indicated that as a result of GEMS, they were more likely to tinker with mechanical or electrical devices, work on a STEM project in a university or professional setting, participate in a STEM camp, fair, or competition, or participate in a STEM club, student association, or professional organization.
	• After participating in GEMS, students indicated being more likely to go further in their schooling than they would have before GEMS, with the greatest change being in the

GEMS succeeded in raising students' education and career aspirations.	proportion of students who expected to continue their education beyond a Bachelor's degree (45% before GEMS, 62% after). • Students were asked to indicate what kind of work they expected to be doing at age 30, and the data were coded as STEM-related or non-STEM-related. There was a small, statistically significant increase in the proportion of students aspiring to a STEM-related career after participating in GEMS.
GEMS students may be unaware of the full portfolio of AEOP initiatives, but students show substantial interest in future AEOP opportunities.	• Although large proportions of students are unaware of many other AEOP initiatives, the majority of students indicated interest in participating in future AEOP programs. Most participants (88%) credited GEMS with increasing their interest in participating in other programs.
GEMS raised student awareness of DoD STEM research and careers, as well as their interest in pursuing a STEM career with the DoD.	• A majority of students reported that they had a greater awareness (81%) of DoD STEM research and careers. In addition, 84% indicated that GEMS raised their interest in pursuing a STEM career with the DoD.

Recommendations

1. In FY14, GEMS received 3,343 applications to participate in GEMS and funded 2,095 positions (not including GEMS Near-Peer mentors). From FY13 to FY14 the evaluation provides some evidence that the GEMS program could successfully be expanded to accommodate the considerable amount of unmet need and interest that persists with qualified students. Evaluators continue to recommend that more GEMS sites be identified, recruited, and started in a variety of geographic locations to meet the needs and interest in more communities. Additionally, evaluators continue to recommend that existing sites expand their capacity to accommodate more students so that they may meet existing needs and interest in communities that are already served by GEMS programs. Increasing the number of existing GEMS sites' administrative staff, teaching staff, physical infrastructure, and mentor (S&E's specifically) participation is the most effective way to increase enhance existing site's capacities to meet the very large needs and interest of potential GEMS participants.

2. GEMS and AEOP objectives include expanding participation of historically underrepresented and underserved populations. ASEE has conducted targeted marketing of GEMS to underrepresented and underserved populations to meet this objective. However, the demographic characteristics of GEMS participants have not changed significantly from FY13 to FY14. Specifically, about one-third of GEMS students report that they are from underrepresented or underserved racial/ethnic groups (Black or African American, Hispanic or Latino, & Native American or Alaska Native) and only 12% report that they qualify for free or reduced-price lunches at

school. It is likely that GEMS will need to implement more aggressive marketing and recruitment practices than years past. Proven practices include; targeted marketing and partnerships with low-income and minority-serving schools, educational networks, community organizations, and professional associations that serve these populations. As in FY13, FY14 guidance includes the directive to ensure other "connected" applicants (e.g., those with family, family friends, or school-based connections to the site) are not disproportionately selected into the program over other qualified applicants who have no previous association with the GEMS site. Finally, The Army, ASEE, and GEMS sites will need to consider practical solutions to help more GEMS students travel to sites that are not close in proximity to their homes. Most notably, as a day program, GEMS may consider offering commuting accommodations (e.g., bus transportation) that make participation more feasible for underrepresented and underserved populations that live further from GEMS sites.

3. Given the goal of having students progress from GEMS into other AEOP programs, the program may want to work with sites to increase students' exposure to AEOP. Although, many students expressed interest in participating in other AEOP programs, a substantial proportion indicated having no interest. Given the proportion of students who reported learning about other AEOPs from their mentors, the program may want to work with each site to ensure that all students have access to structured opportunities that both describe the other AEOPs and provide information to students on how they can apply to them. In addition, given that a relatively large proportion of mentors have not experienced many of the resources provided for exposing students to AEOPs, it would likely be useful for the program to familiarize mentors with these resources and how these can be used to provide students with more information and facilitate their enrollment in other AEOPs.

4. Similarly, mentors play an important role in exposing students, especially students from underrepresented and underserved populations, to Army STEM careers. Evaluation data indicate that only about three-quarters of mentors discuss STEM career opportunities, DoD or otherwise, with students, with only 67% of mentors report recommending AEOPs that align with students' educational goals. Further, only 40% of mentors highlighted the under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM as part of supporting students educational and career pathways. Similar to providing resources for helping raise student awareness of other AEOPs, it would be useful for the program to familiarize mentors with resources available to expose students to DoD STEM careers as many mentors have indicated that they have had "no experience" with a number of the resources available to them. In addition, it would be beneficial to familiarize mentors with strategies that to increase the likelihood that the program will have a long-term impact on the number of students who pursue STEM. For example, interactions with role models with similar backgrounds as the students and providing coaching on the "soft skills" (e.g., time management, communication skills) needed to be successful in STEM careers.

5. Continued efforts should be undertaken to improve participation in completion of the mentor survey, as the low response rate raises questions about the representativeness of the results. Improved communication with the individual program sites about expectations for the evaluation may help. In addition, the mentor survey may need to be streamlined as perceived response burden can affect participation. In particular, consideration should be given to whether the parallel nature of the student and mentor questionnaires is necessary, with items being asked only of the most appropriate data source.

Introduction

The Army Educational Outreach Program (AEOP) vision is to offer a collaborative and cohesive portfolio of Army-sponsored science, technology, engineering and mathematics (STEM) programs that effectively engage, inspire, and attract the next generation of STEM talent through K-college programs and expose them to Department of Defense (DoD) STEM careers. The consortium, formed by the Army Educational Outreach Program Cooperative Agreement (AEOP CA), supports the AEOP in this mission by engaging non-profit, industry, and academic partners with aligned interests, as well as a management structure that collectively markets the portfolio among members, leverages available resources, and provides expertise to ensure the programs provide the greatest return on investment in achieving the Army's STEM goals and objectives.

AEOP Goals

Goal 1: STEM Literate Citizenry.

- Broaden, deepen, and diversify the pool of STEM talent in support of our defense industry base.

Goal 2: STEM Savvy Educators.

- Support and empower educators with unique Army research and technology resources.

Goal 3: Sustainable Infrastructure.

- Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.

This report documents the evaluation study of one of the AEOP elements, Gains in the Education of Mathematics and Science (GEMS). GEMS is administered by the American Society for Engineering Education. The evaluation study was designed and carried out by Virginia Tech, the Lead Organization (LO) in the AEOP CA consortium. Data analyses and reports were prepared in collaboration with Horizon Research, Inc.

Program Overview

GEMS, administered in FY14 by the ASEE on behalf of the Army AEOP, is a non-residential summer STEM enrichment program for elementary, middle, and high school students (herein referred to as students). GEMS is hosted by Army laboratories on site or in close coordination off site with the area Army laboratories (herein referred to as GEMS sites). GEMS is driven by the overarching mission: to interest youth in STEM through a hands-on Army laboratory experience that utilizes inquiry-based learning and Near Peer mentoring. GEMS is an entry point for a pipeline of AEOP opportunities affiliated with the U.S. Army research laboratories. The various GEMS sites are run independently, with ASEE providing support and guidance in program execution to local lab coordinators. Although they operate under a shared mission, GEMS sites are free to include different topics in their curricula that highlight the mission of the laboratory and may set, in addition to the overall program goals, individual laboratory goals. Instead of having a specific model and curriculum forced on individual sites, they are able to design curricula (using the hands-on, experiment-based model) and procedures that make sense considering the specialties of their facility and available resources. GEMS programs run from one to four weeks in length.

The mentorship model also varies by GEMS site. Many of the GEMS sites use Army scientists and engineers (Army S&Es) to lead GEMS educational activities while other sites use Near Peer Mentors (NPMs) as a key element in their instructional model. NPMs are developing scientists and engineers (college students) who translate and communicate complex STEM content and their own STEM experiences to the young GEMS participant. Many sites also leverage the expertise of in-service Resource Teachers (RTs). RTs assist Army S&Es and NPMs in translating STEM research, STEM concepts, and STEM practices into educational curricula as well as provide coaching and instructional supervision to NPMs. RTs also provide adaptive support to individual student participants to ensure maximal engagement and learning. Herein, Army S&Es, NPMs, and RTs are referred together as GEMS "mentors," except where it is appropriate to differentiate their roles and experiences.

All GEMS programs are designed to meet the following objectives:

1. To nurture interest and excitement in STEM for elementary, middle, and high school participants;
2. To nurture interest and excitement in STEM for mentor participants;
3. To implement STEM-enrichment experiences that are hands-on, inquiry-based, educational modules that enhance in-school learning;
4. To increase participant knowledge in targeted STEM areas and laboratory skills;
5. To increase the number of outreach participants inclusive of youth from groups historically underrepresented and underserved in STEM;
6. To encourage participants to pursue secondary and post-secondary education in STEM;
7. To educate participants about careers in STEM fields with a particular focus on STEM careers in Army laboratories; and
8. To provide information to participants about opportunities for STEM enrichment through advancing levels of GEMS as well as other AEOP initiatives.

As can be seen in Table 1, GEMS sites involved 13 Army research laboratories operating at 12 sites in 8 states.

Table 1. 2014 GEMS Sites		
Laboratory	**Command***	**Location**
U.S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC)	RDECOM	Huntsville, AL
U.S. Army Research Laboratory (ARL-APG)/ US Army Medical Research Institute of Chemical Defense (USAMRICD)	RDECOM/USAMRMC	Aberdeen, MD
U.S. Army Research Laboratory- Adelphi (ARL-Adelphi)	RDECOM	Adelphi, MD
U.S. Army Research Laboratory- White Sands Missile Range (ARL-WSMR)	RDECOM	White Sands, NM
U.S. Armed Forces Medical Examiner System (USAFMES)	USAMRMC	Dover, DE
U.S. Army Aeromedical Research Laboratory (USAARL)	USAMRMC	Fort Rucker, AL
U.S. Army Medical Research and Material Command at Fort Detrick (USAMRMC-Ft. Detrick)	USAMRMC	Fort Detrick, MD
U.S. Army Research Institute for Surgical Research (USAISR)	USAMRMC	Fort Sam Houston, TX
U.S. Army Research Institute for Environmental Medicine (USARIEM)	USAMRMC	Natick, MA
Walter Reed Army Institute of Research (WRAIR)	USAMRMC	Silver Spring, MD
Engineer Research & Development Center- Construction Engineering Research Laboratory (ERDC-CERL)	USACE	Champaign, IL
Engineer Research & Development Center - Vicksburg, MS (ERDC-MS)	USACE	Vicksburg, MS

Commands: "USAMRMC" is the Medical Research and Materiel Command, "RDECOM" is the Research Development and Engineering Command, and "USACE" is the U.S. Army Corps of Engineers.

In 2014, GEMS provided outreach to 2,095 students at 12 different sites. This number represents about a 3% increase in enrollment from the 2,038 student participants in 2013. Consistent with historical data, many of the GEMS sites received applications from more qualified students than they could serve. A total of 3,343 GEMS applications were submitted centrally through the online AEOP application tool. Applicant numbers from ERDC-MS are not available to be included in the applicant total. Table 2 provides the application and participation data by GEMS site for 2014.

Table 2. 2014 GEMS Site Applicant and Enrollment Numbers			
Command	**2014 GEMS Site**	**No. of Applicants**	**No. of Enrolled Participants**
RDECOM	Army Aviation and Missile Research Development and Engineering Center (AMRDEC)	108	77
	Army Research Laboratory-Aberdeen Proving Ground (ARL-APG)	822	303
	Army Research Laboratory-Adelphi (ARL-Adelphi)	96	76
	Army Research Laboratory-White Sands Missile Range (ARL-WSMR)	78	39
USAMRMC	Armed Forces Medical Examiner System (USAFMES)	121	95
	Army Aeromedical Research Laboratory (USAARL)	256	177
	Army Medical Research and Material Command at Fort Detrick (USAMRMC-Ft. Detrick)	671	445
	Army Medical Research Institute of Chemical Defense (USAMRICD)	Included with ARL-APG	Included with ARL-APG
	Army Research Institute for Surgical Research (USAISR)	82	68
	Army Research Institute for Environmental Medicine (USARIEM)	322	195
	Walter Reed Army Institute of Research (WRAIR)	727	492
USACE	Engineer Research & Development Center- Construction Engineering Research Laboratory (ERDC-CERL)	60	40
	Engineer Research & Development Center-Mississippi (ERDC-MS)	Not available	88
TOTAL		**3,343**[†]	**2,095**

[†] This number is lower than the actual number of applications, as one site did not report this information.

In addition, across the various GEMS sites, there were a total of 52 teacher participants and 92 NPMs working in the program.

The total cost of the 2014 GEMS program was $994,139 which includes administrative costs to ASEE, costs to participating labs for supplies, student stipends as well as Resource Teacher and Near-Peer Mentor stipends. The cost per GEMS student was $475. Aligned with the rates of similar AEOP initiatives, GEMS provides student participants with a stipend of $100 per week. Table 3 summarizes these and other 2014 GEMS program costs.

Table 3. 2014 GEMS Program Costs	
2014 GEMS Students – Cost Per Participant	
No. of Students	2,095
Total Cost	$994,139
Cost Per Participant (Student)	$475
2014 GEMS Students, Near-Peer Mentors, and Resource Teachers – Cost Per Participant	
No. of Students	2,095
No. of NPM	92
No. of RTs	52
Grand Total Participants	2,239
Cost Per Participant (Students, Near-Peer Mentors, Teachers)	**$444**
2014 GEMS Cost Breakdown	
Total Administrative Cost to ASEE	$149,464
Supplies & Equipment (GEMS sites)	$116,999
Total Stipend Cost (includes Students, Near-Peer Mentors, and Teachers)	$727,676
Weekly Student Stipend	$100
Average NPM Stipend (over the summer)	$2,695
Average RT Stipend (over the summer)	$4,027

Evidence-Based Program Change

Based on recommendations from the FY13 summative evaluation report, the AEOP identified three key priorities for programs in FY14: (1) Increase outreach to populations that are historically underrepresented and underserved in STEM; (2) Increase participants' awareness of Army/DoD STEM careers; and (3) Increase participants' awareness of other AEOP opportunities. ASEE initiated the following program changes/additions to the FY14 administration of the GEMS program in light of the key AEOP priorities, the FY13 GEMS evaluation study, and site visits conducted by ASEE and the LO.

I. **Increase outreach to populations that are historically underrepresented and underserved in STEM.**
   a. 2014 Outreach Plan for GEMS that included:
      i. Help Desk fielded calls and emails from inquiries into GEMS.
      ii. Mass email campaign targeted 4000+ teachers, guidance counselors, and principals in schools that are in close proximity to GEMS program sites.
      iii. Participated in outreach efforts at conferences/expos that serve diverse audiences.
         1. Event it. Build it. Career Expo at the Society of Women Engineers Conference
         2. Hispanic Association for Colleges and Universities Conference
         3. District of Columbia Public Schools (DCPS) Event at ASEE headquarters
         4. 2014 ASEE Annual Conference
      iv. Held bi-weekly meetings with LPCs to identify new targets and strategies for outreach.
      v. Ran social Media campaign in conjunction with the LO.

1. 17 Facebook posts and 30 Twitter posts

II. Increase participants' awareness of other AEOP opportunities.

a. Performed direct mailing of promotional materials upon request from teachers.
b. Directly emailed previous participants with links to AEOP social.
c. Explored cross-promotional opportunities with eCYBERMISSION.

III. Other changes/activities.

a. In partnership with the LO, GEMS initiated a Mentor survey to begin gathering information about how mentors become aware of GEMS, are motivated to pursue GEMs, perceive value in the GEMs program, initiate mentorship behaviors, are satisfied with GEMS, and how they attempt to educate students about AEOP programs and DoD STEM careers.

FY14 Evaluation At-A-Glance

Virginia Tech, in collaboration with ASEE, conducted a comprehensive evaluation study of the GEMS program. The GEMS logic model below presents a summary of the expected outputs and outcomes for the GEMS program in relation to the AEOP and GEMS-specific priorities. This logic model provided guidance for the overall GEMS evaluation strategy.

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• Army sponsorship • ASEE providing oversight of site programming • Operations conducted by 13 Army research laboratories operating at 12 sites in 8 states • 2,095 Students participating in GEMS programs • Army S&Es, 92 Near Peer Mentors, and 52 Resource Teachers participating in GEMS as mentors • Stipends for students to support meals and travel • Centralized branding and comprehensive marketing • Centralized evaluation	• Students engage in hands-on and experiment-based STEM programs • Army S&Es, Near Peers, and Resource Teachers facilitate hands-on learning experiences for students • Program activities that expose students to AEOP programs and/or STEM careers in the Army or DoD	• Number and diversity of student participants engaged in GEMS • Number and diversity of Army S&Es serving as mentors in GEMS • Number and diversity of , Near Peers serving as mentors in GEMS • Number and diversity of Resource Teachers serving as mentors in GEMS • Number and Title 1 status of schools served through participant engagement • Students, mentors, site coordinators, and ASEE contributing to evaluation	• Increased participant STEM competencies (confidence, knowledge, skills, and/or abilities to do STEM) • Increased interest in future STEM engagement • Increased participant awareness of and interest in other AEOP opportunities • Increased participant awareness of and interest in STEM research and careers • Increased participant awareness of and interest in Army/DoD STEM research and careers • Implementation of evidence-based recommendations to improve GEMS programs	• Increased student participation in other AEOP opportunities and Army/DoD-sponsored scholarship/ fellowship programs • Increased student pursuit of STEM coursework in secondary and post-secondary schooling • Increased student pursuit of STEM degrees • Increased student pursuit of STEM careers • Increased student pursuit of Army/DoD STEM careers • Continuous improvement and sustainability of GEMS

The GEMS evaluation gathered information from multiple participant groups about GEMS processes, resources, activities, and their potential effects in order to address key evaluation questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and GEMS program objectives.

Key Evaluation Questions

- What aspects of GEMS programs motivate participation?
- What aspects of GEMS program structure and processes are working well?
- What aspects of GEMS programs could be improved?
- Did participation in GEMS programs:
  - Increase students' STEM competencies?
  - Increase students' interest in future STEM engagement?
  - Increase students' awareness of and interest in other AEOP opportunities?
  - Increase students' awareness of and interest in Army/DoD STEM careers?

The assessment strategy for GEMS included student and mentor questionnaires, 5 focus groups with students and 4 with mentors, and 1 Annual Program Report (APR) prepared by ASEE using data from all GEMS sites. Tables 4-8 outline the information collected in student and mentor questionnaires and focus groups, as well as information from the APR that is relevant to this evaluation report.

Table 4. 2014 Student Questionnaires

Category	Description
Profile	**Demographics:** Participant gender, age, grade level, race/ethnicity, and socioeconomic status indicators
	Education Intentions: Degree level, confidence to achieve educational goals, field sought
AEOP Goal 1	**Capturing the Student Experience:** In-school vs. In-GEMS experience (students)
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of GEMS to gains (impact)
	Transferrable Competencies: Gains in 21st Century Skills
	STEM Identity: Gains in STEM identity, intentions to participate in STEM, and STEM-oriented education and career aspirations; contribution of GEMS to gains (impact)
	AEOP Opportunities: Past participation, awareness of, and interest in participating in other AEOP programs; contribution of GEMS, impact of AEOP resources
	Army/DoD STEM: Exposure to Army/DoD STEM jobs, attitudes toward Army/DoD STEM research and careers, change in interest for STEM and Army/DoD STEM jobs; contribution of GEMS, impact of AEOP resources
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies (students respond to a subset)
	Comprehensive Marketing Strategy: How students learn about GEMS, motivating factors for participation, impact of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers
Satisfaction & Suggestions	Benefits to participants, suggestions for improving programs, overall satisfaction

Table 5. 2014 Mentor Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, race/ethnicity, occupation, past participation
Satisfaction & Suggestions	Awareness of GEMS, motivating factors for participation, satisfaction with and suggestions for improving GEMS programs, benefits to participants
AEOP Goal 1	**Capturing the Student Experience:** In-program experiences for students
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of GEMS to gains (impact)
	Transferrable Competencies: Gains in 21st Century Skills
	AEOP Opportunities: Past participation, awareness of other AEOP programs; efforts to expose students to AEOPs, impact of AEOP resources on efforts; contribution of GEMS to gains (impact)
	Army/DoD STEM: Attitudes toward Army/DoD STEM research and careers, efforts to expose students to Army/DoD STEM research/careers, impact of AEOP resources on efforts; contribution of GEMS in changing student Army/DoD career metrics (impact)
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies (mentors)
	Comprehensive Marketing Strategy: How mentors learn about GEMS, usefulness of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers

Table 6. 2014 Student Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in GEMS, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of GEMS, motivating factors for participation, involvement in other programs in addition to GEMS, satisfaction with and suggestions for improving GEMS programs, benefits to participants
AEOP Goal 1 and 2 Program Efforts	**Army STEM:** AEOP Opportunities – Extent to which students were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers– Extent to which students were exposed to STEM and Army/DoD STEM jobs

Table 7. 2014 Mentor Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, occupation, organization, role in GEMS, past participation in GEMS, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of GEMS, benefits to participants, suggestions for improving GEMS programs
AEOP Goal 1 and 2 Program Efforts	**Army STEM:** AEOP Opportunities – Efforts to expose students to AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Efforts to expose students to STEM and Army/DoD STEM jobs
	Mentor Capacity: Local Educators – Strategies used to increase diversity/support diversity in GEMS

Table 8. 2014 Annual Program Report	
Category	**Description**
Program	Description of course content, activities, and academic level (high school or college)
AEOP Goal 1 and 2 Program Efforts	**Underserved Populations:** mechanisms for marketing to and recruitment of students from underserved populations
	Army STEM: Army/DoD STEM Careers – Career day exposure to Army STEM research and careers; Participation of Army engineers and/or Army research facilities in career day activities
	Mentor Capacity: Local Educators - University faculty and student involvement, teacher involvement

Detailed information about methods and instrumentation, sampling and data collection, and analysis are described in Appendix A, the evaluation plan. The reader is strongly encouraged to review Appendix A to clarify how data are summarized, analyzed, and reported in this document. Findings of statistical and/or practical significance are noted in the report narrative, with tables and footnotes providing results from tests for significance. Questionnaires and respective data summaries are provided in Appendix B (student) and Appendix C (mentor). Focus group protocols are provided in Appendices D (students) and E (mentors); the APR template is located in Appendix F. Major trends in data and analyses are reported herein.

Study Sample

Students from all 12 GEMS sites responded to questionnaires; mentors from 11 of the 12 sites completed questionnaires. Table 9 shows the number of student and mentor respondents by site.

Table 9. 2014 GEMS Site Survey Respondent Numbers				
2014 GEMS Site	**Students**		**Mentors**	
	No. of Participants	**No. of Survey Respondents†**	**No. of Participants‡**	**No. of Survey Respondents§**
AMRDEC	77	75	27	0
ARL-APG/USAMRICD	303	304	82	26
ARL-Adelphi	76	76	18	4
ARL-WSMR	39	39	28	8
USAFMES	95	91	6	4
USAARL	177	178	31	5
USAMRMC-Ft. Detrick	445	437	35	14
USAISR	68	69	37	5
USARIEM	195	131	14	7
WRAIR	492	380	26	4
ERDC-CERL	40	39	20	3
ERDC-MS	88	80	66	4
TOTAL	**2,095**	**1,899**	**390**	**84**

† For three sites, the number of respondents was greater than the number of participants. The location of the GEMS site is collected on the student survey and may have been inaccurately reported by some students.

‡ The number of mentors per site includes Near Peer mentors, Resource Teachers, and all other adult participants.

§ Three mentors did not indicate a GEMS location.

Table 10 provides an analysis of student and mentor participation in the GEMS questionnaires, the response rate, and the margin of error at the 95% confidence level (a measure of how representative the sample is of the population). The margin of error for the mentor survey is larger than generally acceptable, indicating that the sample may not be representative of the population of GEMS mentors. Note that the student response rate for the 2014 student questionnaire is higher than in 2013 (which had response rates of 71% and 74% for the pre and post questionnaires, respectively). There was no mentor questionnaire in 2013; thus, the 22% response rate can be seen as a first step in getting feedback from mentors, but is an area in which continued effort will be needed.

Table 10. 2014 GEMS Questionnaire Participation				
Participant Group	**Respondents (Sample)**	**Total Participants (Population)**	**Participation Rate**	**Margin of Error @ 95% Confidence[1]**
Students	1899	2,095	91%	±0.7%
Mentors	84	390	22%	±9.5%

[1] "Margin of error @ 95% confidence" means that 95% of the time, the true percentage of the population who would select an answer lies within the stated margin of error. For example, if 47% of the sample selects a response and the margin of error at 95%

Five student focus groups were conducted that included students from 4 of the 12 GEMS sites. Student focus groups included 30 students (14 females, 16 males) ranging from grades 6 to 11 (or rising 7th to rising 12th graders). Four mentor focus groups were also conducted that included 19 mentors (13 females, 6 males) from four sites. The participating mentors included 2 teachers, a non-teaching school staff member, 6 university students majoring in STEM, 5 STEM professionals, and an active-duty soldier. Focus groups were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of questionnaire data. They add to the overall narrative of GEMS' efforts and impact, and highlight areas for future exploration in programming and evaluation.

Respondent Profiles

Student demographics. Demographic information collected from GEMS questionnaire respondents is summarized in Table 11.[2] More females (55%) than males (44%) completed the questionnaire. More responding students identified with the race/ethnicity category of white (45%) than any other single race/ethnic category, though there is substantial representation of Black or African American (22%) and Asian (15%) populations. It should be noted that demographic characteristics of the survey respondents are similar to those of participating students reported in the APR (47% female, 37% male,[3] 44% white, 25% Black or African American, 14% Asian), although both the survey data and APR were based on a subset of participants (85% and 88% of the population, respectively). Demographic data of students participating in 2014 are also similar to the data for students participating in 2013, indicating that there have been no substantial shifts in the population being served between 2013 and 2014.

As would be expected, and similar to 2013, the grades of students who completed the 2014 questionnaire spanned across middle and high school, with the largest proportion of respondents reporting that they were in middle school. A relatively small number of students indicated that they were rising 4th or 5th graders, or would be first-year college students in the next school year. The APR reported that about half of participants were in grades 6-8 and about a third of participants were in grades 9-12, a somewhat smaller proportion of high school students than respondents to surveys in 2014.

Similar to the data provided in the APR, only 12% of students responding to questionnaires in 2014 reported qualifying for free or reduced-price lunch (FRL)—a common indicator of low-income status. Interestingly, this number is substantially lower than in 2013, when 37% were qualified for FRL. As can be seen in Table 12, the vast majority of respondents attend

confidence is calculated to be 5%, if you had asked the question to the entire population, there is a 95% likelihood that between 42% and 52% would have selected that answer. A 2-5% margin of error is generally acceptable at the 95% confidence level.

[2] In FY15 the AEOP developed and implemented a new application tool through the vendor, Cvent. This centralized tool will facilitate accurate and improved collection of demographic information from participants across the portfolio of AEOP initiatives.

[3] The APR indicated that 16% of students chose not to report their gender.

public schools (80%); most attend schools in suburban areas (68%). These data are similar to 2013 and to those provided in the APR.[4]

Table 11. 2014 GEMS Student Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 1888)		
Female	1035	55%
Male	827	44%
Choose not to report	26	1%
Respondent Race/Ethnicity (n = 1887)		
Asian	283	15%
Black or African American	417	22%
Hispanic or Latino	123	7%
Native American or Alaska Native	13	1%
Native Hawaiian or Other Pacific Islander	9	<1%
White	849	45%
Other race or ethnicity, (specify):†	109	6%
Choose not to report	84	4%
Respondent Grade Level (n = 1890)		
4th	2	<1%
5th	88	5%
6th	206	11%
7th	335	18%
8th	390	21%
9th	299	16%
10th	250	13%
11th	194	10%
12th	107	6%
First-Year College Student	13	1%
Other†	2	<1%
Choose not to report	4	<1%
Respondent Eligible for Free/Reduced-Price Lunch (n = 1873)		
Yes	228	12%
No	1474	79%
Choose not to report	171	9%

† Other = "Asian and White" (n = 17), "Mixed/Multiracial" (n = 13), "Black and White" (n = 9), "Indian" (n = 6), "Hispanic and White" (n = 5), "Italian" (n = 2), "Middle Eastern" (n = 2), "Arab" (n = 2), "African American, Native American, White" (n = 2), "Hispanic and Black" (n = 2), "Black, White, Indian" (n = 2), "Iranian," "Jamaican," "Arab Palestine/ Jordan," "American/ Japanese," "1/4 Hispanic," "African American & Indian," "African American and Hispanic," "African-American/ Lebanese," "afro Latino," "Amerasian," "American," "Asian, Italian," "Asian/ Brazilian," "Australian," "biracial," "black & Latino," "Black + Native American," "Black and Native American," "black and Puerto Rican," "Brazilian/Black," "Cambodian American," "Caucasian," "Chinese/ black," "Eurasian," "Ginger," "Guyanese/white," "Haitian, native American," "Hawaiian,"

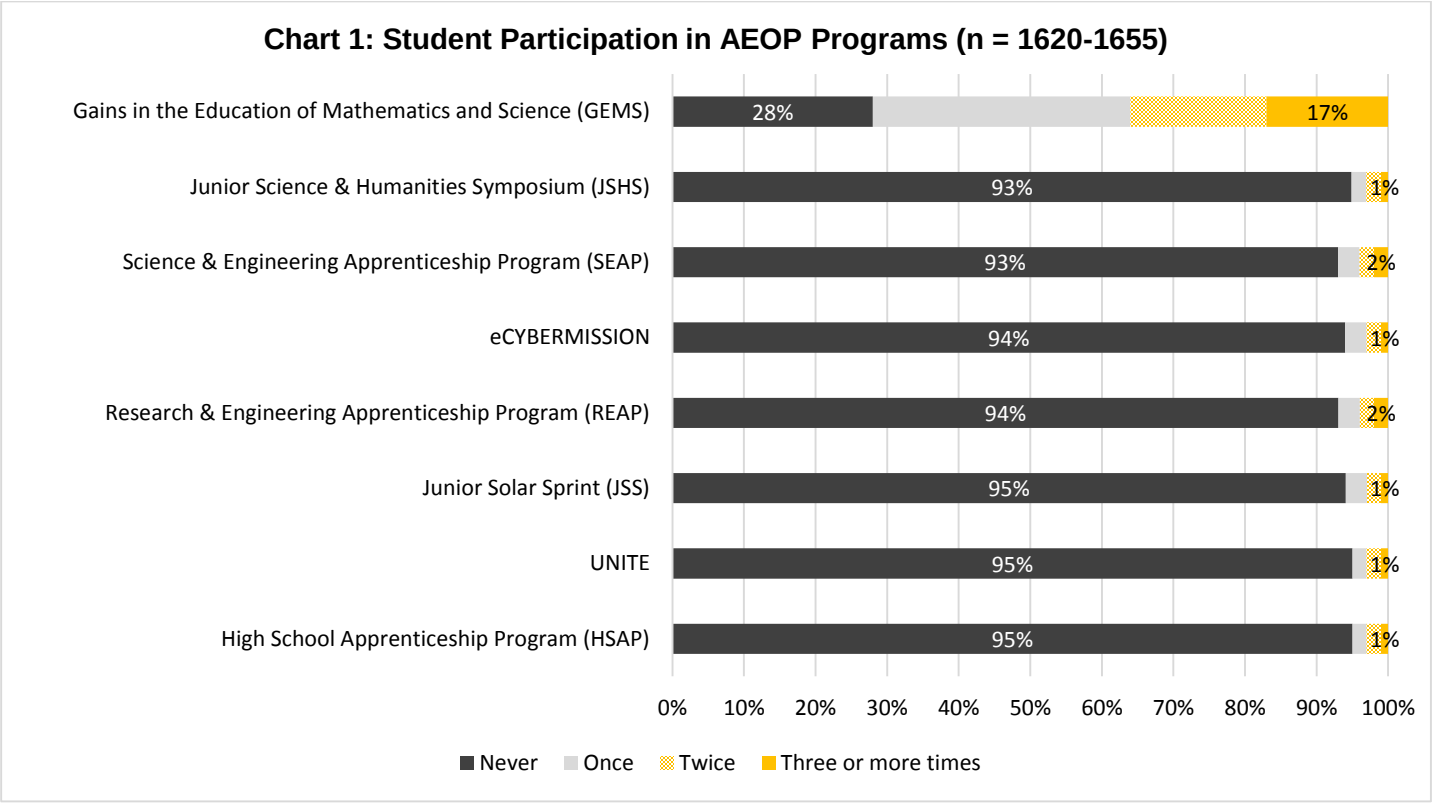
[4] Information on school type of participants, e.g., public or private, were not provided in the APR.

"Hinduism," "Hispanic and Asian," "Hispanic or Asian," "Hispanic, Black, White," "Native American + white," "Puerto Rican," "South Asian," "Turkish," "white and Columbian," "White and German," "White and Native American," "White, German, English," "White, Hispanic," and "White, Peruvian."

‡ Other = "Homeschool" (n = 2).

Table 12. 2014 GEMS Student Respondent School Information		
Demographic Category	**Questionnaire Respondents**	
Respondent School Location (n = 1883)		
Urban (city)	377	20%
Suburban	1288	68%
Frontier or tribal school	4	<1%
Rural (country)	214	11%
Respondent School Type (n = 1890)		
Public school	1517	80%
Private school	263	14%
Home school	95	5%
Online school	6	<1%
Department of Defense school (DoDDS or DoDEA)	8	<1%

In addition, students were asked how many times they participated in each of the AEOP programs. As can be seen in Chart 1, 72% of responding students reported participating in GEMS at least once. Few students (20% or less) reported participating in any of the other AEOP programs.



Mentor demographics. The 2014 Mentor Questionnaire collected more extensive demographic information on the mentors than past years; these data are summarized in Table 13. Almost two times as many male as female mentors completed the questionnaire (64% vs. 33%). Similar to the responding students, the majority of mentors identified themselves as white (68%). Forty-one percent of respondents were undergraduate or graduates students in STEM fields and about one-fourth were teachers. The majority of mentors served as NPMs and about a quarter served as RTs. Additional characteristics of the mentors are included in Appendix C.

Table 13. 2014 GEMS Mentor Respondent Profile

Demographic Category	Questionnaire Respondents	
Respondent Gender (n = 87)		
Female	29	33%
Male	56	64%
Choose not to report	2	2%
Respondent Race/Ethnicity (n = 87)		
Asian	6	7%
Black or African American	7	8%
Hispanic or Latino	8	9%
Native American or Alaska Native	0	0%

Native Hawaiian or Other Pacific Islander	1	1%
White	59	68%
Other race or ethnicity, (specify):[†]	3	3%
Choose not to report	3	3%
Respondent Occupation (n = 87)		
Teacher	21	24%
Other school staff	1	1%
University educator	0	0%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	36	41%
Scientist, Engineer, or Mathematics professional	2	2%
Other, (specify):[‡]	27	31%
Respondent Role in GEMS (n = 84)		
Instructor (typically a University or Army Scientist or Engineer)	3	4%
Near peer mentor	55	65%
Resource teacher	21	25%
Other, (specify)[§]	5	6%

[†] Other = "Ethiopian," and "Multi-ethnic."

[‡] Other = "Student" (n = 10), "College/University Student" (n=3), "Education student" (n = 3), "High school student" (n = 3), "Curriculum Writer and Marketing Coordinator," "Mentor," "Program coordinator," "SEAP," "seeking employment in science education," and "WRAIR."

[§] Other = "Assistant Near Peer Mentor" (n = 2), and "Program Coordinator."

Actionable Program Evaluation

Actionable Program Evaluation is intended to provide assessment and evaluation of program processes, resources, and activities for the purpose of recommending improvements as the program moves forward. This section highlights information outlined in the Satisfaction & Suggestions and AEOP Goal 1 & 2 Program Efforts sections of Tables 4-8.

A focus of the Actionable Program Evaluation is efforts toward the long-term goal of GEMS and all of the AEOP to increase and diversify the future pool of talent capable of contributing to the nation's scientific and technology progress. GEMS sites reach out to students of traditionally underrepresented and underserved populations. Thus, it is important to consider how GEMS is marketed and ultimately recruits student participants, the factors that motivate students to participate in GEMS, participants' perceptions of and satisfaction with activities, what value participants place on program activities, and what recommendations participants have for program improvement. The following sections report perceptions of students, mentors, and site program coordinators (from the APR) that pertain to current programmatic efforts, as well as recommendations for evidence-based improvements to help GEMS achieve its desired outcomes.

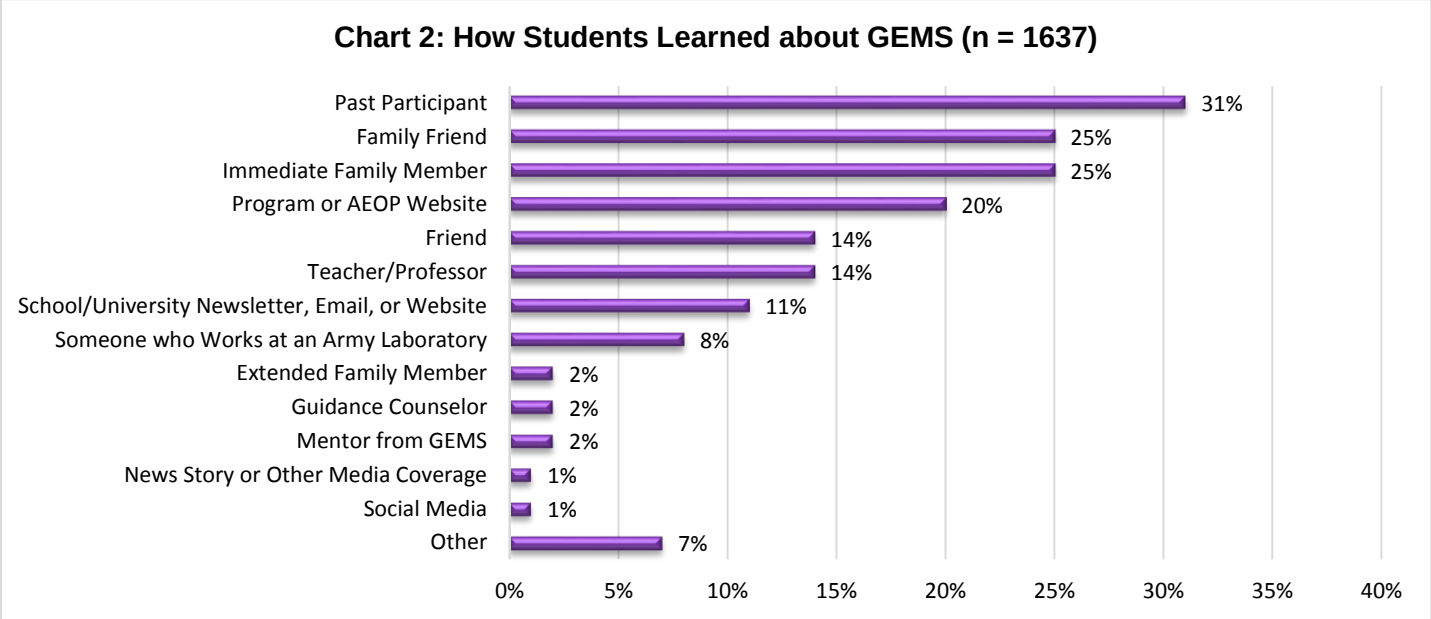
Marketing and Recruiting

According to the FY14 Annual Program Report, multiple strategies were used to disseminate information about the GEMS program. Email blasts were sent to over 4,000 teachers, guidance counselors, and principals in areas near

participating GEMS labs. Promotional materials, e.g., AEOP brochures, were mailed to requesting teachers. Outreach efforts via social media were also coordinated with Virginia Tech and a cross-promotional outreach effort was organized with eCYBERMISSION. In addition, outreach efforts targeted historically underrepresented and underserved populations. For example, outreach events were organized at:

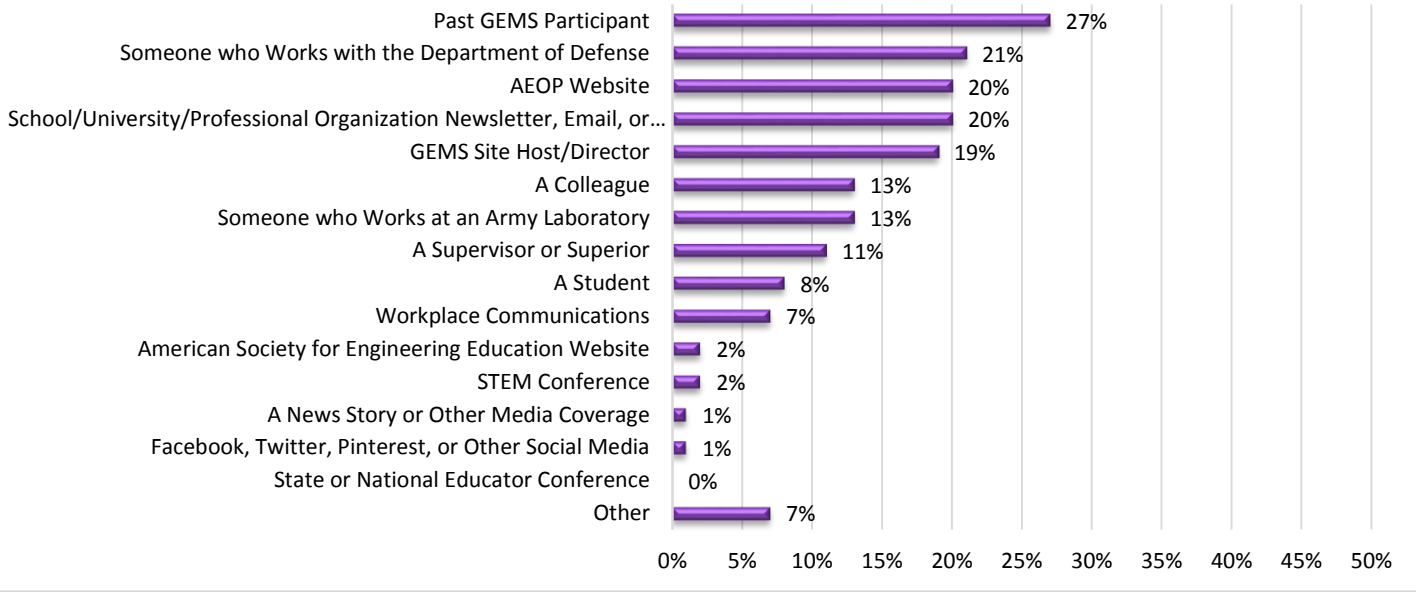
- Event it. Build it. Career Expo at the Society of Women Engineers Conference;
- Hispanic Association for Colleges and Universities Conference;
- DCPS Event at ASEE Headquarters; and
- 2014 ASEE Annual Conference.

In order to understand which recruitment methods are most effective, the questionnaire asked students to select all of the different ways they heard about GEMS. Chart 2 summarizes students' responses. The most frequently reported source of information about the local GEMS program, other than past participation, was an immediate family member (25%) or family friend (25%). Other sources selected relatively frequently were the AEOP website (20%), a teacher or professor (14%), and a school/university newsletter, email, or website (11%).



Mentors were also asked how they learned about GEMS (see Chart 3). Mentor responses indicated that they learned about the program through various sources. About a quarter of the mentors heard about GEMS from a past participant in the program. Other mechanisms frequently identified were learning about GEMS from a Department of Defense employee (21%); a school/university/professional organization newsletter, email, or website (20%); the AEOP website (20%); and a GEMS Site Host/Director (19%).

Chart 3: How Mentors Learned about GEMS (n = 84)



To examine whether mentors are expanding their participation in AEOP programs, the questionnaire asked how many times they participated in each of the AEOP programs. As would be expected, responding mentors most frequently reported participating in GEMS. Outside of GEMS, 15% or fewer mentors reported participating in any other AEOP program. It will be important to track this information on the mentor survey in future years to determine whether the program is building a cadre of mentors who can support to GEMS over time.

Motivating Factors for Participation

Motivating factors for students. Student questionnaires and focus groups included questions to explore what motivated students to participate in GEMS. Specifically, the questionnaire asked how motivating a number of factors were in their decision to participate. As can be seen in Table 14, the vast majority of responding students indicated that the desire to learn something new or interesting (95%), interest in STEM (94%), and learning in ways that are not possible in school (90%) were "very much" motivating. The opportunity to use advance laboratory technology (87%), having fun (85%), the desire to expand laboratory or research skills (83%), and parent encouragement (75%) were each indicated as "very much" motivating by three-quarters or more of the respondents. Interestingly, fewer than half of GEMS students indicated that earning money over the summer (48%) or interest in STEM careers with the Army (47%) were "very much" motivating factors for participation.

Table 14. Factors Motivating Student Participation in GEMS (n = 1471-1515)	
Item	**Percent Indicating "Very much"**
Desire to learn something new or interesting	95%
Interest in science, technology, engineering, or mathematics (STEM)	94%
Learning in ways that are not possible in school	90%
Opportunity to use advanced laboratory technology	87%
Having fun	85%
Desire to expand laboratory or research skills	83%
Parent encouragement	75%
Serving the community or country	62%
Teacher or professor encouragement	59%
Opportunity to do something with friends	55%
Building college application or résumé	49%
Earning money over the summer	48%
Interest in STEM careers with the Army	47%
Networking opportunities	46%
The program mentor(s)	46%
An academic requirement or school grade	38%

In addition to some of the motivating factors students noted on the survey, focus groups also revealed that some students participated in GEMS in order to explore different careers or already had a STEM career in mind. As four students explained why they chose to participate:

> *Because I want to be an engineer. I feel like doing the program introduces me to different careers.* (GEMS Student)

> *I'm not sure what I want to do when I grow up, but I know I want to do something in the math and science field. So I did GEMS to figure out what jobs I might want to do when I'm older.* (GEMS Student)

> *I really like science, and it's what I want to do as a career when I get when I get older. I had a 6th grade science teacher recommend me for the program and informed me about it. So, I decided you know, "Okay, I'll check it out." and I've come here for the past four years.* (GEMS Student)

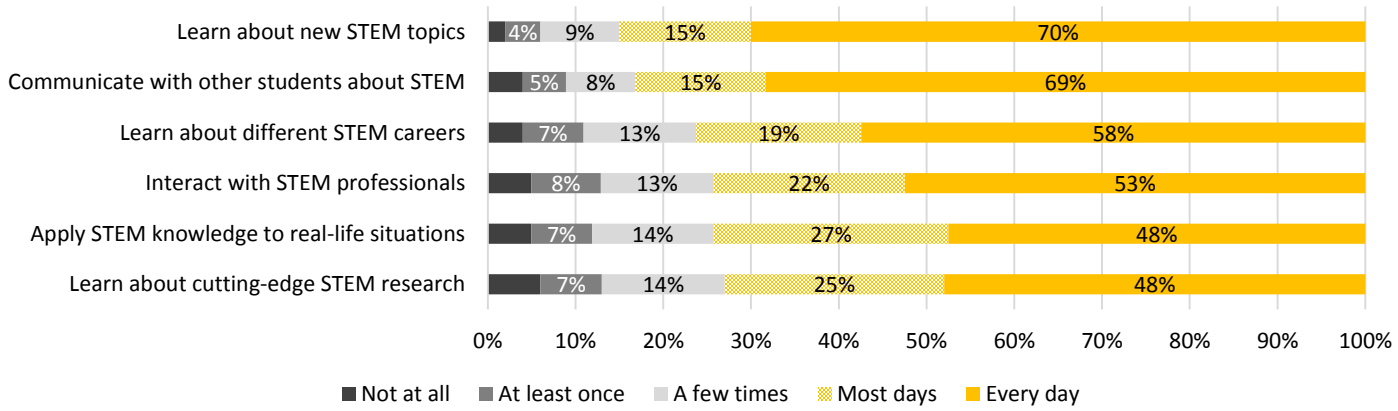
> *I'm looking to become a scientist or a research scientist when I'm older so this will help me in my career path if I chose that one.* (GEMS Student)

The GEMS Experience

The student questionnaire included several items asking about the nature of students' experience in GEMS, and how that experience compared to their STEM learning opportunities in school.[5] In addition, the student and mentor questionnaires included items about how mentors engaged their students.

When asked what field their GEMS experience focused on, 61% of responding students selected science, 23% engineering, 14% technology, and 2% mathematics. Students were also asked a series a questions about what their GEMS experience focused on. As can be seen in Chart 4, the vast majority of respondents indicated learning about new STEM topics, and communicating with other students about STEM on most days or every day of the experience. Students also reported interacting with STEM professionals, applying STEM knowledge to real-life situations, learning about different STEM careers, and learning about cutting-edge STEM research on most days or every day. Mentors were asked similar questions about the nature of their students' experience. Mentor reports of frequency of student opportunity to engage in various activities were generally higher than students (responses to these items can be found in Appendix C).[6]

Chart 4: Nature of Student Activities in GEMS (n = 1847-1872)



Because exposing students to STEM careers in the Army and DoD is one objective of the GEMS program, student participants in focus groups were asked about how they learned about STEM research and careers in GEMS. Although student descriptions of the emphasis placed on this component varied, speakers on and discussions about different careers were often cited as mechanisms for learning about careers. The student questionnaire also asked how many jobs/careers in STEM in general, and STEM jobs/careers in the DoD more specifically, students learned about during their experience. As can be seen in Table 15, nearly all students reported learning about at least one STEM job/career,

[5] The mentor questionnaire asked parallel items. Results were similar and can be found in Appendix C.

[6] Because of the relatively low response rates on the mentor questionnaire, it is impossible to determine whether any differences between the two datasets are real or an artifact of which mentors provided data. In addition, as mentors typically worked with multiple students, it is not clear which students mentors were considering when responding to these items.

and the majority (66%) reported learning about five or more. Similarly, 84% of students reported learning about at least one DoD STEM job/career, though only about a third reported learning about many different STEM jobs/careers in the DoD. The distributions of responses to these items were tested to see if there were changes in the number of jobs students learned about in 2014 compared to 2013. The results indicated that, for both items, the distribution of responses in 2014 were statistically different from responses in 2013, though the effect sizes were extremely small: STEM Jobs/Careers d = 0.050 standard deviations, DoD STEM Jobs/Careers d = 0.080 standard deviations.[7]

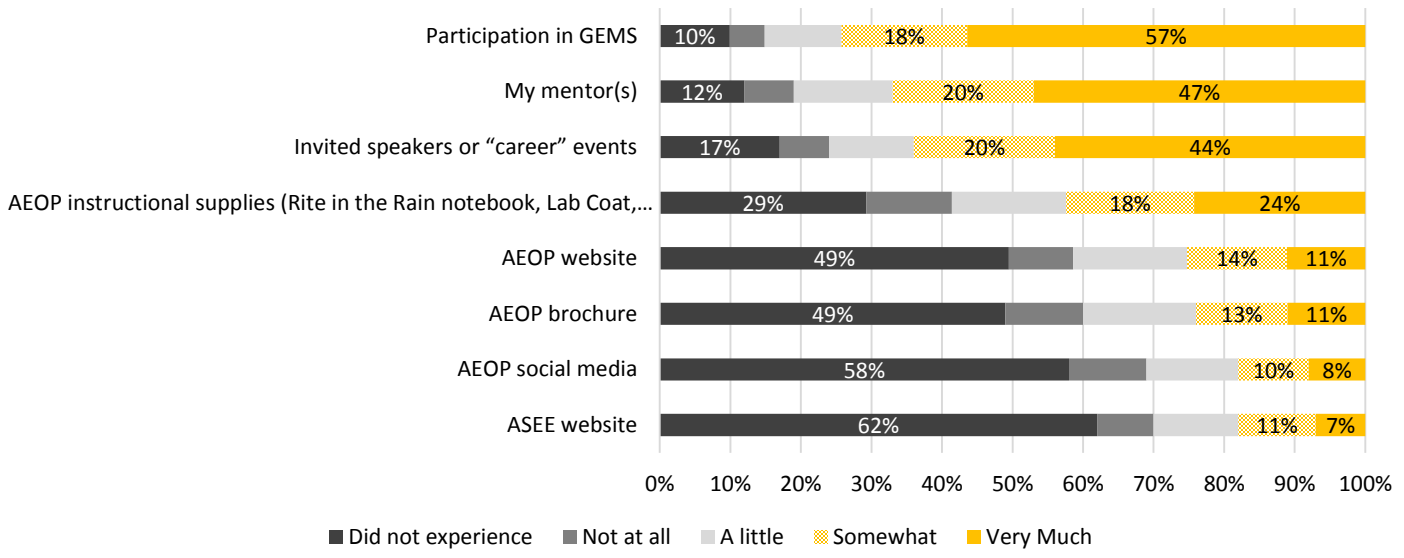
Table 15. Number of STEM Jobs/Careers Students Learned about During GEMS

	STEM Jobs/Careers		DoD STEM Jobs/Careers	
	2013 (n =1476)	2014 (n =1745)	2013 (n =1473)	2014 (n = 1653)
None	3%	2%	11%	16%
1	3%	3%	9%	9%
2	7%	6%	19%	13%
3	13%	12%	24%	20%
4	13%	11%	12%	9%
5 or more	61%	66%	25%	33%

Students were also asked which resources impacted their awareness of DoD STEM careers. Participation in GEMS (75%), students' mentors (67%), and invited speakers or career events (64%) were most often reported as being somewhat or very much responsible for this impact (see Chart 5). Data from the mentor questionnaire (shown in Appendix C) indicated greater impact of each of these resources than the student data.

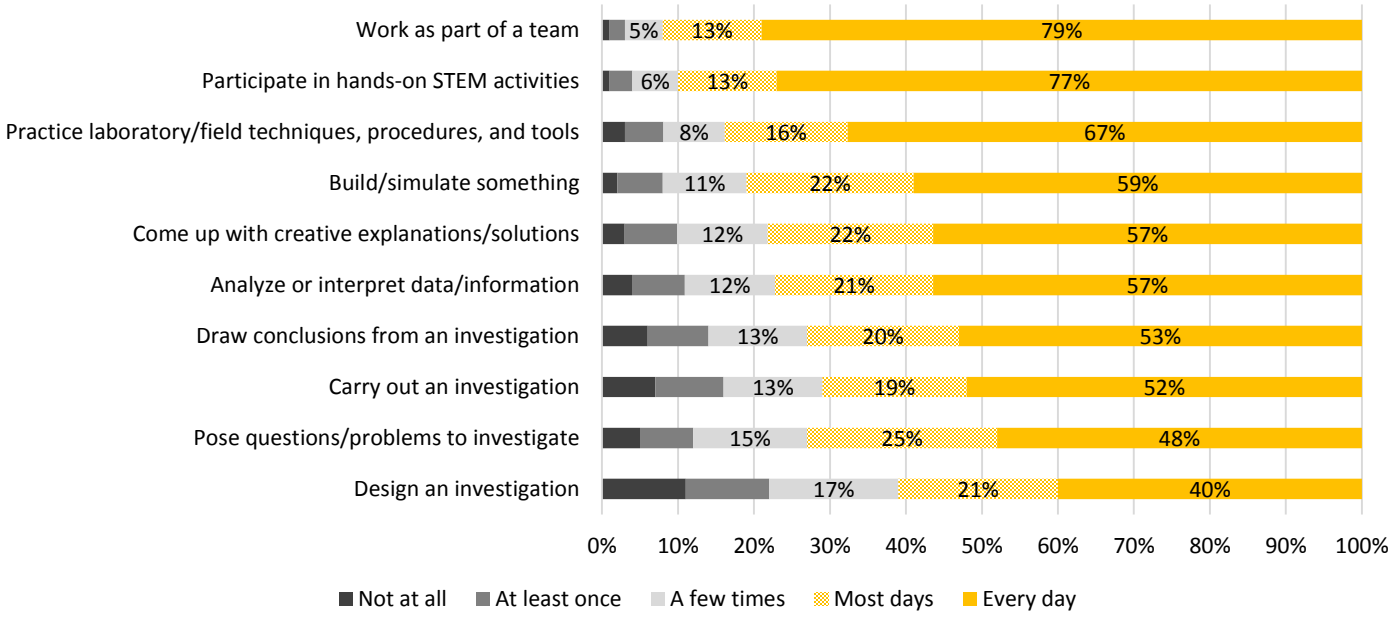
[7] Independent-samples Kolmogorov-Smirnov test, $D = 1.414$, $p = 0.037$.

Chart 5: Impact of Resources on Student Awarenessof DoD STEM Careers (n = 1698-1713)



The questionnaire also asked students how often they engaged in various STEM practices during GEMS. Results indicate that students were very actively engaged in doing STEM during the program (see Chart 6). For example, 92% of responding students indicated working as part of a team on most days or every day; 90% reported participating in hands-on activities, 83% reported practicing laboratory/field techniques, procedures, and tools; and 81% reported building/simulating something. In addition, students indicated being integrally involved the work of STEM on most days or every day, including, designing investigations (61%), carry out investigations (71%), analyzing or interpreting data (78%), and drawing conclusions from an investigation (73%).

Chart 6: Student Engagement in STEM Practices in GEMS(n = 1799-1873)



A composite score[8] was calculated for each of these two sets of items, the first titled "Learning about STEM in GEMS,"[9] and the second "Engaging in STEM Practices in GEMS."[10] Response categories were converted to a scale of 1 = "Not at all" to 5 = "Every day" and calculating the average across all items in the scale. The composite scores were used to test whether there were differences in student experiences by gender, race/ethnic group (minority vs. non-minority students), and FRL status. There was a significant difference in scores on both composites by each of these variables, although the differences were quite small in all cases. Minority students had, on average, lower scores on the Learning about STEM in GEMS and Engaging in STEM practices in GEMS composites than did non-minority students with small

[8] Using multiple statistical tests on related outcomes requires the use of a Type I error rate adjustment to reduce the likelihood of false positives (i.e., detecting a difference when one does not truly exist). However, Type I error rate adjustments lead to a reduction in statistical power (i.e., the ability to detect a difference if it does exist). The use of a composite score helps avoid both of these problems by reducing the total number of statistical tests used. In addition, composite scores are typically more reliable than individual questionnaire items.

[9] The Cronbach's alpha reliability for these 6 items was 0.878.

[10] The Cronbach's alpha reliability for these 10 items was 0.916.

effects of d = 0.222 standard deviations[11] and d = 0.270 standard deviations, respectively.[12] Female students had, on average, higher scores than males on both composites with small effect sizes for both: Learning about STEM, d = 0.133 standard deviations; Engaging in STEM, d = 0.116 standard deviations.[13] Students who qualified for FRL, on average scored lower than student who did not qualify for FRL, again with small effects: d = 0.217 standard deviations for Learning about STEM and d = 0.235 standard deviations for Engaging in STEM Practices.[14]

To examine how the GEMS experience compares to their typical school experience, students were asked how often they engaged in the same activities in school (individual item responses can be found in Appendix B). These responses were also combined into two composite variables: "Learning about STEM in School,"[15] and "Engaging in STEM Practices in School"[16] that are parallel to the ones asking about GEMS. As can be seen in Chart 7, scores were significantly higher on the "in GEMS" versions of both composites than on the "in school" versions with large effects of d = 1.171 standard deviations for Learning about STEM and d = 1.104 standard deviations for Engaging in STEM Practices.[17] These findings indicate that GEMS provides students with more intensive STEM learning experiences than they would typically receive in school.

[11] Effect size calculated as Cohen's d: the difference in means of the two groups divided by the pooled standard deviation. Effect sizes of about 0.20 are typically considered small, 0.50 medium, and 0.80 large. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

[12] Two-tailed independent samples t-tests: Learning about STEM $t(1878) = 4.46$, $p = 0.000$; Engaging in STEM Practices $t(1878) = 5.35$, $p < 0.001$.

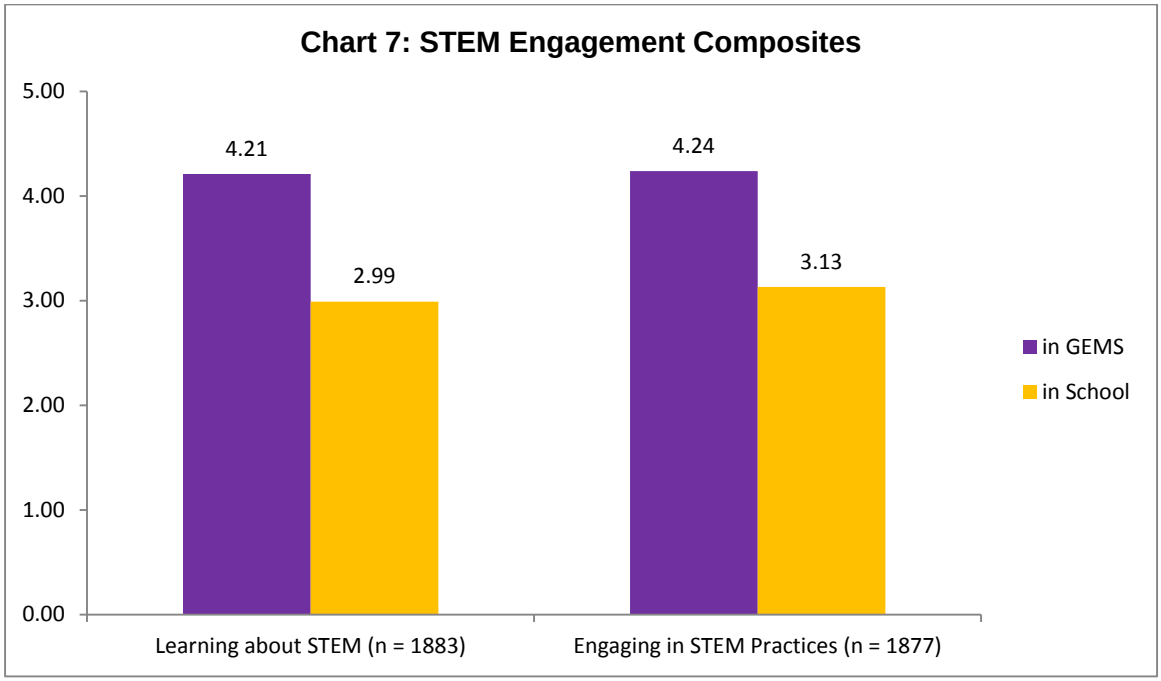
[13] Two-tailed independent samples t-tests: Learning about STEM $t(1852) = 2.84$, $p = 0.005$; Engaging in STEM Practices $t(1852) = 2.48$, $p = 0.013$.

[14] Two-tailed independent samples t-tests: Learning about STEM $t(1694) = 3.04$, $p = 0.002$; Engaging in STEM Practices $t(1694) = 3.29$, $p = 0.001$.

[15] Cronbach's alpha reliability of 0.880.

[16] Cronbach's alpha reliability of 0.952.

[17] Two-tailed paired samples t-tests: Learning about STEM $t(1882) = 50.82$, $p < 0.001$; Engaging in STEM Practices $t(1876) = 47.85$, $p < 0.001$.



The Role of Mentors

Mentors, (i.e., NPMs, RTs, and site directors) play a critical role in the GEMS program. The nature and quality of the various support provided by these individuals is a critical factor for maximizing students' engagement during STEM activities and for inspiring or sustaining their interest in future STEM. In general, the number of students a mentor works with varies depending on the role. For example, Near Peers tend to work with small groups of students while RTs work with entire classes of students. On average, mentors responding to the mentor questionnaire reported working with 69 students, with a range of 8 to 300 students. The average number of students per mentor varied widely by site, with a low of 28 students per mentor at Army Research Laboratory-Aberdeen Proving Ground to a high of 285 at Walter Reed Army Institute of Research.

Mentors were also asked whether or not they used a number of strategies when working with students. These strategies comprised five main areas of effective mentoring:[18]

[18] Mentoring strategies examined in the evaluation were best practices identified in various articles including:

Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among US students. *Science Education*, *95*(5), 877-907.

Ornstein, A. (2006). The frequency of hands-on experimentation and student attitudes toward science: A statistically significant relation (2005-51-Ornstein). *Journal of Science Education and Technology*, *15*(3-4), 285-297.

Sadler, P. M., Sonnert, G., Hazari, Z., & Tai, R. (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science Education*, *96*(3), 411-427.

1. Establishing the relevance of learning activities;
2. Supporting the diverse needs of students as learners;
3. Supporting students' development of collaboration and interpersonal skills;
4. Supporting students' engagement in "authentic" STEM activities; and
5. Supporting students' STEM educational and career pathways.

Large proportions of responding mentors used several strategies to help make the learning activities relevant to students (see Table 16). For example, nearly all reported helping students become aware of the roles STEM plays in their everyday lives (99%). A vast majority also found out about students backgrounds and interests at the beginning of the program (93%), gave students real-life problems to investigate and solve (91%), asked students to relate outside events or activities to topics covered in the program (90%), and helped students understand how STEM can help them improve their communities (87%). Fewer mentors selected readings or activities related to students' backgrounds (44%). It also should be noted that about half of the mentors (48%) made explicit provisions for students wishing to carry out independent studies even though the opportunity to conduct independent studies is not an expectation of the GEMS program.

Table 16. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 81-82)

Item	Questionnaire Respondents
Helping students become aware of the roles STEM plays in their everyday lives	99%
Finding out about students' backgrounds and interests at the beginning of the program	93%
Giving students real-life problems to investigate or solve	91%
Asking students to relate outside events or activities to topics covered in the program	90%
Helping students understand how STEM can help them improve their communities	87%
Encouraging students to suggest new readings, activities, or projects	66%
Making explicit provisions for students who wish to carry out independent studies	48%
Selecting readings or activities that relate to students' backgrounds	44%

Similarly, mentors reported using a variety of strategies to support the diverse needs of students as learners. As can be seen in Table 17, 96% of mentors reported treating all students the same way, regardless of gender or race/ethnicity, and using diverse teaching/mentoring activities. Many mentors used gender neutral language (93%), tried to find out about student learning styles (77%), and found out about students' learning styles at the beginning of the program (76%).

Table 17. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 81-82)	
Item	**Questionnaire Respondents**
Interacting with all students in the same way regardless of their gender or race and ethnicity	96%
Using diverse teaching/mentoring activities to address a broad spectrum of students	96%
Using gender neutral language	93%
Directing students to other individuals or programs if I can only provide limited support	77%
Finding out about students' learning styles at the beginning of the program	76%
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	57%
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	48%

Mentors reported using many strategies to support students' development of collaboration and interpersonal skills (see Table 18). For example, nearly all of those responding to the questionnaire indicated having students work as members of a team on activities or projects (98%), listen to the ideas of others with an open mind (96%), develop ways to resolve conflict and reach agreement (95%), and pay attention to the feelings of all team members (95%). The vast majority also had students exchange ideas with others whose backgrounds or viewpoints were different from their own (94%), explain difficult ideas to others (94%), participate in giving and receiving feedback (94%), and tell others about their backgrounds and interests (88%).

Table 18. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 80-81)	
Item	**Questionnaire Respondents**
Having students work on collaborative activities or projects as a member of a team	98%
Having students listen to the ideas of others with an open mind	96%
Having students develop ways to resolve conflict and reach agreement among the team	95%
Having students pay attention to the feelings of all team members	95%
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	94%
Having students explain difficult ideas to others	94%
Having students participate in giving and receiving feedback	94%
Having students tell others about their backgrounds and interests	88%

When asked about strategies used to support student engagement in authentic STEM activities, 99% of responding mentors reported encouraging students to see support from other team members and helping students practice STEM skills with supervision (see Table 19). The strategies of demonstrating the use of laboratory or field techniques,

procedures, and tools students and giving constructive feedback were used by 96% and 95% of mentors, respectively. Allowing students to work independently as appropriate for their self-management abilities and STEM competencies (89%), encouraging opportunities in which students could learn from others (85%), and teaching/assigning readings about specific STEM subject matter (74%) were also widely used strategies. Interestingly less than half of the responding mentors reported having students access and critically review technical texts or media (43%).

Table 19. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 80)	
Item	**Questionnaire Respondents**
Encouraging students to seek support from other team members	99%
Helping students practice STEM skills with supervision	99%
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	96%
Giving constructive feedback to improve students' STEM competencies	95%
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	89%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	85%
Teaching (or assigning readings) about specific STEM subject matter	74%
Having students access and critically review technical texts or media to support their work	43%

The last series of items about mentoring strategies focused on supporting students' STEM educational and career pathways (see Table 20).[19] Nearly all of the responding mentors reported asking students about their educational and career interests (99%) and sharing their own experiences, attitudes, and values about STEM (98%). Many also provided guidance to students, either about educational pathways that would prepare them for a STEM career (91%) or recommending extracurricular programs that align with their educational goals (85%).

However, given the GEMS program goals of exposing participants to STEM careers in the Army and DoD, it is somewhat surprising that only about three-quarters of responding mentors reported discussing STEM career opportunities with the DoD or other government agencies. Additionally, only 67% of mentors reported recommending AEOPs that align with students' educational goals. Further, only 40% of the responding mentors reported highlighting the under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM, which seems inconsistent with the broader AEOP goal of increasing the diversity of STEM talent in support of the defense industry base.

[19] The student questionnaire included a subset of these items. The student data are similar to the mentor data, and can be found in Appendix B.

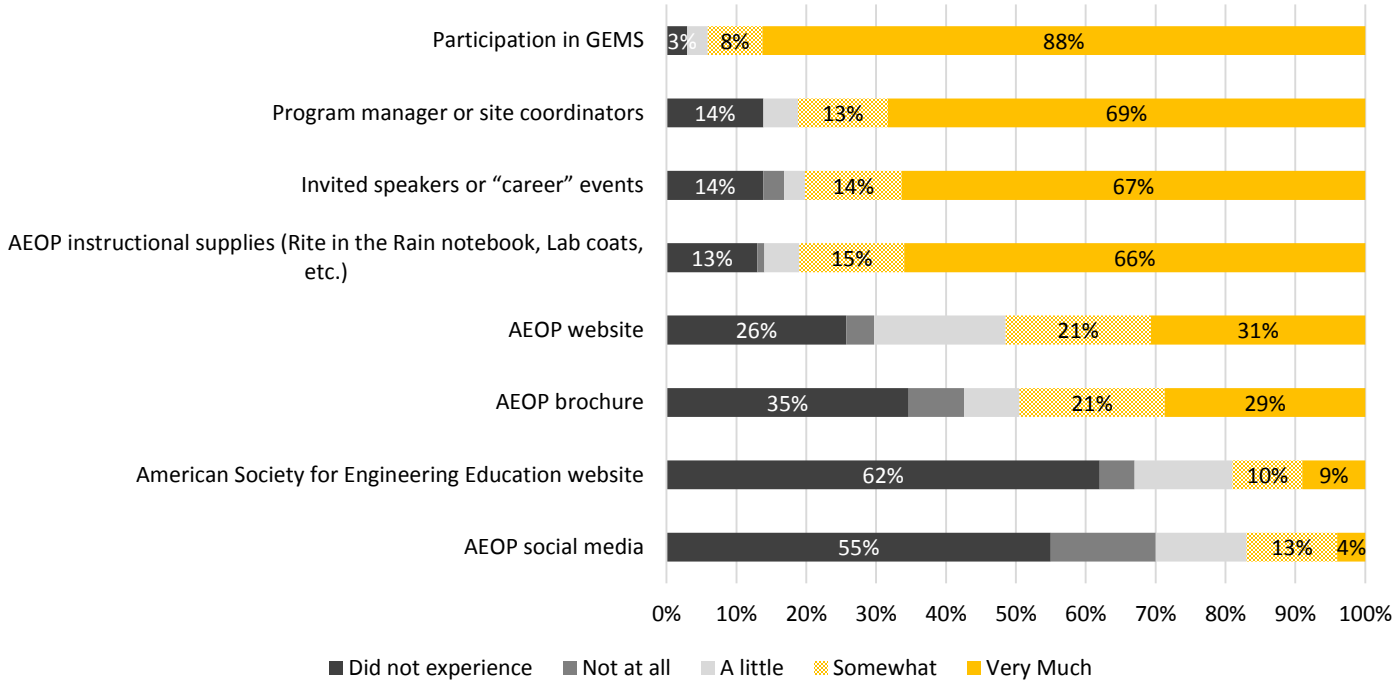
Table 20. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 79-80)	
Item	**Questionnaire Respondents**
Asking about students' educational and career interests	99%
Sharing personal experiences, attitudes, and values pertaining to STEM	98%
Providing guidance about educational pathways that would prepare students for a STEM career	91%
Recommending extracurricular programs that align with students' educational goals	85%
Recommending student and professional organizations in STEM	76%
Discussing STEM career opportunities with the DoD or other government agencies	74%
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	71%
Helping students build effective STEM networks	71%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	68%
Recommending AEOPs that align with students' educational goals	67%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	40%
Critically reviewing students' résumé, application, or interview preparations	25%

A separate item on the mentor questionnaire asked which of the AEOP programs mentors explicitly discussed with their students during GEMS. Not surprisingly, the most frequently discussed program was GEMS (94%) and GEMS NPMs (86%), as can be seen in Table 21. Three-fifths of the responding mentors indicated discussing at least one other AEOP with students, most commonly SEAP (49%) and CQL (35%). Other programs discussed with students by about a quarter of responding mentors were HSAP (27%), WPBDC (27%), REAP (25%), eCYBERMISSION (24%), SMART (24%), and URAP (24%).

Table 21. Mentors Explicitly Discussing AEOPs with Students (n = 78-80)	
Item	**Questionnaire Respondents**
Gains in the Education of Mathematics and Science (GEMS)	94%
GEMS Near Peers	86%
Science & Engineering Apprenticeship Program (SEAP)	49%
College Qualified Leaders (CQL)	35%
High School Apprenticeship Program (HSAP)	27%
Research & Engineering Apprenticeship Program (REAP)	25%
eCYBERMISSION	24%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	24%
Undergraduate Research Apprenticeship Program (URAP)	24%
Junior Science & Humanities Symposium (JSHS)	23%
Junior Solar Sprint (JSS)	22%
UNITE	18%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	11%

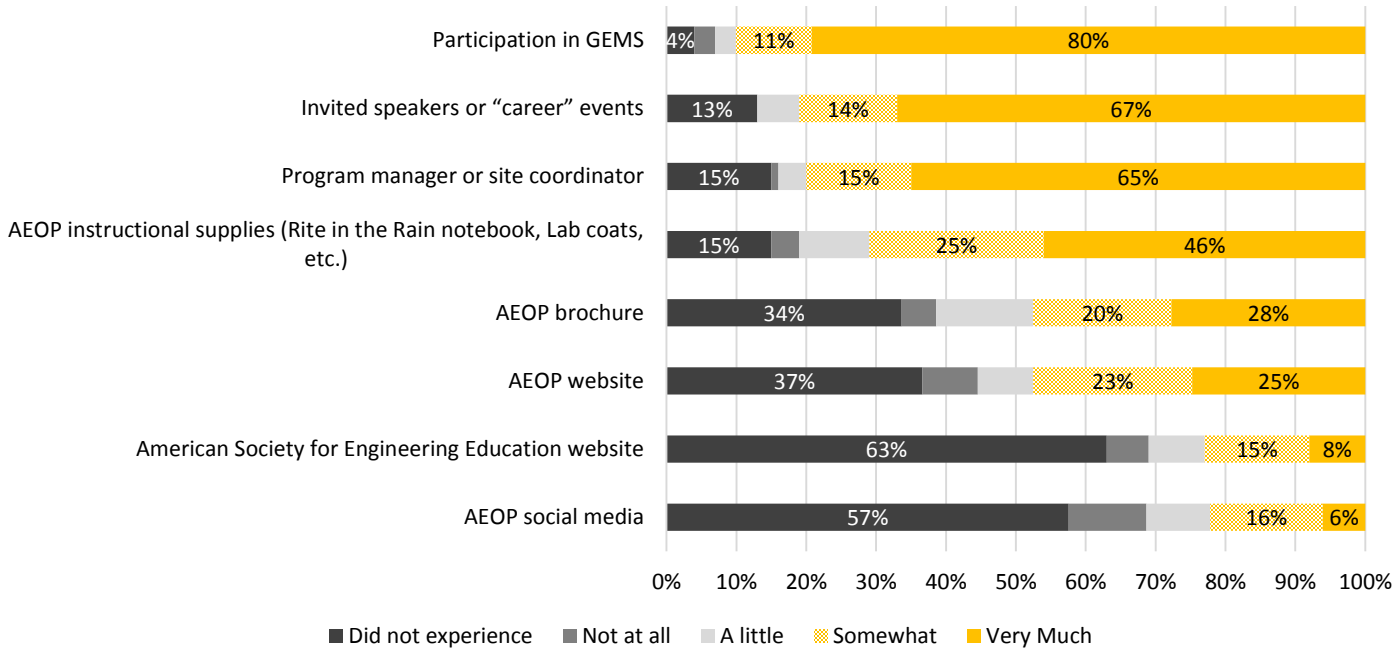
Mentors were also asked how useful various resources were in their efforts to expose students to the different AEOPs. As can be seen in Chart 8, participation in GEMS (88%), program managers or site coordinators (69%), invited speakers or career events (67%), and AEOP instructional supplies (66%) were most often rated as "very much" useful. Other resources provided by the AEOP program tended not to be seen as very useful, with large proportions of mentors indicating they did not experience these resources. For example, 62% of responding mentors reported not experiencing the American Society for Engineering Education website and only 9% rated it as "very much" useful. Similarly, about 55% of responding mentors did not experience the AEOP social media; 4% found this resource very useful.

Chart 8: Usefulness of Resources for Exposing Students to AEOPs (n = 78-80)



Mentors were also asked how useful these resources were for exposing students to DoD STEM careers (see Chart 9). As with the previous item, mentors were most likely to rate participation in GEMS as useful, with 80% selecting "very much." Invited speakers or career events (67%), and program managers or site coordinators (65%) were seen as very useful by a substantive number of responding mentors. Again, AEOP materials were less likely to be seen as very useful for this purpose (a range of 6-28%), with a substantial proportion of mentors indicating they did not experience these resources.

Chart 9: Usefulness of Resources for Exposing Students to DoD STEM Careers (n = 78-80)



Mentors in focus groups discussed in more detail the strategies used in their program to expose students to various DoD careers. One mentor described the facility tours and guest speakers:

> *We take a weekly tour, every week, and it's different each week, so that the students would get that exposure. Today we had two different presenters, but usually there's 3 or 4 different areas where you will go in a particular facility, and each one, after talking about what each particular job is, talks about what a student would need to do if they were interested in that. And that's one thing I know that they incorporated to be able to add that piece, and they do it every week.* (GEMS Mentor)

Two other mentors talked about how discussion of DoD careers was integrated into the lessons that students experience. As they said:

> *When I spent time with the kids, I try to emphasize some of the different career paths you can take to work on a very specific area. You know, batteries, you can have a materials background, you can come at it from a chemistry background, you can come at it from an engineering background. I think that emphasizes there are a lot of different paths to get to different places. The other thing I think is important is that some of that just goes with the lessons that we teach them. I see them, even as I talk to adults, they think if you're working for the Army you're making bombs or guns. I think it is important to show them that there is a lot that happens that*

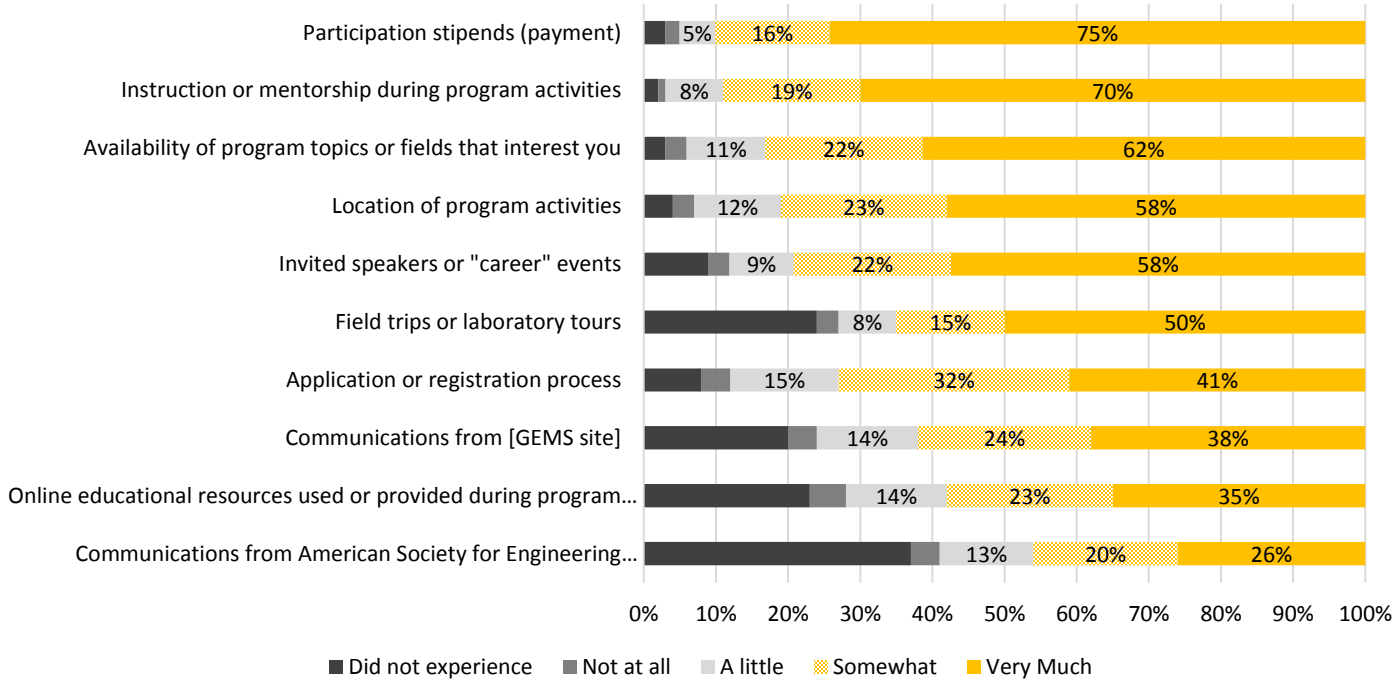
provides important technologies and important capabilities for our soldiers and a lot of them get spun off into commercial products as well. There is a lot more there besides just that first level perspective. (GEMS Mentor)

I know a lot of times after we present material on a new subject, the last couple slides on every PowerPoint will have: these are some careers you can go in to that will relate to whatever subject you just learned…we ask the kids what careers they're interested in, and we go through the list and pick a couple and especially use some that are STEM related and show them videos on how the career affects the world, or what sort of education you need. Then we have a class discussion on that career, and we'll probably do that twice a day. (GEMS Mentor)

Satisfaction with GEMS

Students and mentors were asked how satisfied they were with a number of features of the GEMS program. As can be seen in Chart 10, the majority of responding students were somewhat or very much satisfied with most of the listed program features. For example, 91% of students were at least somewhat satisfied with the participation stipend, 89% with the instruction or mentorship during program activities, and with the availability of program topics or fields of interest to them (84%). In addition, 81% of students were at least somewhat satisfied with the location of program activities, and with the invites speakers or career events (81%). In contrast, fewer than half were somewhat or very much satisfied with communication from ASEE.

Chart 10: Student Satisfaction with GEMS Program Features (n = 1695-1714)



An open-ended item on the questionnaire asked student about their overall satisfaction with their GEMS experience. The responses were quite positive. Of the 199 students sampled,[20] 172 students answered this question. About 80% of these students commented only on positive aspects of the program, most frequently describing areas of learning, the quality of the mentors, and how enjoyable the program was. For example:

> *It was very fun and interesting. I learned a lot of new things and was opened to more ideas of majors and jobs. The mentors/teachers were really nice and made GEMS fun. I was very happy and plan on applying for next year.* (GEMS Student)

> *GEMS was overall a great program. I thought that the activities were fun, but I also learned about different careers in GEMS. I wish they had shown more math and engineering careers because that is what I'm interested in. I liked the hands-on activities and I had a great week.* (GEMS Student)

> *I had a lot of fun. I would definitely want to do this next year. I loved learning about all the different fields and being able to tell my friends about all the things I learned in GEMS. I now want to have a career in biomedical engineering, thanks to the GEMS program. I also feel more comfortable being a women going into an engineering field, and not scared to be the only one, but proud :) Thanks for this amazing opportunity!!!!* (GEMS Student)

Other responses included positive comments, but had some caveats (13% of respondents). For example, one student indicated learning about STEM-related education pathways, but that the lessons and labs were too simple. Another student commented that there was too much lecturing:

> *I was surprised by how fun the whole GEMS experience was. We did lots of interesting labs and learned about very diverse topics. But the only thing I didn't like was that there was way too much time put into lecturing and sometimes it got very boring. In conclusion, I made a lot of friendships and the overall experience was very enlightening.* (GEMS Student)

[20] Responses from a random sample of 199 students were coded, which represents 10% of the population. The random sample was compared to the full dataset and found to be representative in terms of grade, gender, race, FRL, school location, and school type.

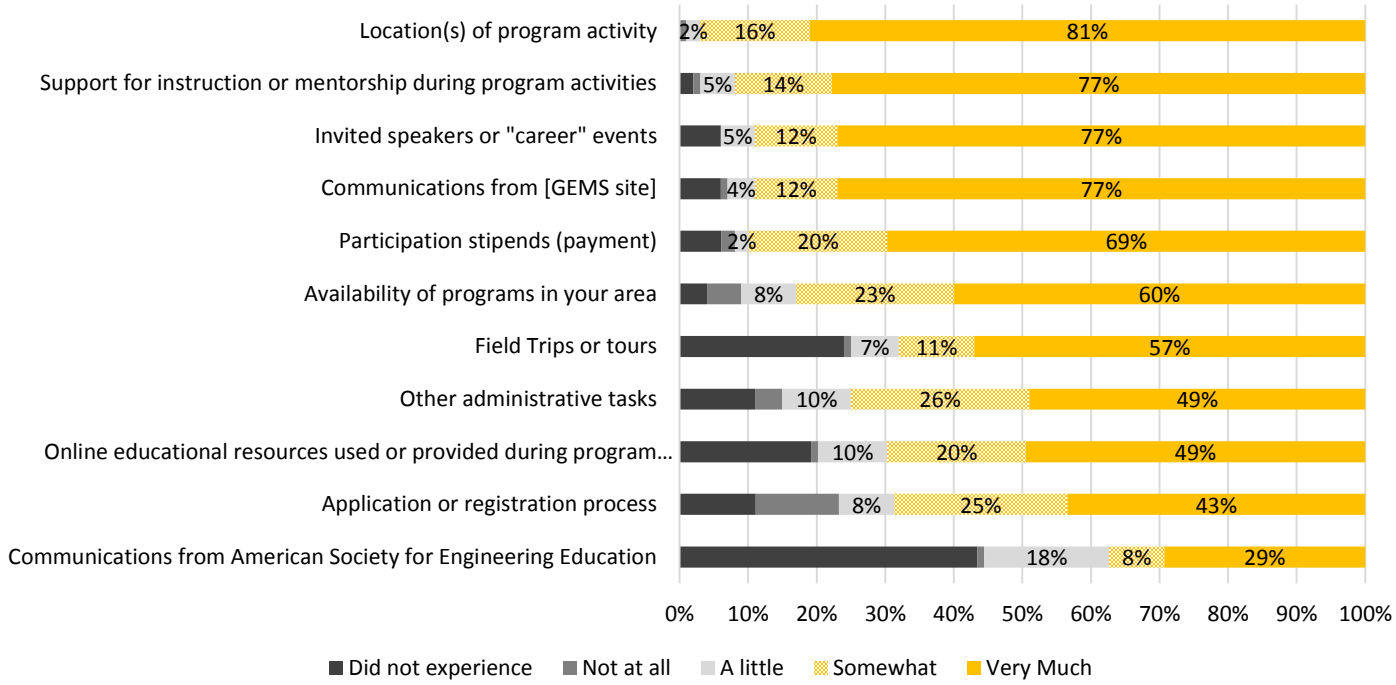
"I now want to have a career in biomedical engineering, thanks to the GEMS program. I also feel more comfortable being a women going into an engineering field, and not scared to be the only one, but proud :) Thanks for this amazing opportunity!!!!"-- GEMS Student

When asked how the program could be improved, 150 of the 199 students provided at least one response other than "none" or "not applicable." About two-thirds of students responding suggested changes related to program logistics. The most common theme in this area were changes to the length of the program (typically longer), the length of the day (typically shorter), or the start time (typically later). Students also suggested changing participant grouping, the amount and quality of food, and the equipment/supplies provided.

Almost half of students responding to this question (47%) suggested improvements to the program's content, though the suggestions varied widely. The most common responses were related to the topics offered in the program, proposing additional topics or increasing the amount of time spent on topics already addressed. A similar number of students (46%) made suggestions for the format of the program activities, most frequently suggesting more labs and hands-on activities. Other suggestions included increasing the number of field trips (11%), and having fewer/shorter lectures (8%).

Mentors also reported being somewhat or very much satisfied with most program components they experienced (see Chart 11). For example 97% were at least somewhat satisfied with the location of program activities, 91% with the support for instruction or mentorship during program activities, 89% with the invited speakers or career events, and 89% with communications from the local GEMS site. Also similar to the students, less than 40% were somewhat or very much satisfied with communication from ASEE.

Chart 11: Mentor Satisfaction with GEMS Program Features (n = 81-83)



As with the student questionnaire, the mentor questionnaire included open-ended items asking for their opinions about the program. One item asked them to identify the three most important strengths of GEMS; 76 mentors responded to this question. Although several important aspects of the program were listed, the most frequently described was the experiences provided to the students including opportunities to do hands-on activities, work with lab equipment, tour facilities, and hear guest speakers (36 mentors, or 47%). Mentors wrote things like "Give students hands-on experience" and "Utilizing laboratory materials." This sentiment was echoed in the mentor focus group. As two mentors said:

> *I think they also learn by doing, and it's more of a fun environment where there are no demands set on achievement, there are no tests at the end of the camp. They are allowed to explore their curiosity in a non-confrontational pressure environment.* (GEMS Mentor)

> *Well they get to experience some really comprehensive projects that are price prohibitive for schools. I mean, I could not buy the materials on my budget for a hovercraft, or all of the investment that is involved in the science materials. So that's not available to the public schools, unless you go out of your own pocket.* (GEMS Mentor)

Other responses to the open-ended questionnaire item focused on the exposure that GEMS provides to a variety of STEM topics, careers, and DoD opportunities in these areas (32 mentors or 42%). As two mentors wrote:

> *Students learn about STEM and many different concepts of science throughout the week, and [GEMS] makes learning science fun. This sets a base for them in the future to realize that science can be fun as well.* (GEMS Mentor)

> *[GEMS] gives students an opportunity to learn about different careers in all different science fields that they might not have thought of. [It] gives kids the opportunity to see career possibilities through labs they enjoyed.* (GEMS Mentor)

Collaboration with others was another common area mentors cited as a strength of GEMS (24 mentors or 35%). Mentors noted the opportunity to interact with scientists and engineers, with military personnel, and with their peers, along with the skills that are built in the process. As was described by one mentor in a focus group:

> *It also fosters teamwork, because you have a group of people that are working together. And I think there are some of these soft skills that are reinforced in a way that we run the curriculum that's not necessarily content based, but allows them to work with one another and allows them to see different points of view. I think that's really important in a science environment because people look at solutions in different ways, and you know, working together for a common goal always gets you there so much faster.* (GEMS Mentor)

Another area of strength noted by mentors was the opportunities that the program provided for students to develop disciplinary content knowledge and connect that learning to real-world issues and applications (21 mentors or 31%). Mentors also comment on the strong leadership in the program, interactions with NPMs, and how GEMS is fun and engaging for students. Interestingly, when asked about the strengths of the program, a handful of mentors commented on opportunities GEMS provided to them, such as doing community outreach and connecting with/teaching students.

Mentors were also asked to note three ways in which GEMS should be improved for future participants. Of the 68 individuals who responded to this question, 66% indicated improvements needed to logistical aspects of the program. For example, 9 mentors each noted the need for more teaching or lab space and resources/supplies. Eight mentors commented on the need to modify the application process, allowing the sites to revise the application for their needs and having the application process ready earlier. Similar to students, 7 of the mentors suggested changing the length of the session (typically longer) or shortening the day. Other logistics issues mentioned were shortening the overly long student surveys and modifying the stipend amount (either increasing it or eliminating it entirely).

About a third of the mentors, (23 mentors or 34%) cited improvements needed to the student activities, suggesting fewer lectures, more engaging labs, and more hands-on activities. Another 30% (21 mentors) commented on the need to cover additional topics, provide more challenging content, cover topics in more depth, or cover topics at multiple levels. As a mentor in a focus group shared:

> *I like the aspect of focusing on different areas. I know for environmental it's always the younger kids, but maybe trying to find something like an engineering type section just for the younger kids because they love that stuff. Then maybe having two options for each level, because I see a lot of recurring kids, through each of the years I've been here. I had one student this week, he's in Getgame right now, I had him last year for intermediate, he wanted to go to advanced, but he was too young, so he went to Getgame and I'm like, "it's okay bud, you'll get good experience this week, and then next year you can go to advanced," and he's like, "but I want to go to bio, I love that bio." So, maybe a nice transition so that a kid, if they fall in love with an area, they can stay with that area and not jump around each year exploring different areas. Maybe the options for each grade instead of just like, oh okay, they have to be here, they have to be there, depending on how old they are.* (GEMS Mentor)

In addition, 24% of responding mentors commented on getting more students into the program, many specifically focusing on students from more diverse backgrounds. A number of these mentors suggested strategies such as advertising better in more schools and providing GEMS in more locations. As one mentor commented:

> *One thing GEMS could really do, is maybe advertise themselves a little more in middle school and high school because I have, honestly I never heard of GEMS until I got into college, and heard about this job from my roommate, so I feel like there could be-I know that in high school there are career days, where there are professionals that come in and talk about their careers and such, perhaps one of our department of defense members can come in and talk, and say if you guys are interested, you guys should try to attend this GEMS program, stuff like that. And also middle school as well, just maybe put a couple posters up or maybe perhaps have a huge student assembly maybe, just talk about what they could do during the summer. Because I know back in my day I just threw a couple rocks in the lake and called that fun. But I feel like spending time in the lab and learning about STEM related courses is a better place for your time.* (GEMS Mentor)

Other areas of improvement mentors suggested were related to the involvement program personnel (13 mentors or 19%). For example, mentors commented on the need for more NPMs, engaging teachers more in planning activities, and having more scientists and engineers from underrepresented groups work in the program.

Lastly, mentors were asked to share their overall satisfaction with their GEMS experience. The responses were very positive. Of the 66 individuals who responded to this question, nearly all (64 mentors or 97%) were complementary about the program. The most common themes in these responses were GEMS was a good experience for them personally, that the program was good for students, that they enjoyed seeing students excited about learning. For example:

> *I was very happy with my GEMS experience. It was awesome to be able to see so many kids so enthusiastic about science and interested in learning. I really enjoyed working with the GEMS program. It was not only a great opportunity for me to learn about the topics and about myself but also gave the students a great opportunity to learn, have fun and make connections in science.* (GEMS Mentor)

> *This has been a fantastic summer. The resource teacher and program coordinators have provided me with an amazing level of support and information whenever I needed it, and they have helped me grow so much in my skills and confidence. As a future science teacher, I have learned many fun and interesting experiments and techniques for my classroom, and I have gained a lot in the area of classroom management. GEMS is much more fun than school, because there are smaller groups, fewer regulations, and no standards or achievement tests. The students were (almost) all excited to be at GEMS, and their enjoyment made the program more fun for all of us.* (GEMS Mentor)

In summary, findings from the Actionable Program Evaluation indicate that the program is having increasing success in providing a program that actively engages students in authentic STEM experiences. The multi-faceted approach to marketing GEMS has allowed the program to recruit students from underrepresented and underserved students.

Once in the GEMS program, students are learning about DoD or STEM job/careers, with most mentors crediting student participation in the program and invited speakers as useful in this process. In an attempt to catalyze continued student engagement in the AEOP programs, mentors are also discussing other AEOPs with students, with SEAP and CQL being the most commonly discussed AEOPs.

The GEMS program actively engages students in learning about STEM and in STEM practices, more than they would typically experience in school. As part of this engagement, large proportions of mentors employed strategies to help make the learning activities relevant to students, support the diverse needs of students as learners, support students' development of collaboration and interpersonal skills, and support student engagement in authentic STEM activities. Overall, students and mentors were somewhat or very much satisfied with the GEMS program.

Outcomes Evaluation

The evaluation of GEMS included measurement of several outcomes relating to AEOP and program objectives, including impacts on students' STEM competencies (e.g., knowledge and skills), STEM identity and confidence, interest in and intent

"I really enjoyed working with the GEMS program. It was not only a great opportunity for me to learn about the topics and about myself but also gave the students a great opportunity to learn, have fun and make connections in science."-- GEMS Mentor

for future STEM engagement (e.g., further education, careers), attitudes toward STEM, knowledge of and interest in participating in additional AEOP opportunities, and knowledge of DoD STEM careers.[21]

STEM competencies are necessary for a STEM-literate citizenry. STEM competencies include foundational knowledge, skills, and abilities in STEM, as well as the confidence to apply them appropriately. STEM competencies are important for those engaging in STEM enterprises, but also all members of society as critical consumers of information and effective decision makers in a world that is heavily reliant on STEM. The evaluation of GEMS measured students' self-reported gains in STEM competencies and engagement in opportunities intended to develop what is considered to be a critical STEM skill in the 21st century—collaboration and teamwork.

STEM Knowledge and Skills

As can be seen in Chart 12, nearly all responding students reported gains in their STEM knowledge as a result of the GEMS program, with large majorities indicating large or extreme gains in most areas. For example, large or extreme gains were reported by 74% of students on their knowledge of how professionals work on real problems in STEM, and 68% on their knowledge of what everyday research work is like in STEM. Similar impacts were reported on knowledge of a STEM topic or field in depth (65%), and knowledge of research processes, ethics, and rules for conduct in STEM (59%). Slightly fewer than half of the responding student reported large or extreme gains of knowledge of research conducted in a STEM topic or field (46%). Mentors reported somewhat greater impacts on their students' STEM knowledge (see Appendix C).

[21] The outcomes measured in the evaluation study were informed by the following documents:

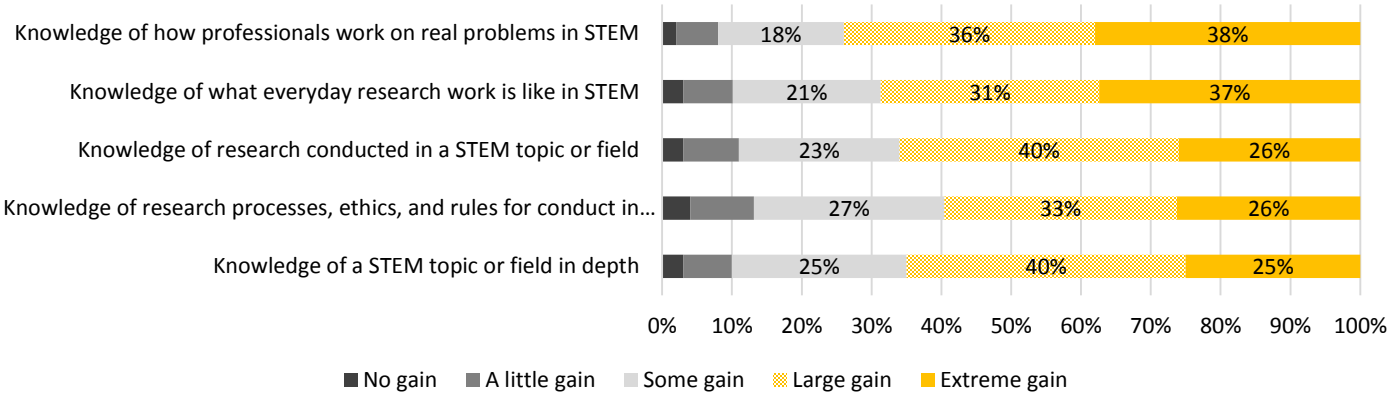
Committee on STEM Education. (2013*). Federal Science, Technology, Engineering, and Mathematics (STEM) education 5-year strategic plan: A report from the Committee on STEM Education, National Science and Technology Council.* Washington, DC: The White House, Office of Science and Technology Policy.

National Research Council. (2009). Learning Science in Informal Environments: People, Places, and Pursuits. Committee on Learning Science in Informal Environments. Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, Editors. Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

President's Council of Advisors on Science and Technology (P-CAST). (February 2012). *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics.* Executive Office of the President.

Report of the Academic Competitiveness Council (ACC). (2007). U.S. Department of Education. Available on the Department's Web site at: http://www.ed.gov/about/inits/ed/competitiveness/acc-mathscience/index.html.

Chart 12: Student Report of Impacts on STEM Knoweldge (n = 1817-1827)



These items were combined into a composite variable[22] to test for differential impacts across subgroups of students. Female students reported greater gains in this area than male students, although the effect was quite small at d = 0.129 standard deviations.[23] There were no significant differences between minority and non-minority students or between students eligible for FRL and those not eligible.

The student questionnaire also asked about perceived impacts on STEM practices. Table 22 shows the percentage of responding students reporting large or extreme gains in science-related practices. More than half of the responding students reported large or greater gains on their ability to apply knowledge, logic, and creativity to propose scientific explanations or engineering solutions that can be tested with investigations (64%); carry out procedures for an investigation and record data accurately (60%); consider different ways to analyze or interpret data when answering a question (59%); make a model to represent the key features and functions of an object, process, or system (59%); support a scientific explanation or engineering solution with relevant scientific, mathematical, and/or engineering knowledge (59%); design procedures for investigations (58%); support a scientific explanation or engineering solution with data from investigations (57%); communicate information about investigations in different formats; and ask questions that can be answered by one or more investigations (54%). Slightly less than half of the respondents reported large or extreme gains in displaying numeric data from investigations (47%) and using mathematics or computers to analyze numeric data (46%). Mentors generally reported greater impacts on their students in this area (see Appendix C).

[22] The Cronbach's alpha reliability for these 5 items was 0.887.

[23] Independent samples t-test, $t(1800) = 2.73$, $p = 0.006$,

Table 22. Students Reporting Large or Extreme Gains in their STEM Competencies – Science Practices (n = 1678-1697)	
Item	**Questionnaire Respondents**
Applying knowledge, logic, and creativity to propose scientific explanations or engineering solutions that can be tested with investigations	64%
Carrying out procedures for an investigation and recording data accurately	60%
Considering different ways to analyze or interpret data when answering a question	59%
Making a model to represent the key features and functions of an object, process, or system	59%
Supporting a scientific explanation or engineering solution with relevant scientific, mathematical, and/or engineering knowledge	59%
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	58%
Supporting a scientific explanation or engineering solution with data from investigations	57%
Communicating information about your investigations in different formats (orally, written, graphically, mathematically, etc.)	55%
Asking a question that can be answered with one or more investigations	54%
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	47%
Using mathematics or computers to analyze numeric data	46%

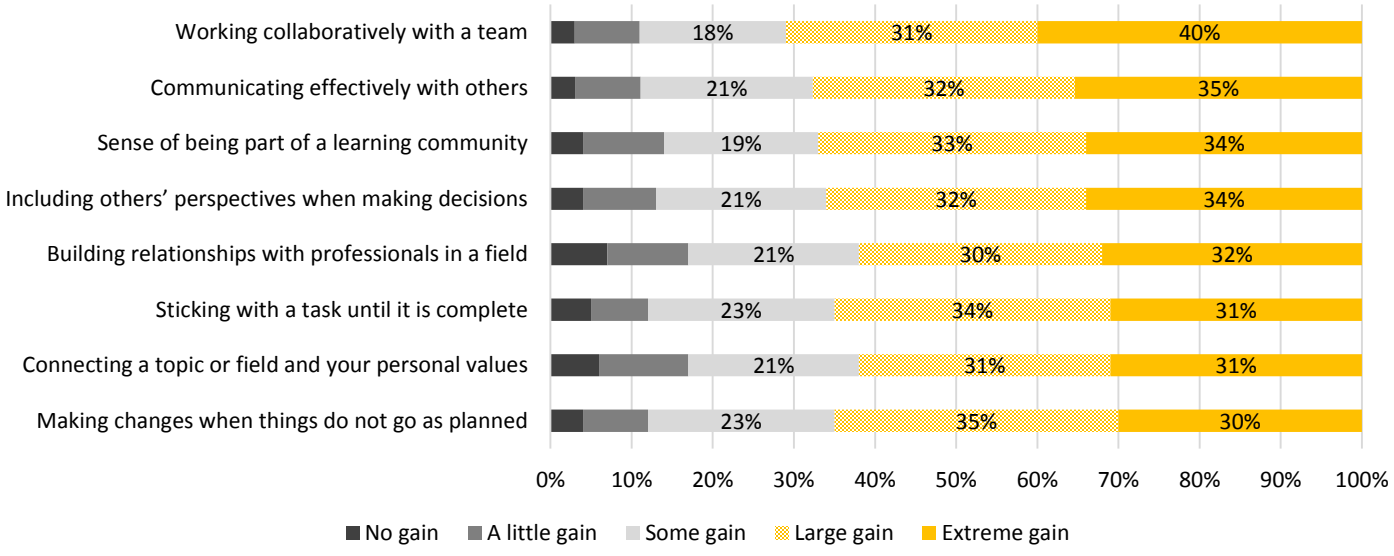
A composite score was calculated from this set of items[24] to examine whether the GEMS program had differential impacts on subgroups of students. There were no significant differences between minority and non-minority students or by FRL status on either composite. However, there were significant differences this composite by gender, as females reported greater impacts than males although the effects were quite small (d = 0.146 standard deviations).[25]

The student questionnaire also asked students about the impact of GEMS on their "21st Century Skills" that are necessary across a wide variety of fields. As can be seen in Chart 13, approximately two-thirds of responding students reported large or extreme gains in all of these skills, including working collaboratively with a team (71%), communicating effectively with others (67%), and a sense of being part of a learning community (66%). Mentors generally reported greater impacts on their students' in this area (see Appendix C).

[24] The science practices composite has a Cronbach's alpha reliability of 0.947.

[25] Independent samples t-test, $t(1668) = 2.98$; $p = 0.033$.

Chart 13: Student Report of Impacts on 21st Century Skills (n = 1679-1688)



These items were also combined into a composite variable[26] to test for differential impacts across subgroups of students. Similar to other knowledge composites, female students reported greater gains in this area than male students with a very small effect of d = 0.163 standard deviations.[27] There were no significant differences between minority and non-minority students or between students eligible for FRL and those not eligible.

STEM Identity and Confidence

Deepening students' STEM knowledge and skills are important for increasing the likelihood that they will pursue STEM further in their education and/or careers. However, they are unlikely to do so if they do not see themselves as capable of succeeding in STEM.[28] Consequently, the student questionnaire included a series of items intended to measure the impact of GEMS on students' STEM identity. These data are shown in Chart 14, and strongly suggest that the program has had a positive impact in this area. For example, 70% of responding students reported a large or extreme gain in their ability to think creatively about a STEM project or activity. Similarly, substantial proportions of students reported large or greater gains in their confidence to do well in future STEM courses (69%), preparedness for more challenging STEM activities (68%), sense of accomplishing something in STEM (68%), and confidence to contribute to STEM (66%). In addition, 60% reported increased interest in a new STEM topic or field, building academic credentials in STEM (61%), and

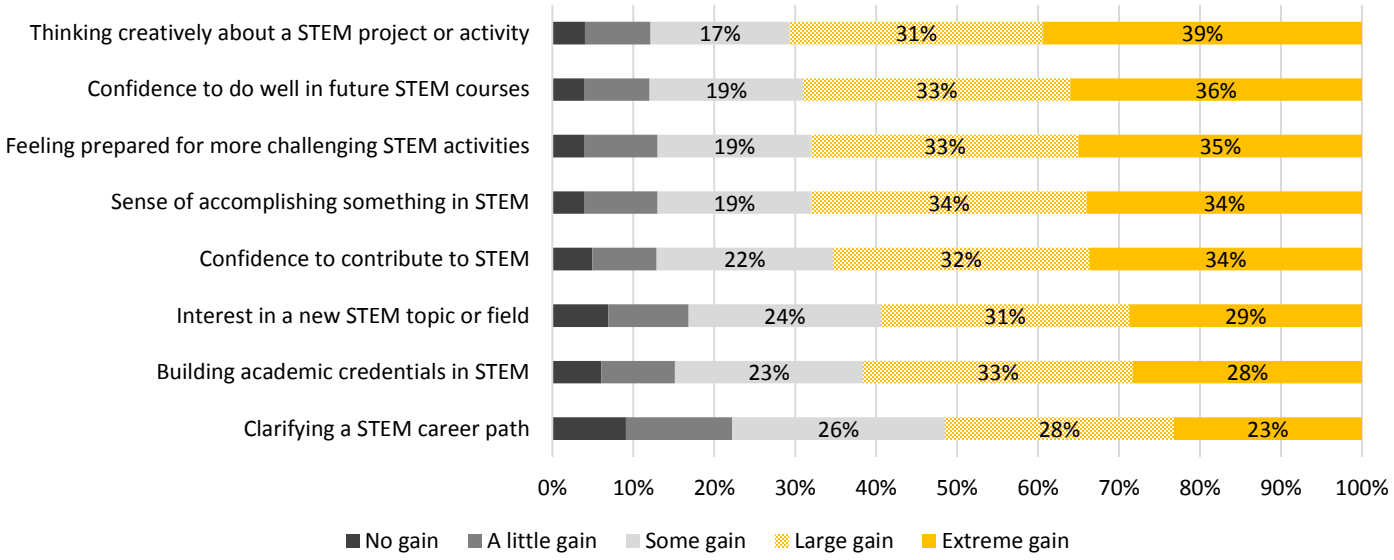
[26] The 21st Century Skills composite has a Cronbach's alpha reliability of 0.928.

[27] Independent samples t-test, t (1658) = 3.31, p = 0.001

[28] Chang, M. J., Sharkness, J., Hurtado, S. and Newman, C. B. (2014), What matters in college for retaining aspiring scientists and engineers from underrepresented racial groups. J. Res. Sci. Teach., 51: 555–580.

clarifying a STEM career path (51%). Comparing results on the composite created from these items,[29] females reported greater gains in STEM identity than males, a very small effect of d = 0.155 standard deviations.[30] There were no differences in impact based on race/ethnicity or FRL eligibility.

Chart 14: Student Report of Impacts on STEM Identity (n = 1796-1808)



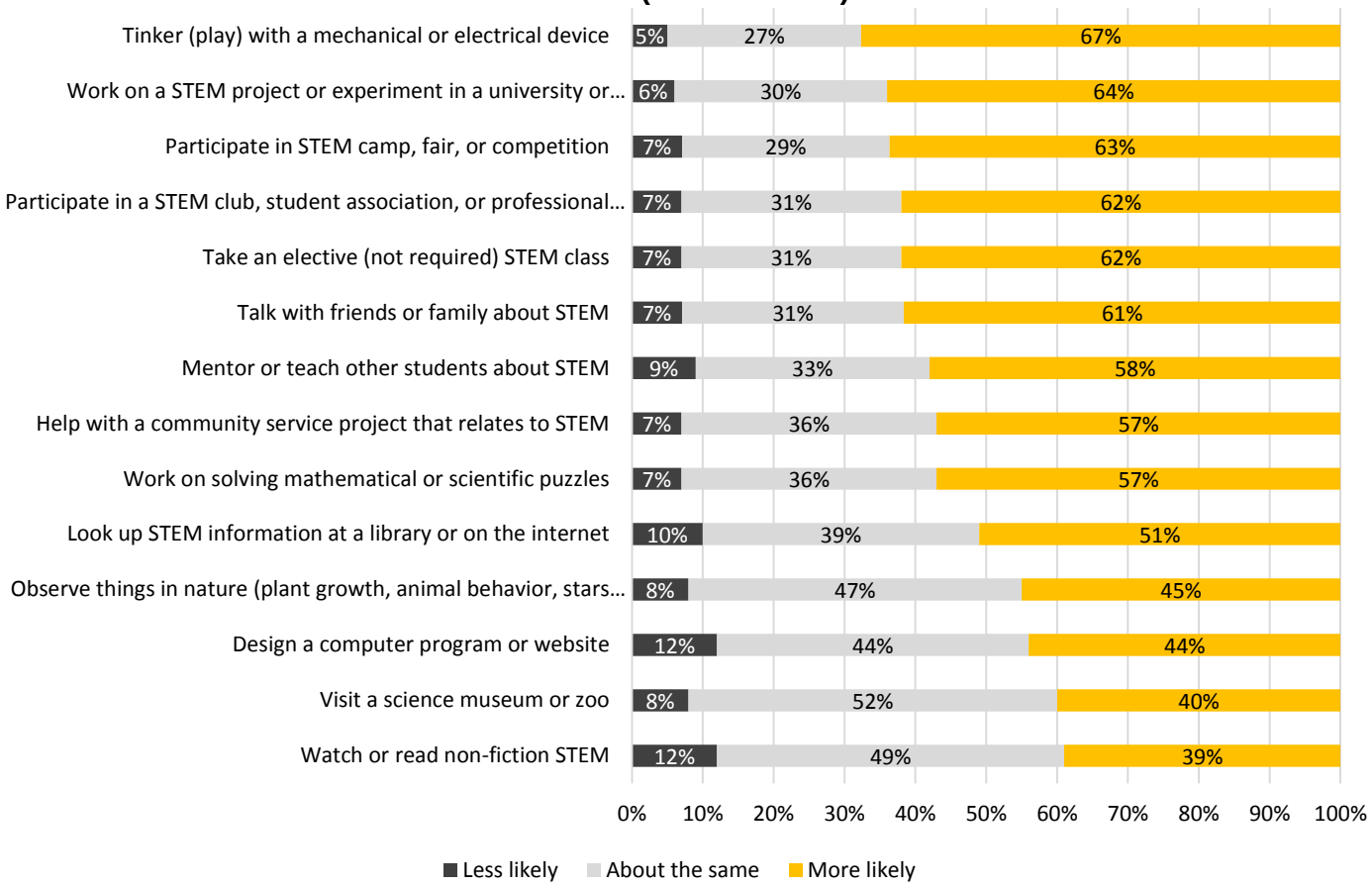
Interest and Future Engagement in STEM

A key goal of the AEOP program is to develop a STEM literate citizenry. To do so, students need to be engaged in and out of school with high-quality STEM activities. In order **t**o examine the impact of GEMS on students' interest in future engagement in STEM, the questionnaire asked them to reflect on whether the likelihood of their engaging in STEM activities outside of school changed as a result of their experience, as well as their interest level in participating in future AEOP programs. As can be seen in Chart 15, students indicated they were more likely to engage in many of these activities as a result of GEMS. For example, 67% reported being more likely to tinker with a mechanical or electrical device, 64% to work on a STEM project or experiment in a university or professional setting, 63% to participate in a STEM camp, fair, or competition, and 62% to participate in a STEM club, student association, or professional organization.

[29] The Cronbach's alpha reliability for these 8 items was 0.942.

[30] Independent samples t-test, $t(1778) = 3.25$, $p = 0.001$.

Chart 15: Change in Likelihood Students Will Engage in STEM Activities Outside of School (n = 1790-1813)



In an analysis of a composite created from these items[31] by subgroup, female students reported greater gains than males (a small effect of d = 0.151 standard deviations).[32] In addition, non-minority students scored higher than minority students (a small effect of d = 0.184 standard deviations).[33] There were no significant differences between students eligible for FRL and those not eligible.

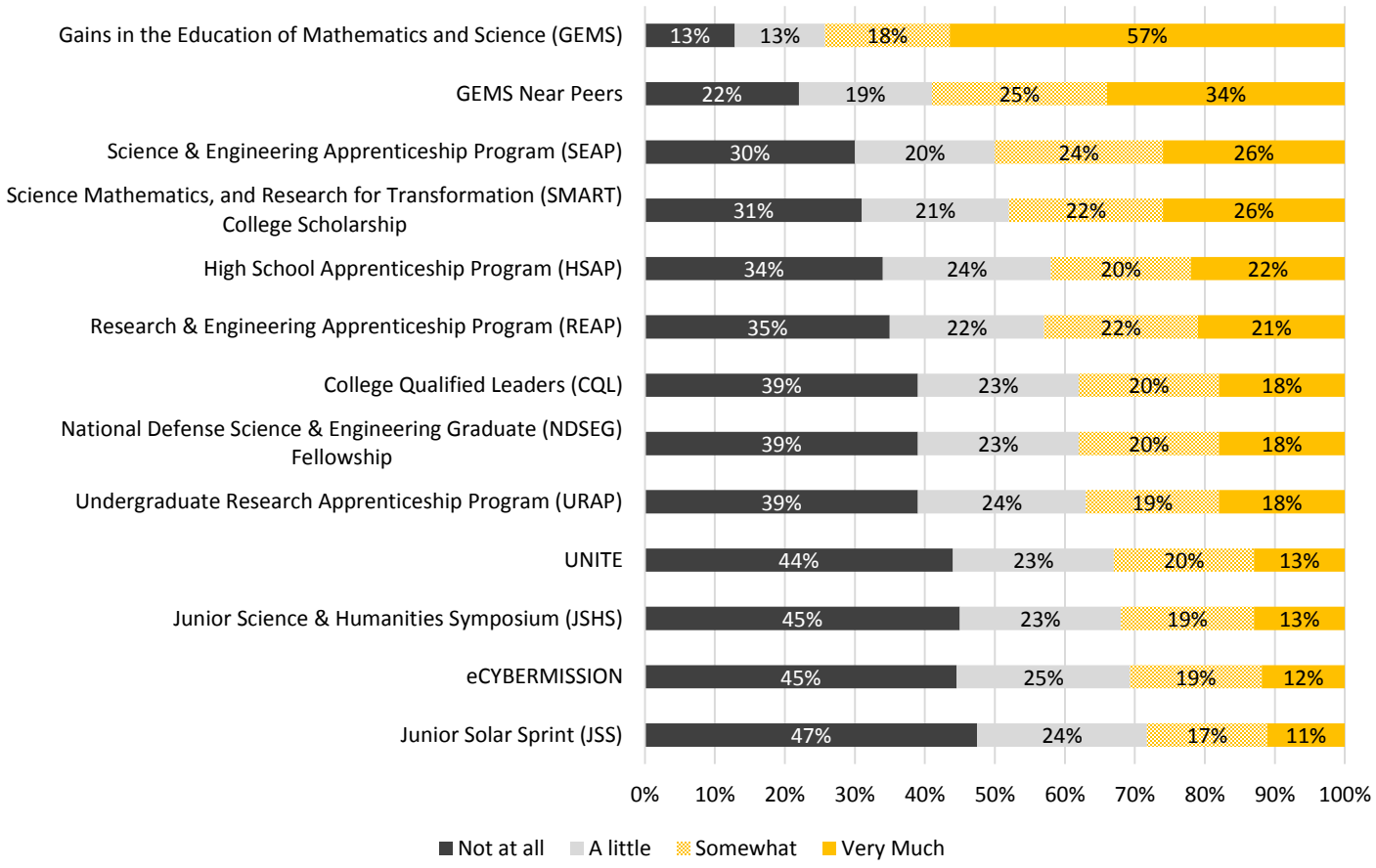
When asked how interested they are in participating in future AEOP programs, a large majority (75%) indicated being somewhat or very interested in participating in GEMS again, 59% in GEMS NPMs, and 50% in SEAP (see Chart 16). Roughly equal proportions expressed having no interest vs. at least a little interest in JSHS, UNITE, eCYBERMISSION, and JSS.

[31] The Cronbach's alpha reliability for these 15 items was 0.928

[32] Independent samples t-test, $t(1788) = 3.18$, $p = 0.002$.

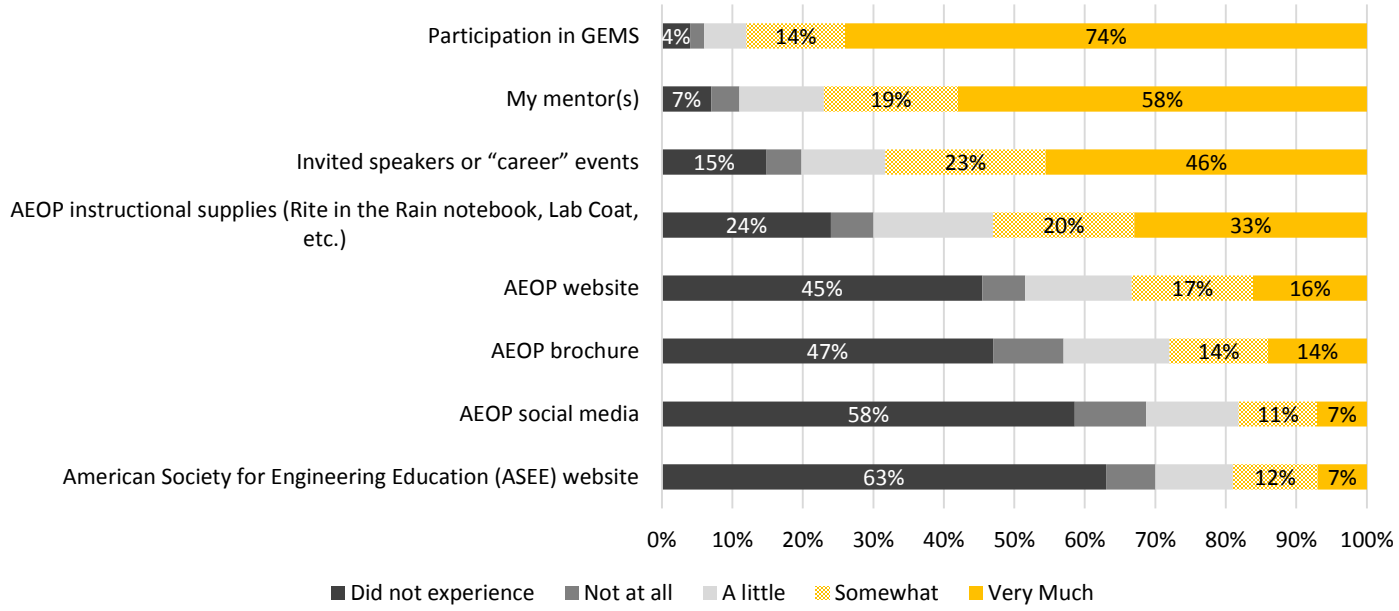
[33] Independent samples t-test, $t(1811) = 3.52$, $p < 0.001$.

Chart 16: Student Interest in Future AEOP Programs (n = 1622-1713)



Students were asked which resources impacted their awareness of the various AEOPs. As can be seen in Chart 17, simply participating in GEMS was most likely to be rated as impacting their awareness "somewhat" or "very much" (88%). Their mentor (77%), invited speakers or career events (69%), and AEOP instructional supplies (53%) were also rated by a majority of students as having at least some impact on their awareness of AEOP programs.

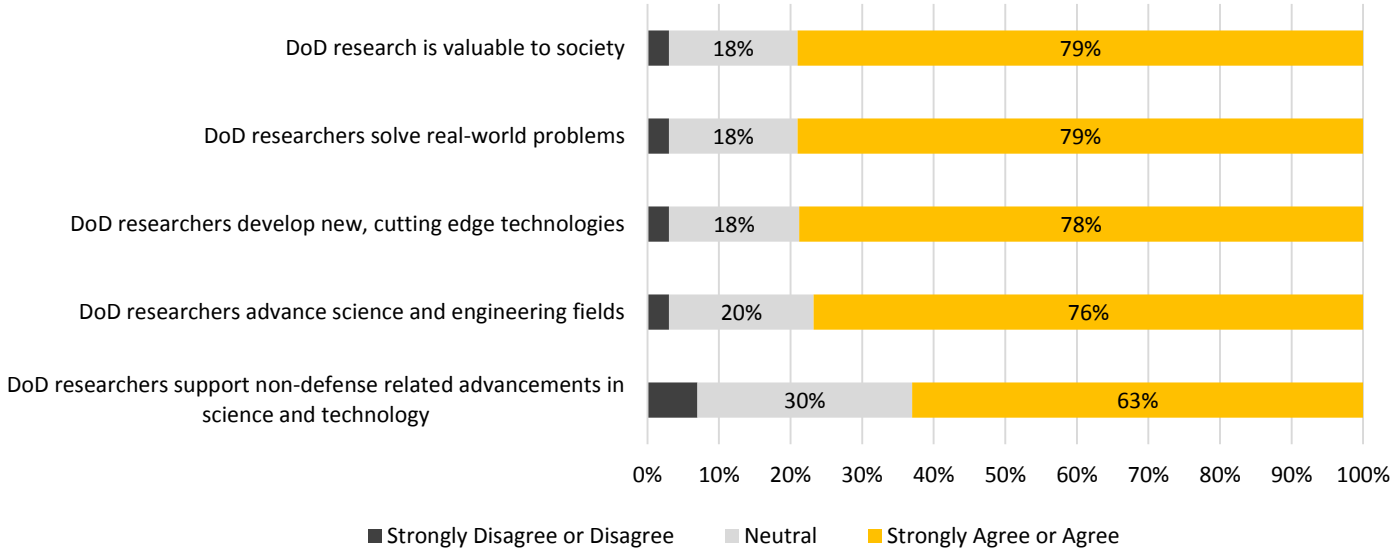
Chart 17: Impact of Resources on Student Awareness of AEOPs (n = 1719-1728)



Attitudes toward Research

Students' attitudes about the importance of DoD research is an important prerequisite to their continued interest in the field and potential involvement in the future. In order to gauge student attitudes in this area, the questionnaire asked students about their opinions of what DoD researchers do and the value of DoD research more broadly. The data indicate that most responding students have favorable opinions (see Chart 18). For example, 79% agreed or strongly agreed that DoD research is valuable to society, 79% that DoD researchers solve real-world problems, and 78% that DoD researchers develop cutting-edge technologies.

Chart 18: Student Opinions about DoD Researchers and Research (n = 1628-1633)



These items were also combined into a composite variable[34] to test for differential impacts across subgroups of students. Although there were no differences by gender, small to medium differences were detected in the other subgroups. Specifically, non-minority students scored higher than minority students (d = 0.281 standard deviations)[35] and students not eligible for FRL scored higher than those eligible for FRL (d = 0.341 standard deviations).[36]

Education and Career Aspirations

The evaluation also examined the program's impact on students' education and career aspirations. In terms of education, the questionnaire asked students how far they wanted to go in school before and after participating in GEMS. As can be seen in Table 23, when asked to think back on how far they wanted to go in school before participating in GEMS, 12% indicated graduating from high school, 38% finishing college, and 45% getting more education after college. In contrast, after GEMS, only 3% reported wanting to finish their education after high school, 32% wanted to finish college, and 62% wanted to get more education after college. This shift towards more education was statistically significant[37] and quite substantial in size (an effect size[38] ϕ= 0.883).

[34] Cronbach's alpha reliability of 0.918.

[35] Independent samples t test, $t(1729) = 1.90$, $p = 0.058$

[36] Independent samples t test, $t(1562) = 0.03$, $p = 0.979$

[37] Chi-square test of independence, $\chi^2(2) = 1298.82$, $p < 0.001$

[38] The effect size for a chi-square test of independence is calculated as $\varphi = \sqrt{\frac{\chi^2}{n}}$. With 2 degrees of freedom, ϕ of 0.07 is considered small, 0.21 medium, and 0.35 large.

Table 23. Student Education Aspirations (n = 1661)		
	Before GEMS	**After GEMS**
Graduate from high school	12%	3%
Go to a trade or vocational school	1%	1%
Go to college for a little while	4%	3%
Finish college (get a Bachelor's degree)	38%	32%
Get more education after college	45%	62%

In terms of career aspirations, students were asked what kind of work they expect to be doing at age 30, both reflecting on what their aspirations were before participating in GEMS and after GEMS (see Table 24). A substantive portion of responding students expressed interest in STEM-related careers both before and after participating in GEMS. For example, 16% indicated aspiring to a career in engineering before GEMS, with another 15% interested in medicine. After GEMS, 17% of students expressed interest in engineering, and 14% in medicine. To examine whether the GEMS program increased student interest in STEM-related careers, each career option was coded as being STEM related or non-STEM related. There was a statistically significant increase[39] in the proportion of students aspiring to a STEM-related career (a small effect[40] of $\phi = 0.179$).

[39] McNemar test of dependent proportions, $\chi^2(1) = 54.005$, $p < 0.001$

[40] The effect size for is calculated as $\varphi = \sqrt{\frac{\chi^2}{n}}$. With 1 degree of freedom, ϕ of 0.1 is considered small, 0.3 medium, and 0.5 large.

Table 24. Student Career Aspirations (n = 1678)		
	Before GEMS	After GEMS
Engineering	16%	17%
Medicine (e.g., doctor, dentist, veterinarian, etc.)	15%	14%
Computer science	5%	6%
Science (no specific subject)	5%	6%
Biological science	4%	5%
Military, police, or security	4%	4%
Physical science (e.g., physics, chemistry, astronomy, materials science)	3%	4%
Technology	3%	4%
Art (e.g., writing, dancing, painting, etc.)	4%	2%
Law	3%	2%
Business	2%	2%
Health (e.g., nursing, pharmacy, technician, etc.)	2%	2%
Earth, atmospheric or oceanic science	1%	1%
Environmental science	1%	1%
Mathematics or statistics	1%	1%
Social science (e.g., psychologist, sociologist)	1%	1%
Teaching, non-STEM	1%	1%
Teaching, STEM	1%	1%
Agricultural science	0%	0%
English/language arts	0%	0%
Farming	0%	0%
Skilled trade (carpenter, electrician, plumber, etc.)	0%	0%
Undecided	14%	13%
Other[†]	13%	13%

[†] Before, other includes STEM-related careers (n = 117), Non-STEM careers (n = 102), "Everything," "Multiple," and blank or illegible (n = 5). After, other includes STEM-related careers (n = 123), Non-STEM careers (n = 80), "Everything" (n = 3), "Other," "None, I'm rich enough at 30," "Multiple," and blank (n = 4).

Students were also asked the extent to which they expect to use their STEM knowledge, skills, and/or abilities in their work when they are age 30. As can be seen in Table 25, almost all students expect to STEM somewhat in their career. Slightly fewer than half (49%) expect to use STEM 76-100% of the time in their work, 31% expect to use STEM 51-75% of the time, and 13% expect to use STEM 26-50% of the time.

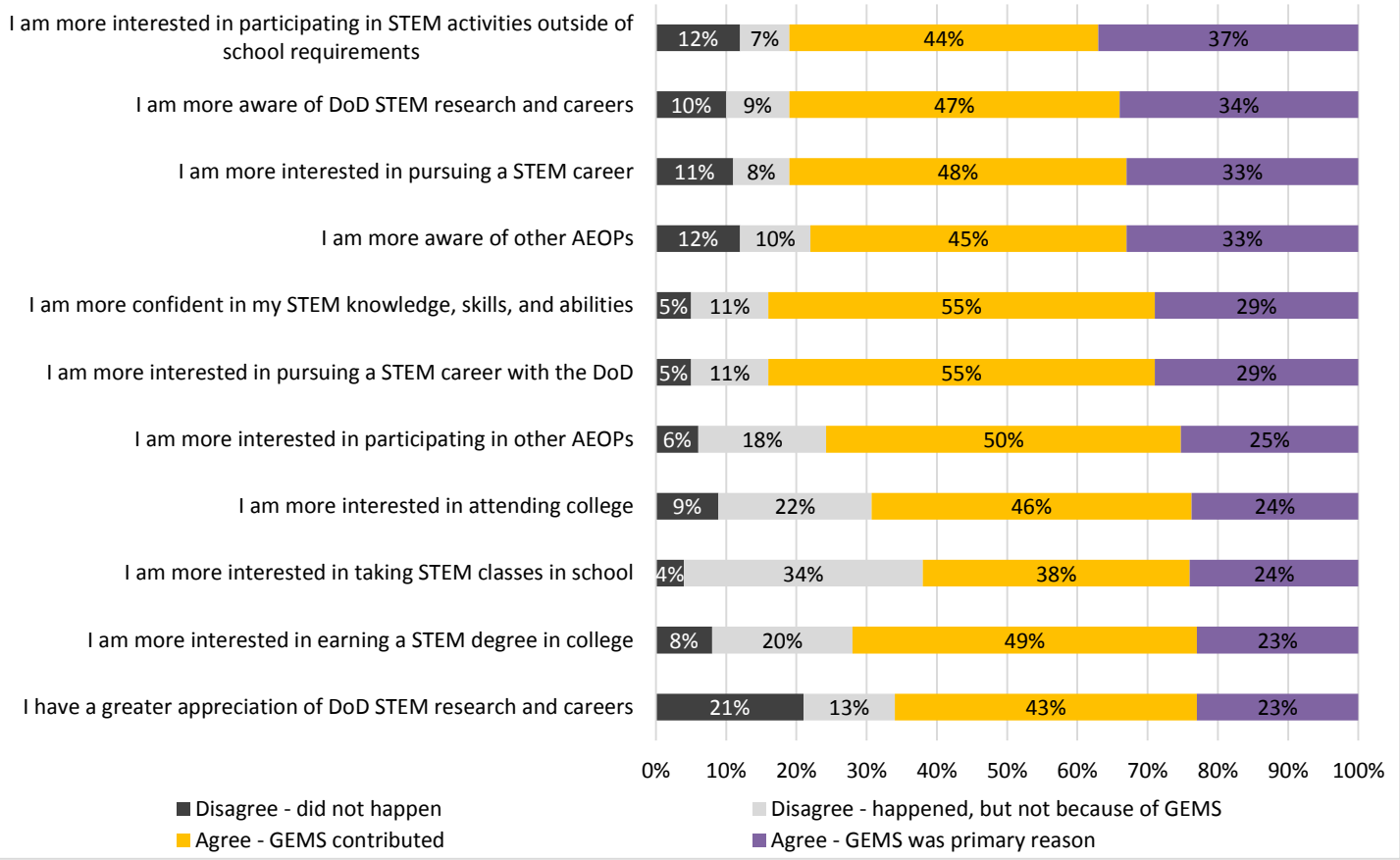
Table 25. Students Expecting to use STEM in Their Work at Age 30 (n = 1649)	
	Questionnaire Respondents
Not at all	1%
Less than 25% of the time	5%
26% to 50% of the time	13%
51% to 75% of the time	31%
75% to 100% of the time	49%

Overall Impact

Lastly, students were asked about impacts of participating in GEMS more broadly. From these data, it is clear that students thought the program had substantial impacts on them (see Chart 19). For example, a large majority of responding students indicated more confidence in STEM knowledge, skills, and abilities (84%); more interest in pursuing a STEM career with the DoD (84%); more interest in participating in STEM activities outside of school requirements (81%); and being more aware of DoD STEM research and careers (81%). Similarly, students indicated more interest in pursuing a STEM career (81%) and increased awareness of other AEOPs (78%). These items were combined into a composite variable[41] to test for differences among subgroups of students; no significant differences were found. Interestingly, mentors' reports of student gains in these areas varied somewhat from students'. In some cases mentors reported greater gains than did students, and in other cases students' reported gains were higher. These inconsistencies may be due to the data quality concerns described previously, or differences in perspectives between students and mentors.

[41] The Cronbach's alpha reliability for these 11 items was 0.916.

Chart 19: Student Opinions of GEMS Impacts (n = 1631-1731)



An open-ended item on the questionnaire asked students to list the three most important ways they benefited from the program; 179 of the 199 sampled students provided at least one answer to the question. Almost all of the students (92%) who responded to the questions identified increased knowledge, either in general or in a specific topic area, as a benefit (e.g., "I learned about engineering," "I gained STEM knowledge that I can use at school"). Just over one-third of the responding students listed career- or college-related benefits of the program, usually citing being introduced to STEM careers.

Another benefit noted by 23% of student was developing or utilizing skills that are not specific to STEM. Most commonly, students pointed to working as part of a team or developing problem-solving and communication skills. For example:

> *Learning how to work in teams.* (GEMS Student)

I have learned how to work well with a group and contribute new ideas. (GEMS Student)

I think more creatively when solving difficult problems. (GEMS Student)

Other areas indicated by students as beneficial included meeting new people or making friends, increasing interest in STEM, and increased confidence and perseverance.

Summary of Findings

The FY14 evaluation of GEMS collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in Table 26.

Table 26. 2014 GEMS Evaluation Findings

Participant Profiles	
GEMS student participation in evaluation yields high level of confidence in the findings.	• The student questionnaire response rate of 91% and corresponding margin of error of ±0.7% provide strong evidence that the questionnaire results are generalizable to the population of participants.
	• Additional evaluation data contribute to the overall narrative of GEMS's efforts and impact, and highlight areas for future exploration in programming and evaluation, though findings from these data are not intended to be generalized to all GEMS sites and participants.
GEMS serves students of historically underrepresented and underserved populations.	• GEMS attracted participation from female students—a population that is historically underrepresented in engineering fields; student questionnaire respondents included more females (55%) than males (44%).
	• GEMS provided outreach to students from historically underrepresented and underserved minority race/ethnicity and low-income groups. Student questionnaire respondents included minority students identifying as Black or African American (22%), Hispanic or Latino (7%), and American Indian or Alaskan Native (1%). A small proportion (12%) of students reported qualifying for free or reduced-price lunch.
	• GEMS served students across a range of school contexts. Most student questionnaire respondents attended public schools (80%) in suburban settings (68%).

GEMS engages a fairly diverse group of adult participants as STEM mentors.	• GEMS mentor participants, based on questionnaire data, included almost two times as many males than females (64% vs. 33%). Although the majority of mentors identified themselves as white (68%), 9% of questionnaire respondents identified as Hispanic or Latino and 8% identified as Black or African American. Forty-one percent of the mentor group reported being a scientist, engineer, or mathematician in training, 24% were teachers, and 31% specified an "other" occupation such as an education student or college/university student.
Actionable Program Evaluation	
GEMS is marketed to schools and teachers serving historically underserved groups.	• ASEE and GEMS sites employed multiple strategies to disseminate information about the GEMS program. Email blasts were sent to over 4,000 teachers, guidance counselors, and principals in areas near participating GEMS labs. Promotional materials, e.g., AEOP brochures, were mailed to requesting teachers. Outreach efforts via social media were also coordinated with Virginia Tech and a cross-promotional outreach effort was organized with eCYBERMISSION. In addition, outreach efforts targeted historically underrepresented and underserved populations through events such as: Event it. Build it. Career Expo at the Society of Women Engineers Conference; Hispanic Association for Colleges and Universities Conference; DCPS Event at ASEE Headquarters; and 2014 ASEE Annual Conference.
	• Students most frequently learned about the local GEMS program, other than from past participation, from an immediate family member (25%) or family friend (25%).
GEMS students are motivated to participate by learning opportunities provided by GEMS.	• Students were most frequently motivated to participate in GEMS this year because of their desire to learn something new or interesting (95%), interest in STEM (94%), and learn in ways that are not possible in school (90%). Large proportions also wanted the opportunity to use advance laboratory technology (87%), have fun (85%), and expand their laboratory or research skills (83%).
GEMS engages students in meaningful STEM learning, through team-based and hands-on activities.	• Most students (73-85%) report learning about STEM topics, careers, cutting-edge research, and applications of STEM to real-life situations; communicating with other students about STEM; and interacting with STEM professionals on most days or every day of their GEMS experience.
	• Most students had opportunities to engage in a variety of STEM practices during their GEMS experience. For example, 92% of responding students indicated working as part of a team on most days or every day; 90% reported participating in hands-on activities, 83% reported practicing laboratory/field techniques, procedures, and tools; and 81% reported building/simulating something on most days or every day.
	• Students reported greater opportunities to learn about STEM and greater engagement in STEM practices in their GEMS experience than they typically have in school.

	• Large proportions of mentors report using strategies to help make learning activities relevant to students, support the needs of diverse learners, develop students' collaboration and interpersonal skills, and engage students in "authentic" STEM activities.
GEMS promotes AEOP initiatives and Army STEM careers available at Army research laboratories.	• About three-fourths of the responding mentors indicated discussing at least one AEOP other than GEMS with students, most commonly SEAP (49%) and CQL (35%). Other programs discussed with students by about a quarter of responding mentors were HSAP (27%), WPBDC (27%), REAP (25%), eCYBERMISSION (24%), SMART (24%), and URAP (24%).
	• Mentors found the participation in GEMS, program managers or site coordinators, invited speakers or career events, and AEOP instructional supplies as most useful in exposing students to other AEOP programs. A large proportion of mentors have no experience with a number of other resources for exposing student to AEOP and DoD careers (AEOP website, brochure, ASEE website, AEOP social media) or did not find them useful.
	• Nearly all of the responding mentors reported asking students about their educational and career interests and sharing their own experiences, attitudes, and values about STEM. Many also provided guidance to students, either about educational pathways that would prepare them for a STEM career or recommending extracurricular programs that align with their educational goals.
	• Nearly all students reported learning about at least one STEM job/career, and the majority (66%) reported learning about five or more. Similarly, 84% of students reported learning about at least one DoD STEM job/career, though only about a third reported learning about many different STEM jobs/careers in the DoD.
The GEMS experience is valued by students and mentors.	• The majority of students indicated being somewhat or very much satisfied with most program features, including the stipend, instruction and mentorship, and availability of program topics. Most students also commented on their overall satisfaction with the program, most often describing areas where they learned, the quality of the mentors, and their enjoyment with the program.
	• About half of GEMS students suggested improvements to the program's content including proposing additional topics, or increasing the amount of time on topics already addressed. A similar number of students (46%) made suggestions for the format of the program activities, most frequently suggesting more labs and hands-on activities.
	• The majority of mentors indicated being somewhat or very much satisfied with most program features, including the location, support of instruction and mentorship, and invited speakers or career events. Nearly all responding mentors indicated having a

	positive experience. Further, many commented on the quality of the experience for students and that they enjoyed seeing students excited about learning.
Outcomes Evaluation	
GEMS had positive impacts on students' STEM knowledge and competencies.	• A majority of students reported large or extreme gains on their knowledge of how professionals work on real problems in STEM, what everyday research work is like in STEM, a STEM topic or field in depth, the research processes, ethics, and rules for conduct in STEM, and research conducted in a STEM topic or field. These impacts were identified across all student groups.
	• Many students also reported impacts on their abilities to do STEM, including such things as applying knowledge, logic, and creativity to propose solutions that can be tested; carrying out procedures for an investigation and record data accurately; considering different ways to analyze or interpret data when answering a question; making a model to represent the key features and functions of an object, process, or system; and supporting a scientific explanation or engineering solution with relevant scientific, mathematical, and/or engineering knowledge.
GEMS had positive impacts on students' 21st Century Skills.	• A large majority of students reported large or extreme gains in a number of 21st Century Skills, such as their ability to work collaboratively with a team, communicate effectively with others, sense of being part of a community, including others' perspectives when making decisions, and building relationships with professionals in a STEM field.
GEMS positively impacted students' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many students reported a large or extreme gain on their ability to think creatively about a STEM project or activity (67%), their confidence to do well in future STEM courses (69%), feelings of preparedness for more challenging STEM activities (68%), sense of accomplishing something in STEM (68%), and confidence to contribute to STEM (66%). In addition, 61% reported building academic credentials in STEM, increasing interest in a new STEM topic or field (60%), and clarifying a STEM career path (51%).
	• Students also reported on the likelihood that they would engage in additional STEM activities outside of school. A majority of students indicated that as a result of GEMS, they were more likely to tinker with mechanical or electrical devices, work on a STEM project in a university or professional setting, participate in a STEM camp, fair, or competition, or participate in a STEM club, student association, or professional organization.
GEMS succeeded in raising students' education and career aspirations.	• After participating in GEMS, students indicated being more likely to go further in their schooling than they would have before GEMS, with the greatest change being in the proportion of students who expected to continue their education beyond a Bachelor's degree (45% before GEMS, 62% after).

	• Students were asked to indicate what kind of work they expected to be doing at age 30, and the data were coded as STEM-related or non-STEM-related. There was a small, statistically significant increase in the proportion of students aspiring to a STEM-related career after participating in GEMS.
GEMS students may be unaware of the full portfolio of AEOP initiatives, but students show substantial interest in future AEOP opportunities.	• Although large proportions of students are unaware of many other AEOP initiatives, the majority of students indicated interest in participating in future AEOP programs. Most participants (88%) credited GEMS with increasing their interest in participating in other programs.
GEMS raised student awareness of DoD STEM research and careers, as well as their interest in pursuing a STEM career with the DoD.	• A majority of students reported that they had a greater awareness (81%) of DoD STEM research and careers. In addition, 84% indicated that GEMS raised their interest in pursuing a STEM career with the DoD.

Recommendations

1. In FY14, GEMS received 3,343 applications to participate in GEMS and funded 2,095 positions (not including GEMS Near-Peer mentors). From FY13 to FY14 the evaluation provides some evidence that the GEMS program could successfully be expanded to accommodate the considerable amount of unmet need and interest that persists with qualified students. Evaluators continue to recommend that more GEMS sites be identified, recruited, and started in a variety of geographic locations to meet the needs and interest in more communities. Additionally, evaluators continue to recommend that existing sites expand their capacity to accommodate more students so that they may meet existing needs and interest in communities that are already served by GEMS programs. Increasing the number of existing GEMS sites' administrative staff, teaching staff, physical infrastructure, and mentor (S&E's specifically) participation is the most effective way to increase enhance existing site's capacities to meet the very large needs and interest of potential GEMS participants.

2. GEMS and AEOP objectives include expanding participation of historically underrepresented and underserved populations. ASEE has conducted targeted marketing of GEMS to underrepresented and underserved populations to meet this objective. However, the demographic characteristics of GEMS participants have not changed significantly from FY13 to FY14. Specifically, about one-third of GEMS students report that they are from underrepresented or underserved racial/ethnic groups (Black or African American, Hispanic or Latino, & Native American or Alaska Native) and only 12% report that they qualify for free or reduced lunches at school. It is likely that GEMS will need to implement more aggressive marketing and recruitment practices than years past. Proven practices include; targeted marketing and partnerships

with low-income and minority-serving schools, educational networks, community organizations, and professional associations that serve these populations. As in FY13, FY14 guidance includes the directive to ensure other "connected" applicants (e.g., those with family, family friends, or school-based connections to the site) are not disproportionately selected into the program over other qualified applicants who have no previous association with the GEMS site. Finally, The Army, ASEE, and GEMS sites will need to consider practical solutions to help more GEMS students travel to sites that are not close in proximity to their homes. Most notably, as a day program, GEMS may consider offering commuting accommodations (e.g., bus transportation) that make participation more feasible for underrepresented and underserved populations that live further from GEMS sites.

3. Given the goal of having students progress from GEMS into other AEOP programs, the program may want to work with sites to increase students' exposure to AEOP. Although, many students expressed interest in participating in other AEOP programs, a substantial proportion indicated having no interest. Given the proportion of students who reported learning about other AEOPs from their mentors, the program may want to work with each site to ensure that all students have access to structured opportunities that both describe the other AEOPs and provide information to students on how they can apply to them. In addition, given that a relatively large proportion of mentors have not experienced many of the resource provide for exposing students to AEOPs, it likely would be useful for the program to familiarize mentors with these resources and how they can be used these to provide students with more information and facilitate their enrollment in other AEOPs.

4. Similarly, mentors play an important role in exposing students, especially students from underrepresented and underserved populations, to Army STEM careers. Evaluation data indicate that only about three-quarters of mentors discuss STEM career opportunities, DoD or otherwise, with students, with only 67% of mentors report recommending AEOPs that align with students' educational goals. Further, only 40% of mentors highlighted the under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM as part of supporting students educational and career pathways. Similar to providing resources for helping raise student awareness of other AEOPs, it would be useful for the program to familiarize mentors with resources available to expose students to DoD STEM careers as many mentors have indicated that they have had "no experience" with a number of the resources available to them. In addition, it would be beneficial to familiarize mentors with strategies that to increase the likelihood that the program will have a long-term impact on the number of students who pursue STEM. For example, interactions with role models with similar backgrounds as the students and providing coaching on the "soft skills" (e.g., time management, communication skills) needed to be successful in STEM careers.

5. Continued efforts should be undertaken to improve participation in completion of the mentor survey, as the low response rate raises questions about the representativeness of the results. Improved communication with the individual program sites about expectations for the evaluation may help. In addition, the mentor

survey may need to be streamlined as perceived response burden can affect participation. In particular, consideration should be given to whether the parallel nature of the student and mentor questionnaires is necessary, with items being asked only of the most appropriate data source.

Appendices

Appendix A

FY14 GEMS Evaluation Plan

Questionnaires

Purpose:
As per the approved FY14 AEOP APP, the external evaluation of GEMS conducted by VT includes two post-program questionnaires:

1. AEOP Youth Questionnaire to be completed by student participants; and
2. AEOP Mentor Questionnaire to be completed by Army S&Es, near-peer mentors, and/or resource teachers that facilitate, assist, or support students during GEMS educational activities.

Questionnaires are the primary method of data collection for AEOP evaluation and collect information about participants' experiences with and perceptions of program resources, structures, and activities; potential benefits to participants; and strengths and areas of improvement for programs.

The questionnaires have been revised for FY14 to align with:

- Army's strategic plan and AEOP Priorities 1 (STEM Literate Citizenry), 2 (STEM Savvy Educators) *and* 3 (Sustainable Infrastructure);
- Federal guidance for evaluation of Federal STEM investments (e.g., inclusive of implementation and outcomes evaluation, and outcomes of STEM-specific competencies, transferrable competencies, attitudes about/identifying with STEM, future engagement in STEM-related activities, and educational/career pathways);
- Best practices and published assessment tools in STEM education, STEM informal/outreach, and the evaluation/ research communities; and
- AEOP's vision to improve the quality of the data collected, focusing on changes in intended student outcomes and contributions of AEOPs like CQL effecting those changes.

The use of common questionnaires and sets of items that are appropriate across programs will allow for comparisons across AEOP programs and, if administered in successive years, longitudinal studies of students as they advance through pipelines within the AEOP. Because the questionnaires incorporate batteries of items from existing tools that have been validated in published research, external comparisons may also be possible.

All AEOPs are expected to administer the Youth and Mentor questionnaires provided for their program. Both the Youth and Mentor questionnaires have two versions, an "advanced" version (JSHS and apprenticeship programs) or a "basic" version (all other programs). The same basic set of items is used in both, with slightly modified items and/or additional items used in the advanced version. Additionally, the surveys are customized to gather information specific structures, resources, and activities of programs.

Site Visits/Onsite Focus Groups

Purpose:

As per the approved FY14 AEOP APP, the external evaluation of GEMS conducted by VT includes site visits for 2-3 laboratories with a local GEMS-SEAP-CQL pipeline.

Site visits provide the VT evaluation team with first-hand opportunities to speak with apprentices and their mentors. We are able to observe the AEOPs in action. The information gleaned from these visits assists us in illustrating and more deeply understanding the findings of other data collected (from questionnaires). In total, VT's findings are used to highlight program successes and inform program changes so that the AEOPs can be even better in the future.

Site Selection:

VT evaluators will visit one or two sites in the National Capitol region whose site schedules would provide a range of STEM topics and grade levels impacted. In addition, we will select two distant sites with new, developing, or atypical programming, or that serve distinct populations. The sites will be mutually agreed upon by VT, ASEE, and the CAM--preliminary conversations include Adelphi, Alabama, and Champaign. VT will coordinate site visits directly with the lab coordinators at the selected sites (final site selection will be made and sites notified by mid-June).

Evaluation Activities during GEMS Site Visits:

- One 45 minute focus group with 6-8 youth participants (apprentices);
- One 45-minute focus group with 6-8 mentors;
- 30-60 minutes to observe your program (specifically, to see students engaged in program activities, preferably with their mentors); and
- 10-15 minute transitions between each evaluation activity for moving groups in and out and providing evaluators with time to organize paperwork and take nature breaks.

Data Analyses

Quantitative and qualitative data were compiled and analyzed after all data collection concluded. Evaluators summarized quantitative data with descriptive statistics such as numbers of respondents, frequencies and proportions of responses, average response when responses categories are assigned to a 6-point scale (e.g., 1 = "Strongly Disagree" to 6 = "Strongly Agree"), and standard deviations. Emergent coding was used for the qualitative data to identify the most common themes in responses.

Evaluators conducted inferential statistics to study any differences among participant groups (e.g., by gender or race/ethnicity) that could indicate inequities in the GEMS program. Statistical significance indicates whether a result is unlikely to be due to chance alone. Statistical significance was determined with t-tests, chi-square tests, and various non-parametric tests as appropriate, with significance defined at $p < 0.05$. Because statistical significance is sensitive to the number of respondents, it is more difficult to detect significant changes with small numbers of respondents. Practical significance, also known as effect size, indicates the magnitude of an effect, and is typically reported when

differences are statistically significant. The formula for effect sizes depends on the type of statistical test used, and is specified, along with generally accepted rules of thumb for interpretation, in the body of the report.

Appendix B

FY14 GEMS Student Questionnaire and Data Summaries

2014 Gains in the Education of Mathematics and Science (GEMS): GEMS Youth Survey

Virginia Tech conducts program evaluation on behalf of the American Society for Engineering Education and U.S. Army to determine how well the Army Educational Outreach Program (AEOP) is achieving its goals of promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). As part of this study Virginia Tech is surveying students (like you) who have participated in Gains in the Education of Mathematics and Science (GEMS). The survey will collect information about you, your experiences in school, and your experiences in GEMS.

About this survey:

- While this survey is not anonymous, your responses are CONFIDENTIAL. When analyzing data and reporting results, your name will not be linked to any item responses or any comments you make.
- Responding to this survey is VOLUNTARY. You are not required to participate, although we hope you do because your responses will provide valuable information for meaningful and continuous improvement.
- If you provide your email address, the AEOP may contact you in the future to ask about your academic and career success.
- The survey takes about 25-30 minutes to complete on average, but could take longer. If there are parts of the survey that you don't understand, ask an adult for help or skip that part.
- In the online survey you can scroll over purple print in the survey to see definitions of words or phrases. These same words or phrases are provided on the "Terms" page in the paper survey.

If you have any additional questions or concerns, please contact one of the following people:

Tanner Bateman, Virginia Tech
Senior Project Associate, AEOPCA
(540) 231-4540, tbateman@vt.edu

Rebecca Kruse, Virginia Tech
Evaluation Director, AEOPCA
(703) 336-7922, rkruse75@vt.edu

If you are 17 and under, your parent/guardian provided permission for you to participate in the evaluation study when they authorized your participation in GEMS.

Q1. Do you agree to participate in this survey? (required)

❍ Yes, I agree to participate in this survey
❍ No, I do not wish to participate in this survey ****If selected, do not complete this survey****

Q2. Please provide your personal information below: (required)

First Name: _____
Last Name: _____

Q3. What is your email address? (optional)

Email: _____

So that we can determine how diverse students respond to participation in AEOP programs please tell us about yourself and your school.

Q4. What grade will you start in the fall?

- ❍ 4th
- ❍ 5th
- ❍ 6th
- ❍ 7th
- ❍ 8th
- ❍ 9th
- ❍ 10th
- ❍ 11th
- ❍ 12th
- ❍ College freshman
- ❍ Other, (specify):
- ❍ Choose not to report

Q5. What is your gender?

- ❍ Male
- ❍ Female
- ❍ Choose not to report

Q6. What is your race or ethnicity?

- ❍ Hispanic or Latino
- ❍ Asian
- ❍ Black or African American
- ❍ Native American or Alaska Native
- ❍ Native Hawaiian or Other Pacific Islander
- ❍ White
- ❍ Other race or ethnicity, (specify): _____
- ❍ Choose not to report

Q7. Do you qualify for free or reduced lunches at school?

- ❍ Yes
- ❍ No
- ❍ Choose not to report

Q8. Which best describes the location of your school?

- ❍ Frontier or tribal school
- ❍ Rural (country)
- ❍ Suburban
- ❍ Urban (city)

Q9. What kind of school do you attend?

- ❍ Public school
- ❍ Private school
- ❍ Home school
- ❍ Online school
- ❍ Department of Defense school (DoDDS or DoDEA)

Q10. Where was the GEMS program located?

- ❍ Army Medical Research and Material Command at Fort Detrick (Frederick, MD)
- ❍ Army Aviation and Missile Research Development and Engineering Center (Huntsville, AL)
- ❍ Army Aeromedical Research Laboratory (Fort Rucker, AL)
- ❍ Army Medical Research Institute of Chemical Defense (Aberdeen, MD)
- ❍ Army Research Institute for Surgical Research (San Antonio, TX)
- ❍ Army Research Institute for Environmental Medicine (Natick, MA)
- ❍ Armed Forces Medical Examiner System (Dover AFB, DE)
- ❍ Walter Reed Army Institute of Research (Silver Spring, MD)
- ❍ Walter Reed Army Institute of Research @ Wheaton High School (Wheaton, MD)
- ❍ Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)
- ❍ Army Research Laboratory-Adelphi (Adelphi, MD)
- ❍ Army Research Laboratory-White Sands Missile Range (White Sands, NM)
- ❍ Engineer Research & Development Center-Construction Engineering Research Laboratory (Champaign, IL)
- ❍ Engineer Research & Development Center-Mississippi (Vicksburg, MS)

Q11. Which GEMS program did you attend?

- ❍ GEMS
- ❍ Beginning GEMS/GEMS-1
- ❍ Beginning Biomedical GEMS
- ❍ Beginning Engineering GEMS
- ❍ Intermediate GEMS/GEMS-2
- ❍ Intermediate Biomedical GEMS
- ❍ Intermediate Engineering GEMS
- ❍ Advanced GEMS/GEMS-3
- ❍ Advanced Biomedical GEMS
- ❍ Advanced Engineering GEMS
- ❍ Advanced GEMS - Power
- ❍ Advanced GEMS - Computer Science
- ❍ Advanced GEMS - Advanced Topics
- ❍ Environmental GEMS
- ❍ Battlebots GEMS
- ❍ CSI GEMS
- ❍ GetGame GEMS
- ❍ Robotics GEMS
- ❍ Physical Science & Forensics GEMS
- ❍ Other, (specify):_____

Q12. How often did you do each of the following <u>in STEM classes at school</u> this year?

	Not at all	At least once	A few times	Most days	Every day
Learn about new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍

Interact with STEM professionals	❍	❍	❍	❍	❍

Q13. How often did you do each of the following <u>in GEMS</u> this year?

	Not at all	At least once	A few times	Most days	Every day
Learn about new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍

Q14. How often did you do each of the following <u>in STEM classes at school</u> this year?

	Not at all	At least once	A few times	Most days	Every day
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍

Q15. How often did you do each of the following <u>in GEMS</u> this year?

	Not at all	At least once	A few times	Most days	Every day
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍

Q16. How often did you do each of the following <u>in STEM classes at school</u> this year?

	Not at all	At least once	A few times	Most days	Every day
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍

Q17. How often did you do each of the following in GEMS this year?

	Not at all	At least once	A few times	Most days	Every day
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍

Q18. The list below describes instructional and mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies that your mentor(s) used when working directly with you in GEMS.

	No - my mentor did not use this strategy with me	Yes - my mentor used this strategy with me
Helped me become aware of the roles STEM play in my everyday life	❍	❍
Helped me understand how STEM can help me improve my community	❍	❍
Used teaching/mentoring activities that addressed my learning style	❍	❍
Provided me with extra support when I needed it	❍	❍
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	❍	❍
Allowed me to work on a collaborative project as a member of a team	❍	❍
Helped me practice a variety of STEM skills with supervision	❍	❍
Gave me constructive feedback to improve my STEM knowledge, skills, or abilities	❍	❍
Gave me guidance about educational pathways that would prepare me for a STEM career	❍	❍
Recommended Army Educational Outreach Programs that match my interests	❍	❍
Discussed STEM career opportunities with DoD or other government agencies	❍	❍

Q19. Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during GEMS:

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education (ASEE) website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍

AEOP brochure	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	❍	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in GEMS	❍	❍	❍	❍	❍

Q20. Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during GEMS:

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education (ASEE) website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	❍	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in GEMS	❍	❍	❍	❍	❍

Q21. How SATISFIED were you with each of the following GEMS program features?

	Did not experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Communications from American Society for Engineering Education (ASEE)	❍	❍	❍	❍	❍
Communications from GEMS program site	❍	❍	❍	❍	❍
Location of program activities	❍	❍	❍	❍	❍
Availability of program topics or fields that interest you	❍	❍	❍	❍	❍
Instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Online educational resources used or provided during program activities	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Field trips or laboratory tours	❍	❍	❍	❍	❍

Q22. Which category best describes the focus of your GEMS experience?

- ❍ Science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics

Q23. AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q24. AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Asking a question that can be answered with one or more investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an object, process, or system	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Considering different ways to analyze or interpret data when answering a question	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a scientific explanation or engineering solution with data from investigations	❍	❍	❍	❍	❍
Supporting a scientific explanation or engineering solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	❍	❍	❍	❍	❍

Q25. AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Sticking with a task until it is complete	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and your personal values	❍	❍	❍	❍	❍

Q26. AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Interest in a new STEM topic or field	❍	❍	❍	❍	❍
Clarifying a STEM career path	❍	❍	❍	❍	❍
Sense of accomplishing something in STEM	❍	❍	❍	❍	❍
Building academic credentials in STEM	❍	❍	❍	❍	❍
Feeling prepared for more challenging STEM activities	❍	❍	❍	❍	❍
Confidence to do well in future STEM courses	❍	❍	❍	❍	❍
Confidence to contribute to STEM	❍	❍	❍	❍	❍
Thinking creatively about a STEM project or activity	❍	❍	❍	❍	❍

Q27. AS A RESULT OF YOUR GEMS EXPERIENCE, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?

	Much less likely	Less likely	About the same before and after	More likely	Much more likely
Visit a science museum or zoo	❍	❍	❍	❍	❍
Watch or read non-fiction STEM	❍	❍	❍	❍	❍
Look up STEM information at a library or on the internet	❍	❍	❍	❍	❍
Tinker (play) with a mechanical or electrical device	❍	❍	❍	❍	❍
Work on solving mathematical or scientific puzzles	❍	❍	❍	❍	❍

Design a computer program or website	❍	❍	❍	❍	❍
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	❍	❍	❍	❍	❍
Talk with friends or family about STEM	❍	❍	❍	❍	❍
Mentor or teach other students about STEM	❍	❍	❍	❍	❍
Help with a community service project that relates to STEM	❍	❍	❍	❍	❍
Participate in a STEM club, student association, or professional organization	❍	❍	❍	❍	❍
Participate in STEM camp, fair, or competition	❍	❍	❍	❍	❍
Take an elective (not required) STEM class	❍	❍	❍	❍	❍
Work on a STEM project or experiment in a university or professional setting	❍	❍	❍	❍	❍
Receive an award or special recognition for STEM accomplishments	❍	❍	❍	❍	❍

Q28. How far did you want to go in school BEFORE participating in GEMS?

❍ Graduate from high school
❍ Go to a trade or vocational school
❍ Go to college for a little while
❍ Finish college (get a Bachelor's degree)
❍ Get more education after college

Q29. How far do you want to go in school AFTER participating in GEMS?

❍ Graduate from high school
❍ Go to a trade or vocational school
❍ Go to college for a little while
❍ Finish college (get a Bachelor's degree)
❍ Get more education after college

Q30. BEFORE GEMS, what kind of work did you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career goals BEFORE GEMS)

❍ **Undecided**
❍ **Science (no specific subject)**
❍ **Physical science (e.g., physics, chemistry, astronomy, materials science)**
❍ **Biological science**
❍ **Earth, atmospheric or oceanic science**
❍ **Agricultural science**
❍ **Environmental science**
❍ **Computer science**
❍ **Technology**
❍ **Engineering**
❍ **Mathematics or statistics**
❍ **Teaching, non-STEM**
❍ **Medicine (e.g., doctor, dentist, veterinarian, etc.)**
❍ **Health (e.g., nursing, pharmacy, technician, etc.)**
❍ **Social science (e.g., psychologist, sociologist)**
❍ **Business**
❍ **Law**
❍ **English/language arts**
❍ **Farming**
❍ **Military, police, or security**
❍ **Art (e.g., writing, dancing, painting, etc.)**
❍ **Skilled trade (carpenter, electrician, plumber, etc.)**

❍ Teaching, STEM

Other _____

Q31. AFTER GEMS, what kind of work do you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career AFTER GEMS)

❍ Undecided
❍ Science (no specific subject)
❍ Physical science (e.g., physics, chemistry, astronomy, materials science)
❍ Biological science
❍ Earth, atmospheric or oceanic science
❍ Agricultural science
❍ Environmental science
❍ Computer science
❍ Technology
❍ Engineering
❍ Mathematics or statistics
❍ Teaching, STEM
❍ Teaching, non-STEM
❍ Medicine (e.g., doctor, dentist, veterinarian, etc.)
❍ Health (e.g., nursing, pharmacy, technician, etc.)
❍ Social science (e.g., psychologist, sociologist)
❍ Business
❍ Law
❍ English/language arts
❍ Farming
❍ Military, police, or security
❍ Art (e.g., writing, dancing, painting, etc.)
❍ Skilled trade (carpenter, electrician, plumber, etc.)

Other _____

Q32. When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?

❍ not at all
❍ less than 25% of the time
❍ 26% to 50% of the time
❍ 51% to 75% of the time
❍ 76% to 100% of the time

Q33. How many times have you participated in any of the following Army Educational Outreach Programs (AEOPs)? If you have heard of an AEOP but never participated select "Never". If you have not heard of an AEOP select "Never heard of it".

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍

College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q34. How interested are you in participating in the following programs in the future?

	Not at all	A little	Somewhat	Very much
Camp Invention	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍
UNITE	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍

Q35. How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during GEMS?

❍ None
❍ 1
❍ 2
❍ 3
❍ 4
❍ 5 or more

Q36. How many Department of Defense (DoD) STEM jobs/careers did you learn about during GEMS?

❍ None
❍ 1
❍ 2
❍ 3

❍ 4
❍ 5 or more

Q37. Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍
DoD researchers support non-defense related advancements in science and technology	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

Q38. Which of the following statements describe you AFTER PARTICIPATING IN THE GEMS PROGRAM?

	Disagree - This did not happen	Disagree - This happened but not because of GEMS	Agree - GEMS contributed	Agree - GEMS was primary reason
I am more confident in my STEM knowledge, skills, and abilities	❍	❍	❍	❍
I am more interested in participating in STEM activities outside of school requirements	❍	❍	❍	❍
I am more aware of other AEOPs	❍	❍	❍	❍
I am more interested in participating in other AEOPs	❍	❍	❍	❍
I am more interested in taking STEM classes in school	❍	❍	❍	❍
I am more interested in attending college	❍	❍	❍	❍
I am more interested in earning a STEM degree in college	❍	❍	❍	❍
I am more interested in pursuing a STEM career	❍	❍	❍	❍
I am more aware of DoD STEM research and careers	❍	❍	❍	❍
I have a greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
I am more interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q39. What are the three most important ways that you have benefited from GEMS?

Benefit #1:

Benefit #2:

Benefit #3:

40. What are the three ways that GEMS should be improved for future participants?

Improvement #1:

Improvement #2:

Improvement #3:

Q41. Tell us about your overall satisfaction with your GEMS experience.

Thank you for your input and remember that your responses are completely confidential.

If you have any questions or concerns, please email:
Tanner Bateman – tbateman@vt.edu or Rebecca Kruse – rkruse75@vt.edu

GEMS Youth Data Summary

So that we can determine how diverse students respond to participation in AEOP programs, please tell us about yourself and your school. What grade will you start in the fall? (select one) (Avg. = 8.46, SD = 1.89)		
	Freq.	**%**
4th	**2**	**<1%**
5th	**88**	**5%**
6th	**206**	**11%**
7th	**335**	**18%**
8th	**390**	**21%**
9th	**299**	**16%**
10th	**250**	**13%**
11th	**194**	**10%**
12th	**107**	**6%**
College freshman (13)	**13**	**1%**
College sophomore (14)	**0**	**0%**
College junior (15)	**0**	**0%**
College senior (16)	**0**	**0%**
Graduate program (17)	**0**	**0%**
Other, (specify):	**2**	**<1%**
Choose not to report	**4**	**<1%**
Total	**1890**	**100%**

Note. Other = "Homeschool" (n = 2).

What is your gender?		
	Freq.	**%**
Male	**1035**	**55%**
Female	**827**	**44%**
Choose not to report	**26**	**1%**
Total	**1888**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	**123**	**7%**
Asian	**283**	**15%**
Black or African American	**417**	**22%**
Native American or Alaska Native	**13**	**1%**
Native Hawaiian or Other Pacific Islander	**9**	**<1%**
White	**849**	**45%**
Other race or ethnicity, (specify):	**109**	**6%**
Choose not to report	**84**	**4%**
Total	**1887**	**100%**

Note. Other = “Asian and White” (n = 17), “Mixed/Multiracial” (n = 13), “Black and White” (n = 9), “Indian” (n = 6), “Hispanic and White” (n = 5), “Italian” (n = 2), “Middle Eastern” (n = 2), “Arab” (n = 2), “African American, Native American, White” (n = 2), “Hispanic and Black” (n = 2), “Black, White, Indian” (n = 2), “Iranian”, “Jamaican “, “Arab Palestine/ Jordan”, “American/ Japanese”, “1/4 Hispanic”, “African American & Indian”, “African American and Hispanic”, “African-American/ Lebanese”, “afro Latino”, “Amerasian”, “American”, “Asian, Italian”, “Asian/ Brazilian”, “Australian”, “biracial”, “black & Latino”, “Black + Native American”, “Black and Native American”, “black and Puerto Rican”, “Brazilian/Black”, “Cambodian American”, “Caucasian”, “Chinese/ black”, “Eurasian”, “Ginger”, “Guyanese/white”, “Haitian, native American “, “Hawaiian”, “Hinduism”, “Hispanic and Asian”, “Hispanic or Asian”, “Hispanic, Black, White”, “Natic American + white”, “Puerto Rican”, “South Asian”, “Turkish”, “white and Columbian”, “White and German”, “White and Native American”, “White, German, English”, “White, Hispanic”, and “White, Peruvian”.

Do you qualify for free or reduced lunches at school?		
	Freq.	**%**
Yes	**228**	**12%**
No	**1474**	**79%**
Choose not to report	**171**	**9%**
Total	**1873**	**100%**

Which best describes the location of your school?		
	Freq.	**%**
Frontier or tribal school	**4**	**<1%**
Rural (country)	**214**	**11%**
Suburban	**1288**	**68%**
Urban (city)	**377**	**20%**
Total	**1883**	**100%**

What kind of school do you attend?		
	Freq.	**%**
Public school	**1517**	**80%**
Private school	**263**	**14%**
Home school	**95**	**5%**
Online school	**6**	**<1%**
Department of Defense school (DoDDS or DoDEA)	**8**	**<1%**
Total	**1890**	**100%**

Where was the GEMS program located?						
	Freq.	**%**			**Freq.**	**%**
Army Medical Research and Material Command at Fort Detrick (Frederick, MD)	**437**	**23%**		**Walter Reed Army Institute of Research (Silver Spring, MD)**	**299**	**16%**
Army Aviation and Missile Research Development and Engineering Center (Huntsville, AL)	**75**	**4%**		**Walter Reed Army Institute of Research @ Wheaton High School (Wheaton, MD)**	**81**	**4%**
Army Aeromedical Research Laboratory (Fort Rucker, AL)	**178**	**9%**		**Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)**	**191**	**10%**
Army Medical Research Institute of Chemical Defense (Aberdeen, MD)	**113**	**6%**		**Army Research Laboratory-Adelphi (Adelphi, MD)**	**76**	**4%**
Army Research Institute for Surgical Research (San Antonio, TX)	**69**	**4%**		**Army Research Laboratory-White Sands Missile Range (White Sands, NM)**	**39**	**2%**
Army Research Institute for Environmental Medicine (Natick, MA)	**131**	**7%**		**Engineer Research & Development Center- Construction Engineering Research Laboratory (Champaign, IL)**	**39**	**2%**
Armed Forces Medical Examiner System (Dover AFB, DE)	**91**	**5%**		**Engineer Research & Development Center-Mississippi (Vicksburg, MS)**	**80**	**4%**
				Total	**1899**	**100%**

Which GEMS program did you attend?						
	Freq.	**%**			**Freq.**	**%**
GEMS	**279**	**15%**		**Advanced GEMS - Power**	**22**	**1%**
Beginning GEMS / GEMS-1	**230**	**12%**		**Advanced GEMS - Computer Science**	**30**	**2%**
Beginning Biomedical GEMS	**92**	**5%**		**Advanced GEMS - Advanced Topics**	**15**	**1%**
Beginning Engineering GEMS	**43**	**2%**		**Environmental GEMS**	**72**	**4%**
Intermediate GEMS / GEMS-2	**344**	**18%**		**Battlebots GEMS**	**47**	**2%**
Intermediate Biomedical GEMS	**148**	**8%**		**CSI GEMS**	**93**	**5%**
Intermediate Engineering GEMS	**19**	**1%**		**GetGame GEMS**	**89**	**5%**
Advanced GEMS / GEMS-3	**86**	**5%**		**Robotics GEMS**	**43**	**2%**
Advanced Biomedical GEMS	**121**	**6%**		**Physical Science & Forensic GEMS**	**0**	**0%**
Advanced Engineering GEMS	**22**	**1%**		**Other, (specify):**	**104**	**5%**
				Total	**1899**	**100%**

Note. Other = “Neuroscience” (n = 104).

How often do you do each of the following in STEM classes at school this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn about new science, technology, engineering, or mathematics (STEM) topics	**132 (7%)**	**125 (7%)**	**445 (24%)**	**565 (30%)**	**611 (33%)**	**1878**	**3.74**	**1.18**
Apply STEM knowledge to real life situations	**225 (12%)**	**259 (14%)**	**571 (31%)**	**537 (29%)**	**277 (15%)**	**1869**	**3.20**	**1.21**
Learn about cutting-edge STEM research	**428 (23%)**	**385 (21%)**	**576 (31%)**	**296 (16%)**	**160 (9%)**	**1845**	**2.66**	**1.24**
Learn about different STEM careers	**341 (18%)**	**352 (19%)**	**665 (36%)**	**295 (16%)**	**201 (11%)**	**1854**	**2.82**	**1.22**
Interact with STEM professionals	**653 (35%)**	**471 (25%)**	**413 (22%)**	**116 (6%)**	**215 (12%)**	**1868**	**2.34**	**1.32**

Note. Response scale: 1 = “Not at all,” 2 = “At least once,” 3 = “A few times,” 4 = “Most days,” 5 = “Every day”.

How often do you do each of the following in GEMS this year?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learn about new science, technology, engineering, or mathematics (STEM) topics	**30 (2%)**	**78 (4%)**	**161 (9%)**	**287 (15%)**	**1316 (70%)**	**1872**	**4.49**	**0.93**
Apply STEM knowledge to real life situations	**84 (5%)**	**129 (7%)**	**257 (14%)**	**505 (27%)**	**889 (48%)**	**1864**	**4.07**	**1.14**
Learn about cutting-edge STEM research	**107 (6%)**	**135 (7%)**	**253 (14%)**	**464 (25%)**	**888 (48%)**	**1847**	**4.02**	**1.20**
Learn about different STEM careers	**72 (4%)**	**123 (7%)**	**246 (13%)**	**343 (19%)**	**1070 (58%)**	**1854**	**4.20**	**1.13**
Interact with STEM professionals	**94 (5%)**	**142 (8%)**	**234 (13%)**	**406 (22%)**	**978 (53%)**	**1854**	**4.10**	**1.19**

Note. Response scale: 1 = “Not at all,” 2 = “At least once,” 3 = “A few times,” 4 = “Most days,” 5 = “Every day”.

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Practice using laboratory or field techniques, procedures, and tools	325 (17%)	248 (13%)	678 (36%)	425 (23%)	196 (10%)	1872	2.96	1.21
Participate in hands-on STEM activities	186 (10%)	245 (13%)	720 (39%)	472 (25%)	244 (13%)	1867	3.18	1.13
Work as part of a team	131 (7%)	112 (6%)	474 (25%)	756 (40%)	399 (21%)	1872	3.63	1.10
Communicate with other students about STEM	296 (16%)	270 (14%)	449 (24%)	479 (26%)	373 (20%)	1867	3.19	1.34

Note. Response scale: 1 = "Not at all," 2 = "At least once," 3 = "A few times," 4 = "Most days," 5 = "Every day".

How often do you do each of the following in GEMS this year?								
	1	2	3	4	5	n	Avg.	SD
Practice using laboratory or field techniques, procedures, and tools	51 (3%)	100 (5%)	157 (8%)	302 (16%)	1263 (67%)	1873	4.40	1.03
Participate in hands-on STEM activities	23 (1%)	60 (3%)	114 (6%)	242 (13%)	1432 (77%)	1871	4.60	0.84
Work as part of a team	17 (1%)	35 (2%)	96 (5%)	243 (13%)	1477 (79%)	1868	4.67	0.74
Communicate with other students about STEM	74 (4%)	84 (5%)	146 (8%)	277 (15%)	1285 (69%)	1866	4.40	1.07

Note. Response scale: 1 = "Not at all," 2 = "At least once," 3 = "A few times," 4 = "Most days," 5 = "Every day".

How often do you do each of the following in STEM classes at school this year?								
	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	208 (12%)	229 (13%)	528 (29%)	569 (32%)	264 (15%)	1798	3.25	1.20
Design an investigation	429 (24%)	367 (20%)	577 (32%)	304 (17%)	117 (7%)	1794	2.62	1.20
Carry out an investigation	350 (20%)	334 (19%)	590 (33%)	359 (20%)	157 (9%)	1790	2.80	1.22
Analyze and interpret data or information	163 (9%)	176 (10%)	468 (26%)	648 (36%)	339 (19%)	1794	3.46	1.17
Draw conclusions from an investigation	224 (13%)	228 (13%)	540 (30%)	562 (31%)	233 (13%)	1787	3.20	1.19
Come up with creative explanations or solutions	172 (10%)	219 (12%)	558 (31%)	526 (30%)	299 (17%)	1774	3.32	1.18
Build (or simulate) something	242 (14%)	358 (20%)	663 (37%)	357 (20%)	172 (10%)	1792	2.92	1.15

Note. Response scale: 1 = "Not at all," 2 = "At least once," 3 = "A few times," 4 = "Most days," 5 = "Every day".

How often do you do each of the following in GEMS this year?								
	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	84 (5%)	128 (7%)	274 (15%)	449 (25%)	871 (48%)	1806	4.05	1.16
Design an investigation	202 (11%)	203 (11%)	306 (17%)	381 (21%)	713 (40%)	1805	3.66	1.38
Carry out an investigation	122 (7%)	171 (9%)	232 (13%)	347 (19%)	933 (52%)	1805	4.00	1.28
Analyze and interpret data or information	68 (4%)	118 (7%)	215 (12%)	382 (21%)	1019 (57%)	1802	4.20	1.12
Draw conclusions from an investigation	106 (6%)	147 (8%)	226 (13%)	361 (20%)	961 (53%)	1801	4.07	1.23
Come up with creative explanations or solutions	54 (3%)	119 (7%)	213 (12%)	391 (22%)	1022 (57%)	1799	4.23	1.08
Build (or simulate) something	43 (2%)	112 (6%)	203 (11%)	389 (22%)	1057 (59%)	1804	4.28	1.04

Note. Response scale: 1 = "Not at all," 2 = "At least once," 3 = "A few times," 4 = "Most days," 5 = "Every day".

The list below describes instructional and mentoring strategies that are effective ways to support STEM learners. From the list below, please indicate which strategies your mentor(s) used when working directly with you in GEMS:					
		Yes - my mentor(s) used this strategy with me		No - my mentor(s) did not use this strategy with me	
	n	Freq.	%	Freq.	%
Helped me become aware of the roles STEM play in my everyday life	1741	1482	85%	259	15%
Helped me understand how STEM can help me improve my community	1738	1267	73%	471	27%
Used teaching/mentoring activities that addressed my learning style	1742	1435	82%	307	18%
Provided me with extra support when I needed it	1737	1617	93%	120	7%
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	1737	1391	80%	346	20%
Allowed me to work on a collaborative project as a member of a team	1741	1672	96%	69	4%
Helped me practice a variety of STEM skills with supervision	1738	1604	92%	134	8%
Gave me constructive feedback to improve my STEM knowledge, skills, or abilities	1739	1539	88%	200	12%
Gave me guidance about educational pathways that would prepare me for a STEM career	1736	1421	82%	315	18%
Recommended Army Educational Outreach Programs that match my interests	1739	901	52%	838	48%
Discussed STEM career opportunities with DoD or other government agencies	1739	1063	61%	676	39%

Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during GEMS:								
	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education (ASEE) website	1088 (63%)	120 (7%)	191 (11%)	201 (12%)	125 (7%)	1725	2.52	1.01
Army Educational Outreach Program (AEOP) website	776 (45%)	106 (6%)	260 (15%)	302 (17%)	284 (16%)	1728	2.80	0.99
AEOP social media	1005 (58%)	181 (10%)	232 (13%)	190 (11%)	117 (7%)	1725	2.34	1.03
AEOP brochure	809 (47%)	165 (10%)	265 (15%)	238 (14%)	242 (14%)	1719	2.61	1.06
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	405 (24%)	108 (6%)	292 (17%)	342 (20%)	572 (33%)	1719	3.05	0.99
My mentor(s)	122 (7%)	64 (4%)	207 (12%)	327 (19%)	1004 (58%)	1724	3.42	0.86
Invited speakers or "career" events	252 (15%)	81 (5%)	201 (12%)	400 (23%)	788 (46%)	1722	3.29	0.90
Participation in GEMS	74 (4%)	34 (2%)	102 (6%)	235 (14%)	1278 (74%)	1723	3.67	0.68

Note. Response scale: 0 = "Did Not Experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during GEMS:								
	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education (ASEE) website	1062 (62%)	141 (8%)	197 (12%)	185 (11%)	128 (7%)	1713	2.46	1.04
Army Educational Outreach Program (AEOP) website	840 (49%)	159 (9%)	274 (16%)	241 (14%)	195 (11%)	1709	2.54	1.03
AEOP social media	998 (58%)	193 (11%)	214 (13%)	172 (10%)	132 (8%)	1709	2.34	1.07
AEOP brochure	838 (49%)	187 (11%)	274 (16%)	218 (13%)	185 (11%)	1702	2.46	1.05
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	488 (29%)	210 (12%)	281 (16%)	310 (18%)	418 (24%)	1707	2.77	1.10
My mentor(s)	209 (12%)	116 (7%)	232 (14%)	348 (20%)	793 (47%)	1698	3.22	0.98
Invited speakers or "career" events	299 (17%)	113 (7%)	208 (12%)	346 (20%)	744 (44%)	1710	3.22	0.97
Participation in GEMS	167 (10%)	77 (5%)	189 (11%)	303 (18%)	974 (57%)	1710	3.41	0.89

Note. Response scale: 0 = "Did Not Experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

How SATISFIED were you with the following GEMS program features?								
	0	1	2	3	4	n	Avg.	SD
Application or registration process	137 (8%)	77 (4%)	262 (15%)	543 (32%)	695 (41%)	1714	3.18	0.88
Communications from American Society for Engineering Education (ASEE)	623 (37%)	75 (4%)	221 (13%)	346 (20%)	441 (26%)	1706	3.06	0.94
Communications from [GEMS site]	334 (20%)	67 (4%)	240 (14%)	417 (24%)	647 (38%)	1705	3.20	0.90
Location of program activities	70 (4%)	54 (3%)	200 (12%)	397 (23%)	984 (58%)	1705	3.41	0.83
Availability of program topics or fields that interest you	48 (3%)	46 (3%)	179 (11%)	372 (22%)	1052 (62%)	1697	3.47	0.80
Instruction or mentorship during program activities	40 (2%)	18 (1%)	130 (8%)	317 (19%)	1195 (70%)	1700	3.62	0.68
Participation stipends (payment)	45 (3%)	30 (2%)	89 (5%)	266 (16%)	1269 (75%)	1699	3.68	0.66
Online educational resources used or provided during program activities	394 (23%)	91 (5%)	232 (14%)	392 (23%)	586 (35%)	1695	3.13	0.94
Invited speakers or "career" events	155 (9%)	46 (3%)	150 (9%)	367 (22%)	986 (58%)	1704	3.48	0.79
Field trips or laboratory tours	414 (24%)	59 (3%)	136 (8%)	251 (15%)	845 (50%)	1705	3.46	0.86

Note. Response scale: 0 = “Did Not Experience,” 1 = “Not at all,” 2 = “A little,” 3 = “Somewhat,” 4 = “Very much”.

Which category best describes the focus of your GEMS experience?		
	Freq.	%
Science	1070	61%
Technology	251	14%
Engineering	403	23%
Mathematics	43	2%
Total	1767	100%

AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Knowledge of a STEM topic or field in depth	46 (3%)	132 (7%)	454 (25%)	739 (40%)	455 (25%)	1826	3.78	0.98
Knowledge of research conducted in a STEM topic or field	50 (3%)	137 (8%)	419 (23%)	736 (40%)	483 (26%)	1825	3.80	1.00
Knowledge of research processes, ethics, and rules for conduct in STEM	81 (4%)	172 (9%)	484 (27%)	606 (33%)	474 (26%)	1817	3.67	1.10
Knowledge of how professionals work on real problems in STEM	39 (2%)	116 (6%)	330 (18%)	653 (36%)	687 (38%)	1825	4.00	1.00
Knowledge of what everyday research work is like in STEM	63 (3%)	135 (7%)	392 (21%)	569 (31%)	668 (37%)	1827	3.90	1.08

Note. Response scale: 1 = “No gain,” 2 = “A little gain,” 3 = “Some gain,” 4 = “Large gain,” 5 = “Extreme gain”.

AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Asking a question that can be answered with one or more investigations	88 (5%)	190 (11%)	506 (30%)	543 (32%)	370 (22%)	1697	3.54	1.10
Applying knowledge, logic, and creativity to propose scientific explanations or engineering solutions that can be tested with investigations	59 (3%)	129 (8%)	410 (24%)	598 (35%)	494 (29%)	1690	3.79	1.05
Making a model to represent the key features and functions of an object, process, or system	81 (5%)	169 (10%)	438 (26%)	523 (31%)	482 (28%)	1693	3.68	1.13
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	100 (6%)	169 (10%)	433 (26%)	530 (31%)	456 (27%)	1688	3.64	1.15
Carrying out procedures for an investigation and recording data accurately	90 (5%)	151 (9%)	433 (26%)	537 (32%)	472 (28%)	1683	3.68	1.13
Considering different ways to analyze or interpret data when answering a question	93 (6%)	164 (10%)	431 (26%)	548 (33%)	442 (26%)	1678	3.64	1.13
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	206 (12%)	223 (13%)	470 (28%)	437 (26%)	345 (21%)	1681	3.29	1.27
Using mathematics or computers to analyze numeric data	281 (17%)	228 (14%)	413 (25%)	412 (25%)	345 (21%)	1679	3.19	1.36
Supporting a scientific explanation or engineering solution with data from investigations	104 (6%)	211 (13%)	416 (25%)	499 (30%)	453 (27%)	1683	3.59	1.18
Supporting a scientific explanation or engineering solution with relevant scientific, mathematical, and/or engineering knowledge	93 (6%)	183 (11%)	409 (24%)	543 (32%)	456 (27%)	1684	3.64	1.15
Communicating information about your investigations in different formats (orally, written, graphically, mathematically, etc.)	118 (7%)	206 (12%)	433 (26%)	475 (28%)	449 (27%)	1681	3.55	1.20

Note. Response scale: 1 = “No gain,” 2 = “A little gain,” 3 = “Some gain,” 4 = “Large gain,” 5 = “Extreme gain”.

AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Sticking with a task until it is complete	78 (5%)	126 (7%)	383 (23%)	575 (34%)	526 (31%)	1688	3.80	1.10
Making changes when things do not go as planned	66 (4%)	142 (8%)	383 (23%)	592 (35%)	500 (30%)	1683	3.78	1.08
Working collaboratively with a team	46 (3%)	127 (8%)	308 (18%)	530 (31%)	672 (40%)	1683	3.98	1.06
Communicating effectively with others	54 (3%)	142 (8%)	345 (21%)	543 (32%)	595 (35%)	1679	3.88	1.08
Including others’ perspectives when making decisions	62 (4%)	158 (9%)	357 (21%)	533 (32%)	572 (34%)	1682	3.83	1.11

Sense of being part of a learning community	67 (4%)	165 (10%)	325 (19%)	557 (33%)	570 (34%)	1684	3.83	1.12
Building relationships with professionals in a field	111 (7%)	170 (10%)	348 (21%)	510 (30%)	543 (32%)	1682	3.72	1.20
Connecting a topic or field and your personal values	101 (6%)	186 (11%)	350 (21%)	518 (31%)	530 (31%)	1685	3.71	1.19

Note. Response scale: 1 = "No gain," 2 = "A little gain," 3 = "Some gain," 4 = "Large gain," 5 = "Extreme gain".

AS A RESULT OF YOUR GEMS EXPERIENCE, how much did you GAIN in the following areas?

	1	2	3	4	5	n	Avg.	SD
Interest in a new STEM topic or field	118 (7%)	184 (10%)	427 (24%)	557 (31%)	520 (29%)	1806	3.65	1.18
Clarifying a STEM career path	167 (9%)	227 (13%)	476 (26%)	512 (28%)	423 (23%)	1805	3.44	1.23
Sense of accomplishing something in STEM	70 (4%)	157 (9%)	346 (19%)	611 (34%)	619 (34%)	1803	3.86	1.10
Building academic credentials in STEM	110 (6%)	157 (9%)	422 (23%)	597 (33%)	510 (28%)	1796	3.69	1.15
Feeling prepared for more challenging STEM activities	69 (4%)	158 (9%)	342 (19%)	599 (33%)	640 (35%)	1808	3.88	1.11
Confidence to do well in future STEM courses	67 (4%)	150 (8%)	335 (19%)	603 (33%)	646 (36%)	1801	3.89	1.10
Confidence to contribute to STEM	84 (5%)	145 (8%)	397 (22%)	574 (32%)	606 (34%)	1806	3.82	1.12
Thinking creatively about a STEM project or activity	79 (4%)	150 (8%)	305 (17%)	564 (31%)	707 (39%)	1805	3.93	1.13

Note. Response scale: 1 = "No gain," 2 = "A little gain," 3 = "Some gain," 4 = "Large gain," 5 = "Extreme gain".

AS A RESULT OF YOUR GEMS EXPERIENCE, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?

	1	2	3	4	5	n	Avg.	SD
Visit a science museum or zoo	79 (4%)	67 (4%)	941 (52%)	485 (27%)	241 (13%)	1813	3.41	0.92
Watch or read non-fiction STEM	83 (5%)	122 (7%)	892 (49%)	530 (29%)	184 (10%)	1811	3.34	0.91
Look up STEM information at a library or on the internet	85 (5%)	98 (5%)	710 (39%)	643 (36%)	274 (15%)	1810	3.51	0.97
Tinker (play) with a mechanical or electrical device	31 (2%)	60 (3%)	491 (27%)	677 (37%)	551 (30%)	1810	3.92	0.93
Work on solving mathematical or scientific puzzles	47 (3%)	78 (4%)	644 (36%)	649 (36%)	383 (21%)	1801	3.69	0.94
Design a computer program or website	102 (6%)	107 (6%)	798 (44%)	452 (25%)	347 (19%)	1806	3.46	1.04
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	59 (3%)	85 (5%)	853 (47%)	508 (28%)	307 (17%)	1812	3.51	0.94
Talk with friends or family about STEM	60 (3%)	68 (4%)	568 (31%)	671 (37%)	443 (24%)	1810	3.76	0.97
Mentor or teach other students about STEM	65 (4%)	92 (5%)	598 (33%)	628 (35%)	420 (23%)	1803	3.69	1.00
Help with a community service project that relates to STEM	54 (3%)	72 (4%)	642 (36%)	634 (35%)	394 (22%)	1796	3.69	0.96

Participate in a STEM club, student association, or professional organization	**62 (3%)**	**64 (4%)**	**557 (31%)**	**676 (37%)**	**449 (25%)**	**1808**	**3.77**	**0.98**
Participate in STEM camp, fair, or competition	**53 (3%)**	**78 (4%)**	**528 (29%)**	**655 (36%)**	**492 (27%)**	**1806**	**3.81**	**0.98**
Take an elective (not required) STEM class	**60 (3%)**	**68 (4%)**	**549 (31%)**	**634 (35%)**	**479 (27%)**	**1790**	**3.78**	**0.99**
Work on a STEM project or experiment in a university or professional setting	**41 (2%)**	**66 (4%)**	**542 (30%)**	**636 (35%)**	**517 (29%)**	**1802**	**3.84**	**0.96**
Receive an award or special recognition for STEM accomplishments	**36 (2%)**	**48 (3%)**	**487 (27%)**	**658 (37%)**	**572 (32%)**	**1801**	**3.93**	**0.93**

Note. Response scale: 1 = "Much less likely," 2 = "Less likely," 3 = "About the same before and after," 4 = "More likely," 5 = "Much more likely".

How far did you want to go in school BEFORE participating in GEMS?		
	Freq.	**%**
Graduate from high school	**204**	**12%**
Go to a trade or vocational school	**13**	**1%**
Go to college for a little while	**65**	**4%**
Finish college (get a Bachelor's degree)	**638**	**38%**
Get more education after college	**744**	**45%**
Total	**1664**	**100%**

How far did you want to go in school AFTER participating in GEMS?		
	Freq.	**%**
Graduate from high school	**45**	**3%**
Go to a trade or vocational school	**10**	**1%**
Go to college for a little while	**47**	**3%**
Finish college (get a Bachelor's degree)	**527**	**32%**
Get more education after college	**1038**	**62%**
Total	**1667**	**100%**

BEFORE GEMS, what kind of work did you expect to be doing when you are 30 years old (select the ONE answer that best describes your career goals BEFORE GEMS)

	Freq.	**%**			**Freq.**	**%**
Undecided	**245**	**15%**		**Teaching, non-STEM**	**20**	**1%**
Science (no specific subject)	**85**	**5%**		**Medicine (doctor, dentist, veterinarian, etc.)**	**246**	**15%**
Physical science (physics, chemistry, astronomy, materials science, etc.)	**49**	**3%**		**Health (nursing, pharmacy, technician, etc.)**	**35**	**2%**

Biological science	71	4%		Social science (psychologist, sociologist)	15	1%
Earth, atmospheric or oceanic science	15	1%		Business	39	2%
Agricultural science	6	<1%		Law	44	3%
Environmental science	12	1%		English/language arts	7	<1%
Computer science	82	5%		Farming	4	<1%
Technology	52	3%		Military, police, or security	70	4%
Engineering	261	16%		Art (writing, dancing, painting, etc.)	59	4%
Mathematics or statistics	25	1%		Skilled trade (carpenter, electrician, plumber, etc.)	1	<1%
Teaching, STEM	12	1%		Other, (specify):	226	13%
				Total	1681	100%

Note: Other = STEM careers (n = 75), STEM-related careers (n = 42), Non-STEM careers (102), "Everything", and "Multiple".

AFTER GEMS, what kind of work do you expect to be doing when you are 30 years old? (select the ONE answer that best describes your career goals AFTER GEMS)

	Freq.	%			Freq.	%
Undecided	217	13%		Teaching, non-STEM	10	1%
Science (no specific subject)	105	6%		Medicine (doctor, dentist, veterinarian, etc.)	237	14%
Physical science (physics, chemistry, astronomy, materials science, etc.)	68	4%		Health (nursing, pharmacy, technician, etc.)	32	2%
Biological science	88	5%		Social science (psychologist, sociologist)	18	1%
Earth, atmospheric or oceanic science	17	1%		Business	28	2%
Agricultural science	6	<1%		Law	36	2%
Environmental science	11	1%		English/language arts	3	<1%
Computer science	99	6%		Farming	1	<1%
Technology	62	4%		Military, police, or security	65	4%
Engineering	290	17%		Art (writing, dancing, painting, etc.)	32	2%
Mathematics or statistics	25	1%		Skilled trade (carpenter, electrician, plumber, etc.)	1	<1%
Teaching, STEM	14	1%		Other, (specify):	214	13%
				Total	1679	100%

Note. Other = STEM careers (n = 84), STEM-related careers (n = 40), Non-STEM careers (82), "Everything" (n = 3), "Other", "None, I'm rich enough at 30", and "Multiple".

When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?		
	Freq.	**%**
not at all	**23**	**1%**
less than 25% of the time	**81**	**5%**
26% to 50% of the time	**215**	**13%**
51% to 75% of the time	**515**	**31%**
76% to 100% of the time	**815**	**49%**
Total	**1649**	**100%**

How many times have you participated in any of the following Army Educational Outreach Programs? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."

	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Camp Invention	**785 (47%)**	**698 (42%)**	**85 (5%)**	**47 (3%)**	**40 (2%)**	**1655**	**1.34**	**0.78**
eCYBERMISSION	**671 (41%)**	**873 (53%)**	**51 (3%)**	**32 (2%)**	**23 (1%)**	**1650**	**1.19**	**0.60**
Junior Solar Sprint (JSS)	**716 (43%)**	**849 (52%)**	**42 (3%)**	**29 (2%)**	**11 (1%)**	**1647**	**1.14**	**0.51**
West Point Bridge Design Contest (WPBDC)	**639 (39%)**	**893 (54%)**	**52 (3%)**	**32 (2%)**	**31 (2%)**	**1647**	**1.21**	**0.64**
Junior Science & Humanities Symposium (JSHS)	**704 (43%)**	**817 (50%)**	**38 (2%)**	**40 (2%)**	**21 (1%)**	**1620**	**1.20**	**0.62**
Gains in the Education of Mathematics and Science (GEMS)	**171 (10%)**	**302 (18%)**	**586 (36%)**	**306 (19%)**	**282 (17%)**	**1647**	**2.38**	**1.01**
GEMS Near Peers	**474 (29%)**	**922 (56%)**	**103 (6%)**	**65 (4%)**	**82 (5%)**	**1646**	**1.41**	**0.88**
UNITE	**721 (44%)**	**843 (51%)**	**32 (2%)**	**33 (2%)**	**17 (1%)**	**1646**	**1.16**	**0.56**
Science & Engineering Apprenticeship Program (SEAP)	**604 (37%)**	**923 (56%)**	**49 (3%)**	**38 (2%)**	**33 (2%)**	**1647**	**1.21**	**0.66**
Research & Engineering Apprenticeship Program (REAP)	**657 (40%)**	**883 (54%)**	**43 (3%)**	**34 (2%)**	**30 (2%)**	**1647**	**1.20**	**0.64**
High School Apprenticeship Program (HSAP)	**699 (43%)**	**856 (52%)**	**36 (2%)**	**30 (2%)**	**23 (1%)**	**1644**	**1.17**	**0.59**
College Qualified Leaders (CQL)	**727 (44%)**	**834 (51%)**	**31 (2%)**	**33 (2%)**	**20 (1%)**	**1645**	**1.17**	**0.59**
Undergraduate Research Apprenticeship Program (URAP)	**739 (45%)**	**823 (50%)**	**27 (2%)**	**35 (2%)**	**21 (1%)**	**1645**	**1.18**	**0.60**
Science Mathematics, and Research for Transformation (SMART) College Scholarship	**731 (44%)**	**800 (49%)**	**43 (3%)**	**39 (2%)**	**35 (2%)**	**1648**	**1.25**	**0.71**
National Defense Science & Engineering Graduate (NDSEG) Fellowship	**820 (50%)**	**743 (45%)**	**28 (2%)**	**33 (2%)**	**23 (1%)**	**1647**	**1.20**	**0.64**

Note. Response scale: 0 = “Never heard of it,” 1 = “Never,” 2 = “Once,” 3= “Twice,” 4 = “Three or more times”.

How interested are you in participating in the following programs in the future?							
	1	2	3	4	n	Avg.	SD
Camp Invention	706 (43%)	455 (28%)	306 (19%)	178 (11%)	1645	1.97	1.02
eCYBERMISSION	736 (45%)	410 (25%)	305 (19%)	189 (12%)	1640	1.97	1.05
Junior Solar Sprint (JSS)	775 (47%)	396 (24%)	282 (17%)	180 (11%)	1633	1.92	1.04
West Point Bridge Design Contest (WPBDC)	653 (40%)	395 (24%)	347 (21%)	237 (15%)	1632	2.10	1.09
Junior Science & Humanities Symposium (JSHS)	725 (45%)	381 (23%)	310 (19%)	206 (13%)	1622	2.00	1.07
Gains in the Education of Mathematics and Science (GEMS)	215 (13%)	228 (13%)	301 (18%)	969 (57%)	1713	3.18	1.08
GEMS Near Peers	373 (22%)	328 (19%)	422 (25%)	589 (34%)	1712	2.72	1.15
UNITE	720 (44%)	379 (23%)	324 (20%)	210 (13%)	1633	2.01	1.07
Science & Engineering Apprenticeship Program (SEAP)	487 (30%)	332 (20%)	402 (24%)	423 (26%)	1644	2.46	1.16
Research & Engineering Apprenticeship Program (REAP)	578 (35%)	362 (22%)	354 (22%)	345 (21%)	1639	2.28	1.15
High School Apprenticeship Program (HSAP)	563 (34%)	387 (24%)	335 (20%)	353 (22%)	1638	2.29	1.15
College Qualified Leaders (CQL)	631 (39%)	382 (23%)	335 (20%)	287 (18%)	1635	2.17	1.12
Undergraduate Research Apprenticeship Program (URAP)	639 (39%)	389 (24%)	311 (19%)	297 (18%)	1636	2.16	1.13
Science Mathematics, and Research for Transformation (SMART) College Scholarship	507 (31%)	344 (21%)	362 (22%)	430 (26%)	1643	2.44	1.18
National Defense Science & Engineering Graduate (NDSEG) Fellowship	638 (39%)	379 (23%)	332 (20%)	294 (18%)	1643	2.17	1.13

Note. Response scale: 1 = “Not at all,” 2 = “A little,” 3 = “Somewhat,” 4 = “Very much”.

How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during GEMS?		
	Freq.	%
None	43	2%
1	55	3%
2	97	6%
3	217	12%
4	187	11%
5 or more	1146	66%
Total	1745	100%

How many Department of Defense (DoD) STEM jobs/careers did you learn about during GEMS?

	Freq.	%
None	267	16%
1	141	9%
2	222	13%
3	334	20%
4	151	9%
5 or more	538	33%
Total	1653	100%

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	31 (2%)	24 (1%)	333 (20%)	703 (43%)	542 (33%)	1633	4.04	0.87
DoD researchers develop new, cutting edge technologies	23 (1%)	33 (2%)	300 (18%)	671 (41%)	601 (37%)	1628	4.10	0.87
DoD researchers support non-defense related advancements in science and technology	45 (3%)	64 (4%)	496 (30%)	618 (38%)	405 (25%)	1628	3.78	0.96
DoD researchers solve real-world problems	23 (1%)	25 (2%)	294 (18%)	649 (40%)	642 (39%)	1633	4.14	0.86
DoD research is valuable to society	29 (2%)	21 (1%)	294 (18%)	590 (36%)	698 (43%)	1632	4.17	0.89

Note. Response scale: 1 = “Strongly Disagree,” 2 = “Disagree,” 3 = “Neither Agree nor Disagree,” 4 = “Agree,” 5 = “Strongly Agree”.

Which of the following statements describe you after participating in GEMS?

	1	2	3	4	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	93 (5%)	184 (11%)	954 (55%)	500 (29%)	1731	3.08	0.78
I am more interested in participating in STEM activities outside of school requirements	190 (12%)	122 (7%)	722 (44%)	607 (37%)	1641	3.06	0.95
I am more aware of other AEOPs	201 (12%)	167 (10%)	731 (45%)	532 (33%)	1631	2.98	0.96
I am more interested in participating in other AEOPs	110 (6%)	311 (18%)	857 (50%)	426 (25%)	1704	2.94	0.83
I am more interested in taking STEM classes in school	64 (4%)	554 (34%)	627 (38%)	390 (24%)	1635	2.82	0.84
I am more interested in attending college	139 (9%)	355 (22%)	754 (46%)	384 (24%)	1632	2.85	0.88
I am more interested in earning a STEM degree in college	145 (8%)	336 (20%)	831 (49%)	400 (23%)	1712	2.87	0.87
I am more interested in pursuing a STEM career	174 (11%)	138 (8%)	780 (48%)	549 (33%)	1641	3.04	0.92
I am more aware of DoD STEM research and careers	157 (10%)	154 (9%)	768 (47%)	561 (34%)	1640	3.06	0.90

I have a greater appreciation of DoD STEM research and careers	**341 (21%)**	**205 (13%)**	**713 (43%)**	**381 (23%)**	**1640**	**2.69**	**1.05**
I am more interested in pursuing a STEM career with the DoD	**93 (5%)**	**184 (11%)**	**954 (55%)**	**500 (29%)**	**1731**	**3.08**	**0.78**

Note. Response scale: **1** = "Disagree – This did not happen," **2** = "Disagree – This happened but not because of GEMS," **3** = "Agree – GEMS contributed," **4** = "Agree – GEMS was primary reason".

****Data from GEMS registration/application records*****

How did you learn about GEMS? (check all that apply) (n = 1637)

	Freq.	%		Freq.	%
Program or AEOP website	**330**	**20%**	**Extended family member (grandparents, aunts, uncles, cousins)**	**38**	**2%**
Facebook, Twitter, Pinterest, or other social media	**10**	**1%**	**Friend of the family**	**402**	**25%**
School or university newsletter, email, or website	**187**	**11%**	**Teacher or professor**	**235**	**14%**
News story or other media coverage	**14**	**1%**	**Guidance counselor**	**38**	**2%**
Past participant of GEMS	**512**	**31%**	**Mentor from GEMS**	**40**	**2%**
Friend	**237**	**14%**	**Someone who works at an Army laboratory**	**134**	**8%**
Immediate family member (mother, father, siblings)	**416**	**25%**	**Other, (specify):**	**113**	**7%**

Note. Other = "100 Black Men of Greater Washington, DC" (n = 16), "MWR" (n = 5), "Dr. Clytrice Watson" (n = 3), "STEM Fiesta" (n = 3), "Air Force Base" (n = 2), "Aunt and Uncle in the US Army" (n = 2), "Boyscouts of America" (n = 2), "Career Technology Center Open House" (n = 2), "Dover AFB email" (n = 2), "Marco Ciavolino" (n = 2), "MITRE Employee" (n = 2), "Mother works for USAMRMC at Fort Detrick" (n = 2), "USAMRICD" (n = 2), "A Better Chance", "AEOP booth at state FLL competition", "Air Force Captain/Uncle", "At a Girl Scout sevice unit meeting", "Attended Last Year", "Attended USNA STEM program", "Biomedical Coordinator", "Booth at Frederick Fair", "Brother-Prior participant", "Career Technology Center Open House", "Carol Dyer", "Church Member", "Consistant comer", "Coordinator, Global Studies and International Baccalaureate at Edgewood High School", "CP16 Office", "CSSC", "dad received email", "Dad works on base.", "DC STEM Fair", "Dr. Margery Anderson", "Dr. C. Watson (Professor of Biology at DSU)", "EMAIL TO MOM"S COWORKER", "Engineering your Tomorrow", "First Segeant", "former camper", "Friend of parent", "from a STEM workshop at a DC school", "Girl Power Expo", "Girl Scout Leader", "got email because i was participant in prior year", "Great Frederick Fair", "homeschool support group", "Metro Warriors STEM e-mail", "Military Affiliation", "military email", "Mom received flyer at work", "My brother was a prior participant and really enjoyed the program.", "My brothers attended", "My grrkerandmother co-wo", "My little brother brought home a flyer for the GEMs program.", "my mom's colleague", "Newspaper", "Older sibling attended", "older sibling participated", "Parent Action group at Paul", "Parent of prior participant", "parents", "parent's internet search", "participated last year!", "past teacher", "Pat price", "previous participation", "Randy McCain Metro Warriors", "Recommended by School", "Rhonda Grasberger", "School Staff member", "Scouting Council", "search engine", "Searched it up", "Sister attended", "Sister attended program last year", "Social Worker", "SSG Mitchell Mcknight", "Stacy Robinson", "STEM website", "Uncle is postdoctoral fellow at ALC", "USASEF", "web search - found this on a science and technology for kids website", and "worker from proving ground".

Data from GEMS registration/application records

How motivating were the following factors in your decision to participate in GEMS?							
	1	2	3	4	n	Avg.	SD
Teacher/Professor encouragement	91 (6%)	93 (6%)	427 (29%)	886 (59%)	1497	3.41	0.86
An academic requirement or school grade	322 (22%)	216 (15%)	381 (26%)	560 (38%)	1479	2.80	1.16
Learning something new or interesting	2 (0%)	2 (0%)	78 (5%)	1433 (95%)	1515	3.94	0.26
The program mentor	164 (11%)	139 (9%)	487 (33%)	681 (46%)	1471	3.15	0.99
Resume/college application building	116 (8%)	174 (12%)	474 (32%)	726 (49%)	1490	3.21	0.93
Networking opportunities	138 (9%)	196 (13%)	469 (32%)	678 (46%)	1481	3.14	0.97
Interest in Science, Technology, Engineering, and Mathematics (STEM)	2 (0%)	7 (0%)	86 (6%)	1416 (94%)	1511	3.93	0.29
Interest in STEM careers with the Army	72 (5%)	202 (14%)	520 (35%)	694 (47%)	1488	3.23	0.86
Having fun	4 (0%)	26 (2%)	201 (13%)	1277 (85%)	1508	3.82	0.44
Earning money over the summer	97 (7%)	191 (13%)	487 (33%)	716 (48%)	1491	3.22	0.91
Doing something with friends	59 (4%)	150 (10%)	459 (31%)	816 (55%)	1484	3.37	0.82
Using advanced laboratory technology	6 (0%)	20 (1%)	169 (11%)	1311 (87%)	1506	3.85	0.42
Expanding laboratory or research skills	5 (0%)	31 (2%)	215 (14%)	1256 (83%)	1507	3.81	0.47
Learning in ways that are not possible in school	3 (0%)	8 (1%)	139 (9%)	1357 (90%)	1507	3.89	0.35
Serving the community or country	26 (2%)	95 (6%)	454 (30%)	921 (62%)	1496	3.52	0.69
Parent encouragement	11 (1%)	43 (3%)	322 (21%)	1136 (75%)	1512	3.71	0.56

Note. Response scale: 1 = “Not at all motivating”, 2 = “Not too motivating,” 3 = “Somewhat motivating”, 4 = “Very motivating”.

Appendix C

FY14 GEMS Mentor Questionnaire and Data Summaries

2014 Gains in the Education of Mathematics and Science (GEMS): GEMS Mentor Survey

Virginia Tech is conducting an evaluation study on behalf of the Academy of Applied Science and the U.S. Army to determine how well JSHS is achieving its goals of promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). As part of this study Virginia Tech is surveying adults who participate in JSHS in the capacity of STEM mentors (e.g., instructors, research mentors, or competition advisors). The questionnaire will collect information about you, your experiences in school, and your experiences in JSHS. The results of this survey will be used to help us improve JSHS and to report to the organizations that support JSHS.

About this survey:

- This research protocol has been approved for use with human subjects by the Virginia Tech IRB office.
- Although this questionnaire is not anonymous, it is CONFIDENTIAL. Prior to analysis and reporting responses will be de-identified and no one will be able to connect your responses to you or your apprentice's name.
- Only AEOP evaluation personnel will have access to completed questionnaires and personal information will be stored securely.
- Responding to this survey is VOLUNTARY. You are not required to participate, although we hope you do because your responses will provide valuable information for meaningful and continuous improvement.
- If you provide your email address, the AEOP may contact you in the future to ask about you or your students.

If you have any additional questions or concerns, please contact one of the following people:

Tanner Bateman, Virginia Tech
Senior Project Associate, AEOPCA
(540) 231-4540, tbateman@vt.edu

Rebecca Kruse, Virginia Tech
Evaluation Director, AEOPCA
(540) 315-5807, rkruse75@vt.edu

Q1 Do you agree to participate in this survey? (required)

- ❍ Yes, I agree to participate in this survey
- ❍ No, I do not wish to participate in this survey

If No, I do not wish to partic... Is Selected, Then Skip To End of Survey

Q2 Please provide your personal information below: (required)

First Name _____
Last Name _____

Q3 Please provide your email address: (optional)

Email _____

Q4 What is your gender?

- ❍ Male
- ❍ Female
- ❍ Choose not to report

Q5 What is your race or ethnicity?

- ❍ Hispanic or Latino
- ❍ Asian
- ❍ Black or African American
- ❍ Native American or Alaska Native
- ❍ Native Hawaiian or Other Pacific Islander
- ❍ White
- ❍ Other race or ethnicity, (specify): _____
- ❍ Choose not to report

Q6 Which of the following BEST describes your current occupation (select ONE)

- ❍ Teacher
- ❍ Other school staff
- ❍ University educator
- ❍ Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)
- ❍ Scientist, Engineer, or Mathematics professional
- ❍ Other, (specify): _____

Q7 Which of the following BEST describes your organization? (select ONE)

- ❍ No organization
- ❍ School or district (K-12)
- ❍ State educational agency
- ❍ Institution of higher education (vocational school, junior college, college, or university)
- ❍ Industry
- ❍ Department of Defense or other government agency
- ❍ Non-profit
- ❍ Other, (specify): _____

Answer If Which of the following BEST describes your current occupation (select ONE) Teacher Is Selected Or Which of the following BEST describes your current occupation (select ONE) Other school staff Is Selected

Q8 What grade level(s) do you teach? (Select all that apply)

- ❑ Upper elementary school
- ❑ Middle school
- ❑ High school

Answer If Which of the following BEST describes your current occupation (select ONE) Teacher Is Selected Or Which of the following BEST describes your current occupation (select ONE) Other school staff Is Selected

Q9 Which best describes the location of your school?

- ❍ Frontier or tribal school
- ❍ Rural (country)
- ❍ Suburban
- ❍ Urban (city)

Answer If Which of the following BEST describes your current occupation (select ONE) Teacher Is Selected Or Which of the following BEST describes your current occupation (select ONE) Other school staff Is Selected

Q10 At what kind of school do you work?

- ❍ Public school
- ❍ Private school
- ❍ Home school
- ❍ Online school
- ❍ Department of Defense school (DoDDS, DoDEA)

Answer If Which of the following BEST describes your current occupation (select ONE) Teacher Is Selected Or Which of the following BEST describes your current occupation (select ONE) Other school staff Is Selected

Q11 Do you work at a "Title-I" school?

- ❍ Yes
- ❍ No
- ❍ I am not sure

Answer If Which of the following BEST describes your current occupation (select ONE) Teacher Is Selected Or Which of the following BEST describes your current occupation (select ONE) Other school staff Is Selected

Q12 Which of the following subjects do you teach? (Select all that apply)

- ❑ Physical science (physics, chemistry, astronomy, materials science)
- ❑ Biological science
- ❑ Earth, atmospheric, or oceanic science
- ❑ Agricultural science
- ❑ Environmental science
- ❑ Computer science
- ❑ Technology
- ❑ Engineering
- ❑ Mathematics or statistics
- ❑ Medical, health, or behavioral science
- ❑ Social science (psychology, sociology, anthropology, etc.)
- ❑ Other, (specify) _____

Answer If Which of the following BEST describes your current occupation (select ONE) Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.) Is Selected Or Which of the following BEST describes your current occupation (select ONE) Scientist, Engineer, or Mathematics professional Is Selected

Q13 Which of the following best describes your primary area of research?

- ❍ Physical science (physics, chemistry, astronomy, materials science)
- ❍ Biological science
- ❍ Earth, atmospheric, or oceanic science
- ❍ Agricultural science
- ❍ Environmental science
- ❍ Computer science

- ❍ Technology
- ❍ Engineering
- ❍ Mathematics or statistics
- ❍ Medical, health, or behavioral science
- ❍ Social science (psychology, sociology, anthropology, etc.)
- ❍ Other, (specify) _____

Q14 Where was the GEMS program located?

- ❍ Army Medical Research and Material Command at Fort Detrick (Frederick, MD)
- ❍ Army Aviation and Missile Research Development and Engineering Center (Huntsville, AL)
- ❍ Army Aeromedical Research Laboratory (Fort Rucker, AL)
- ❍ Army Medical Research Institute of Chemical Defense (Aberdeen, MD)
- ❍ Army Research Institute for Surgical Research (San Antonio, TX)
- ❍ Army Research Institute for Environmental Medicine (Natick, MA)
- ❍ Armed Forces Medical Examiner System (Dover AFB, DE)
- ❍ Walter Reed Army Institute of Research (Silver Spring, MD)
- ❍ Walter Reed Army Institute of Research @ Wheaton High School (Wheaton, MD)
- ❍ Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)
- ❍ Army Research Laboratory-Adelphi (Adelphi, MD)
- ❍ Army Research Laboratory-White Sands Missile Range (White Sands, NM)
- ❍ Engineer Research & Development Center- Construction Engineering Research Laboratory (Champaign, IL)
- ❍ Engineer Research & Development Center-Mississippi (Vicksburg, MS)

Q15 Which GEMS program(s) did you support? (Check all that apply)

- ❑ GEMS
- ❑ Beginning GEMS or GEMS-1
- ❑ Beginning Engineering GEMS
- ❑ Beginning Biomedical GEMS
- ❑ Intermediate GEMS or GEMS-2
- ❑ Intermediate Biomedical GEMS
- ❑ Intermediate Engineering GEMS
- ❑ Advanced GEMS or GEMS-3
- ❑ Advanced Biomedical GEMS
- ❑ Advanced Engineering GEMS
- ❑ Advanced GEMS - Power
- ❑ Advanced GEMS - Computer Science
- ❑ Advanced GEMS - Advanced Topics
- ❑ Environmental GEMS
- ❑ Battlebots GEMS
- ❑ CSI GEMS
- ❑ GetGame GEMS
- ❑ Robotics GEMS

- ❑ Physical Science & Forensic GEMS
- ❑ Other, (specify): _____

Q16 Which of the following BEST describes your role during GEMS?

- ❍ Instructor (typically a University or Army Scientist or Engineer)
- ❍ Near peer mentor
- ❍ Resource teacher
- ❍ Other, (specify) _____

Q17 How many GEMS students did you work with this year?

Q18 How did you learn about GEMS? (Check all that apply)

- ❑ Technology Student Association website
- ❑ Army Educational Outreach Program (AEOP) website
- ❑ Facebook, Twitter, Pinterest, or other social media
- ❑ State or national educator conference
- ❑ STEM conference
- ❑ School, university, or professional organization newsletter, email or website
- ❑ A news story or other media coverage
- ❑ Past GEMS participant
- ❑ A student
- ❑ A colleague
- ❑ A supervisor or superior
- ❑ GEMS event or site host/director
- ❑ Workplace communications
- ❑ Someone who works at an Army laboratory
- ❑ Someone who works with the Department of Defense
- ❑ Other, (specify): _____

Q19 How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs (AEOPs) in any capacity? If you have heard of an AEOP but never participated select "Never." If you have not heard of an AEOP select "Never heard of it."

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍

Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q20 How SATISFIED were you with each of the following GEMS features?

	Did not experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Other administrative tasks	❍	❍	❍	❍	❍
Communications from American Society for Engineering Education	❍	❍	❍	❍	❍
Communications from [GEMS site]	❍	❍	❍	❍	❍
Location(s) of program activity	❍	❍	❍	❍	❍
Availability of programs in your area	❍	❍	❍	❍	❍
Support for instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Online educational resources used or provided during program activities	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Field trips or tours	❍	❍	❍	❍	❍

Q21 The list below describes instructional and mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

	Yes - I used this strategy	No - I did not use this strategy
Finding out about students' backgrounds and interests at the beginning of the program	❍	❍
Giving students real-life problems to investigate or solve	❍	❍
Asking students to relate outside events or activities to topics covered in the program	❍	❍
Selecting readings or activities that relate to students' backgrounds	❍	❍
Encouraging students to suggest new readings, activities, or projects	❍	❍
Making explicit provisions for students who wish to carry out independent studies	❍	❍
Helping students become aware of the roles STEM plays in their everyday lives	❍	❍
Helping students understand how STEM can help them improve their communities	❍	❍
Other, (specify):	❍	❍

Q22 The list below describes instructional and mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

	Yes - I used this strategy	No - I did not use this strategy
Finding out about students' learning styles at the beginning of the program	❍	❍
Interacting with all students in the same way regardless of their gender or race and ethnicity	❍	❍
Using gender neutral language	❍	❍
Using diverse teaching/mentoring activities to address a broad spectrum of students	❍	❍
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	❍	❍
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	❍	❍
Directing students to other individuals or programs if I can only provide limited support	❍	❍
Other, (specify):	❍	❍

Q23 The list below describes instructional and mentoring strategies that are effective ways to support students development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

	Yes - I used this strategy	No - I did not use this strategy
Having students tell others about their backgrounds and interests	❍	❍
Having students explain difficult ideas to others	❍	❍
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	❍	❍
Having students participate in giving and receiving feedback	❍	❍
Having students work on collaborative activities or projects as a member of a team	❍	❍
Having students listen to the ideas of others with an open mind	❍	❍
Having students pay attention to the feelings of all team members	❍	❍
Having students develop ways to resolve conflict and reach agreement among the team	❍	❍
Other, (specify):	❍	❍

Q24 The list below describes instructional and mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

	Yes - I used this strategy	No - I did not use this strategy
Teaching (or assigning readings) about specific STEM subject matter	❍	❍
Having students access and critically review technical texts or media to support their work	❍	❍
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	❍	❍
Helping students practice STEM skills with supervision	❍	❍
Giving constructive feedback to improve students' STEM competencies	❍	❍
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	❍	❍
Encouraging students to seek support from other team members	❍	❍
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	❍	❍
Other, (specify):	❍	❍

Q25 The list below describes instructional and mentoring strategies that are effective ways to support students' STEM educational and career pathways. The list also includes items that reflect AEOP and Army priorities. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

	Yes - I used this strategy	No - I did not use this strategy
Asking about students' educational and career interests	❍	❍
Recommending extracurricular programs that align with students' educational goals	❍	❍
Recommending Army Educational Outreach Programs that align with students' educational goals	❍	❍
Providing guidance about educational pathways that would prepare students for a STEM career	❍	❍
Sharing personal experiences, attitudes, and values pertaining to STEM	❍	❍
Discussing STEM career opportunities with the DoD or other government agencies	❍	❍
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	❍	❍
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	❍	❍
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	❍	❍
Recommending student and professional organizations in STEM	❍	❍
Helping students build effective STEM networks	❍	❍
Critically reviewing students' résumé, application, or interview preparations	❍	❍
Other, (specify):	❍	❍

Q26 How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during GEMS?

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
Program manager or site coordinators	❍	❍	❍	❍	❍

Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in GEMS	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍

Q27 Which of the following AEOPs did YOU EXPLICITLY DISCUSS with your student(s) during GEMS? (check ALL that apply)

	Yes - I discussed this program with my student(s)	No - I did not discuss this program with my student(s)
Camp Invention	❍	❍
eCYBERMISSION	❍	❍
Junior Solar Sprint (JSS)	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍
GEMS Near Peers	❍	❍
UNITE	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍
College Qualified Leaders (CQL)	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍
I discussed AEOP with my student(s) but did not discuss any specific program	❍	❍

Q28 How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during GEMS?

	Did not experience	Not at all	A little	Somewhat	Very much
American Society for Engineering Education website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍

AEOP brochure	❍	❍	❍	❍	❍
Program manager or site coordinator	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in GEMS	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍

Q29 Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍
DoD researchers support non-defense related advancements in science and technology	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

Q30 How often did YOUR STUDENT(S) have opportunities do each of the following in GEMS?

	Not at all	At least once	A few times	Most days	Every day
Learn new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍

Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍

Q31 Which category best describes the focus of your student(s)' GEMS experience?

- ❍ Science
- ❍ Technology
- ❍ Engineering
- ❍ Mathematics

Q32 AS A RESULT OF THE GEMS EXPERIENCE, how much did your student(s) GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q33 AS A RESULT OF THE GEMS EXPERIENCE, how much did your student(s) GAIN in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Asking a question that can be answered with one or more investigations	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose scientific explanations or engineering solutions that can be tested with investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an object, process, or system	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Considering different ways to analyze or interpret data when answering a question	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a scientific explanation or engineering solution with data from investigations	❍	❍	❍	❍	❍

Supporting a scientific explanation or engineering or engineering solution with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically)	❍	❍	❍	❍	❍

Q34 AS A RESULT OF THE GEMS EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?

	No gain	A little gain	Some gain	Large gain	Extreme gain
Sticking with a task until it is complete	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and their personal values	❍	❍	❍	❍	❍

Q35 Which of the following statements describe YOUR STUDENT(S) after participating in the GEMS program?

	Disagree - This did not happen	Disagree - This happened but not because of GEMS	Agree - GEMS contributed	Agree - GEMS was primary reason
More confident in STEM knowledge, skills, and abilities	❍	❍	❍	❍
More interested in participating in STEM activities outside of school requirements	❍	❍	❍	❍
More aware of other AEOPs	❍	❍	❍	❍
More interested in participating in other AEOPs	❍	❍	❍	❍
More interested in taking STEM classes in school	❍	❍	❍	❍
More interested in attending college	❍	❍	❍	❍
More interested in earning a STEM degree in college	❍	❍	❍	❍
More interested in pursuing a STEM career	❍	❍	❍	❍
More aware of Department of Defense (DoD) STEM research and careers	❍	❍	❍	❍
Greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
More interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q36 What are the three most important strengths of GEMS?

Strength #1

Strength #2

Strength #3

Q37 What are the three ways GEMS should be improved for future participants?

Improvement #1

Improvement #2

Improvement #3

Q38 Tell us about your overall satisfaction with your GEMS experience.

GEMS Mentor Data Summary

What is your gender?		
	Freq.	**%**
Male	**29**	**33%**
Female	**56**	**64%**
Choose not to report	**2**	**2%**
Total	**87**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	**8**	**9%**
Asian	**6**	**7%**
Black or African American	**7**	**8%**
Native American or Alaska Native	**0**	**0%**
Native Hawaiian or Other Pacific Islander	**1**	**1%**
White	**59**	**68%**
Other race or ethnicity, (specify):	**3**	**3%**
Choose not to report	**3**	**3%**
Total	**87**	**100%**

Note. Other = “Ethiopian”, and “Multi-ethnic”.

Which of the following BEST describes your current occupation? (select ONE)		
	Freq.	**%**
Teacher	**21**	**24%**
Other school staff	**1**	**1%**
University educator	**0**	**0%**
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	**36**	**41%**
Scientist, Engineer, or Mathematics professional	**2**	**2%**
Other, (specify):	**27**	**31%**
Total	**87**	**100%**

Note. Other = “Student” (n = 10), “College/University Student” (n=3), “Education student” (n = 3), “High school student” (n = 3), “Curriculum Writer and Marketing Coordinator”, “Mentor”, “Program coordinator”, “SEAP”, “seeking employment in science education”, and “WRAIR”.

Which of the following BEST describes your organization? (select ONE)		
	Freq.	**%**
No organization	**9**	**10%**
School or district (K-12)	**22**	**25%**
State educational agency	**1**	**1%**
Institution of higher education (vocational school, junior college, college, or university)	**33**	**38%**
Industry	**0**	**0%**
Department of Defense or other government agency	**14**	**16%**
Non-profit	**1**	**1%**
Other, (specify):	**7**	**8%**
Total	**87**	**100%**

Note. Other = "University", "Contractor", "D.A.F.B CSI GEMS", "Student", "dover air force base", and "State University".

What grade level(s) do you teach? (Select all that apply) (n = 22)		
	Freq.	**%**
Upper elementary	**3**	**14%**
Middle school	**12**	**55%**
High school	**12**	**55%**

Which best describes the location of your school?		
	Freq.	**%**
Frontier or tribal school	**0**	**0%**
Rural (country)	**4**	**18%**
Suburban	**10**	**45%**
Urban (city)	**8**	**36%**
Total	**22**	**100%**

At what kind of school do you work?		
	Freq.	**%**
Public school	**19**	**86%**
Private school	**1**	**5%**
Home school	**0**	**0%**
Online school	**0**	**0%**

Department of Defense school (DoDDS or DoDEA)	2	9%
Total	22	100%

Do you work at a "Title-I" school?

	Freq.	%
Yes	6	27%
No	14	64%
I am not sure	2	9%
Total	22	100%

Which of the following subjects do you teach? (Select all that apply) (n = 22)

	Freq.	%			Freq.	%
Physical science (physics, chemistry, astronomy, materials science)	10	45%		Technology	3	14%
Biological science	9	41%		Engineering	4	18%
Earth, atmospheric, or oceanic science	8	36%		Mathematics or statistics	8	36%
Agricultural science	1	5%		Medical, health, or behavioral science	3	14%
Environmental science	4	18%		Social science (psychology, sociology, anthropology, etc.)	1	5%
Computer science	1	5%		Other, (specify):	3	14%

Note. Other = "All", "AVID/Leadership", and "History".

Which of the following best describes your primary area of research?

	Freq.	%			Freq.	%
Physical science (physics, chemistry, astronomy, materials science)	7	19%		Technology	0	0%
Biological science	11	30%		Engineering	11	30%
Earth, atmospheric, or oceanic science	0	0%		Mathematics or statistics	0	0%
Agricultural science	0	0%		Medical, health, or behavioral science	4	11%
Environmental science	1	3%		Social science (psychology, sociology, anthropology, etc.)	0	0%
Computer science	1	3%		Other, (specify):	2	5%
				Total	37	100%

Note. Other = "Architecture" and "Forensic Science".

Where was the GEMS program located?						
	Freq.	%			Freq.	%
Army Medical Research and Material Command at Fort Detrick (Frederick, MD)	14	17%		Walter Reed Army Institute of Research (Silver Spring, MD)	4	5%
Army Aviation and Missile Research Development and Engineering Center (Huntsville, AL)	0	0%		Walter Reed Army Institute of Research @ Wheaton High School (Wheaton, MD)	0	0%
Army Aeromedical Research Laboratory (Fort Rucker, AL)	5	6%		Army Research Laboratory-Aberdeen Proving Ground (Aberdeen, MD)	19	23%
Army Medical Research Institute of Chemical Defense (Aberdeen, MD)	7	8%		Army Research Laboratory-Adelphi (Adelphi, MD)	4	5%
Army Research Institute for Surgical Research (San Antonio, TX)	5	6%		Army Research Laboratory-White Sands Missile Range (White Sands, NM)	8	10%
Army Research Institute for Environmental Medicine (Natick, MA)	7	8%		Engineer Research & Development Center- Construction Engineering Research Laboratory (Champaign, IL)	3	4%
Armed Forces Medical Examiner System (Dover AFB, DE)	4	5%		Engineer Research & Development Center-Mississippi (Vicksburg, MS)	4	5%
				Total	84	100%

Which GEMS program(s) did you support? (Check all that apply) (n = 84)						
	Freq.	%			Freq.	%
GEMS	37	44%		Advanced GEMS - Power	3	4%
Beginning GEMS / GEMS-1	27	32%		Advanced GEMS - Computer Science	0	0%
Beginning Biomedical GEMS	4	5%		Advanced GEMS - Advanced Topics	1	1%
Beginning Engineering GEMS	2	2%		Environmental GEMS	5	6%
Intermediate GEMS / GEMS-2	35	42%		Battlebots GEMS	4	5%
Intermediate Biomedical GEMS	4	5%		CSI GEMS	9	11%
Intermediate Engineering GEMS	1	1%		GetGame GEMS	5	6%
Advanced GEMS / GEMS-3	14	17%		Robotics GEMS	5	6%
Advanced Biomedical GEMS	5	6%		Physical Science & Forensic GEMS	0	0%
Advanced Engineering GEMS	1	1%		Other, (specify):	6	7%

Note. Other = “Biochemistry” (n = 3), “Biochemistry and Neuroscience” (n = 2), and “STARS”.

Which of the following BEST describes your role during GEMS?		
	Freq.	**%**
Instructor (typically a University or Army Scientist or Engineer)	**3**	**4%**
Near peer mentor	**55**	**65%**
Resource teacher	**21**	**25%**
Other, (specify)	**5**	**6%**
Total	**84**	**100%**

Note. Other = "Assistant Near Peer Mentor" (n = 2), and "Program Coordinator".

How many GEMS students did you work with this year?		
# of Students	**Freq.**	**%**
25 or fewer	**21**	**29%**
26 to 50	**17**	**23%**
51 to 75	**13**	**18%**
76 to 100	**13**	**18%**
101 to 125	**0**	**0%**
126 to 150	**1**	**1%**
151 to 175	**1**	**1%**
176 to 200	**5**	**7%**
More than 200	**2**	**3%**
Total	**73**	**100%**

How did you learn about GEMS? (Check all that apply) (n = 84)						
	Freq.	**%**			**Freq.**	**%**
American Society for Engineering Education website	**2**	**2%**		**A student**	**7**	**8%**
Army Educational Outreach Program (AEOP) website	**17**	**20%**		**A colleague**	**11**	**13%**
Facebook, Twitter, Pinterest, or other social media	**1**	**1%**		**A supervisor or superior**	**9**	**11%**
State or national educator conference	**0**	**0%**		**GEMS site host/director**	**16**	**19%**
STEM conference	**2**	**2%**		**Workplace communications**	**6**	**7%**
School, university, or professional organization newsletter, email, or website	**17**	**20%**		**Someone who works at an Army laboratory**	**11**	**13%**
A news story or other media coverage	**1**	**1%**		**Someone who works with the Department of Defense**	**18**	**21%**

Past GEMS participant	23	27%		**Other, (specify):**	6	7%

Note. Other = “someone who works at IRS”, “two of my professors at Troy University mentioned the program to me at separate times”, “Environmental Science Teacher in High School”, “Younger brother of coordinator told me about GEMS”, and “Father”.

How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs in any capacity? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."

	0	1	2	3	4	n	Avg.	SD
Camp Invention	32 (41%)	42 (53%)	3 (4%)	1 (1%)	1 (1%)	79	1.17	0.56
eCYBERMISSION	28 (35%)	49 (61%)	0 (0%)	2 (3%)	1 (1%)	80	1.13	0.56
Junior Solar Sprint (JSS)	34 (43%)	41 (52%)	3 (4%)	0 (0%)	1 (1%)	79	1.13	0.50
West Point Bridge Design Contest (WPBDC)	30 (38%)	44 (56%)	2 (3%)	2 (3%)	1 (1%)	79	1.18	0.60
Junior Science & Humanities Symposium (JSHS)	32 (42%)	41 (53%)	3 (4%)	0 (0%)	1 (1%)	77	1.13	0.50
Gains in the Education of Mathematics and Science (GEMS)	5 (6%)	25 (31%)	21 (26%)	8 (10%)	22 (27%)	81	2.36	1.22
GEMS Near Peers	6 (8%)	17 (22%)	37 (47%)	8 (10%)	10 (13%)	78	2.15	0.94
UNITE	34 (45%)	41 (54%)	0 (0%)	0 (0%)	1 (1%)	76	1.07	0.46
Science & Engineering Apprenticeship Program (SEAP)	22 (28%)	47 (59%)	8 (10%)	1 (1%)	2 (3%)	80	1.28	0.67
Research & Engineering Apprenticeship Program (REAP)	28 (36%)	48 (62%)	1 (1%)	0 (0%)	1 (1%)	78	1.08	0.44
High School Apprenticeship Program (HSAP)	32 (41%)	45 (58%)	0 (0%)	0 (0%)	1 (1%)	78	1.07	0.44
College Qualified Leaders (CQL)	27 (35%)	40 (51%)	6 (8%)	2 (3%)	3 (4%)	78	1.37	0.82
Undergraduate Research Apprenticeship Program (URAP)	30 (38%)	46 (59%)	1 (1%)	0 (0%)	1 (1%)	78	1.08	0.45
Science Mathematics, and Research for Transformation (SMART) College Scholarship	23 (30%)	51 (66%)	1 (1%)	1 (1%)	1 (1%)	77	1.11	0.50
National Defense Science & Engineering Graduate (NDSEG) Fellowship	35 (45%)	41 (53%)	0 (0%)	0 (0%)	1 (1%)	77	1.07	0.46

Note. Response scale: 0 = “Never heard of it,” 1 = “Never,” 2 = “Once,” 3= “Twice,” 4 = “Three or more times”.

How SATISFIED were you with each of the following GEMS features?

	0	1	2	3	4	n	Avg.	SD
Application or registration process	9 (11%)	10 (12%)	7 (8%)	21 (25%)	36 (43%)	83	3.12	1.06
Other administrative tasks	9 (11%)	3 (4%)	8 (10%)	21 (26%)	40 (49%)	81	3.36	0.84
Communications from American Society for Engineering Education	36 (43%)	1 (1%)	15 (18%)	7 (8%)	24 (29%)	83	3.15	0.96
Communications from [GEMS site]	5 (6%)	1 (1%)	3 (4%)	10 (12%)	64 (77%)	83	3.76	0.59
Location(s) of program activity	0 (0%)	1 (1%)	2 (2%)	13 (16%)	67 (81%)	83	3.76	0.55
Availability of programs in your area	3 (4%)	4 (5%)	7 (8%)	19 (23%)	50 (60%)	83	3.44	0.85

Support for instruction or mentorship during program activities	2 (2%)	1 (1%)	4 (5%)	12 (14%)	64 (77%)	83	3.72	0.62
Participation stipends (payment)	5 (6%)	2 (2%)	2 (2%)	17 (20%)	57 (69%)	83	3.65	0.66
Online educational resources used or provided during program activities	16 (19%)	1 (1%)	8 (10%)	17 (20%)	41 (49%)	83	3.46	0.77
Invited speakers or "career" events	5 (6%)	0 (0%)	4 (5%)	10 (12%)	64 (77%)	83	3.77	0.53
Field Trips or tours	20 (24%)	1 (1%)	6 (7%)	9 (11%)	47 (57%)	83	3.62	0.73

Note. Response scale: 0 = "Did Not Experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

The list below describes instructional and mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Finding out about students' backgrounds and interests at the beginning of the program	82	76	93%	6	7%
Giving students real-life problems to investigate or solve	82	75	91%	7	9%
Asking students to relate outside events or activities to topics covered in the program	82	74	90%	8	10%
Selecting readings or activities that relate to students' backgrounds	81	36	44%	45	56%
Encouraging students to suggest new readings, activities, or projects	82	54	66%	28	34%
Making explicit provisions for students who wish to carry out independent studies	81	39	48%	42	52%
Helping students become aware of the roles STEM plays in their everyday lives	82	81	99%	1	1%
Helping students understand how STEM can help them improve their communities	82	71	87%	11	13%
Other, (specify):	18	7	39%	11	61%

Note. Other = "Discuss goal setting; How to identify personal strengths and weaknesses; Discuss the importance of education; and Identify career interests and aspirations", "relating to the students on a friendship level because of my age", "I tried to help explain concepts that they were interested in to begin with", "Actively addressing all paradigms to show how they don't work", "Help them figure out how to get into a STEM career", and "Using multimedia to instruct students about STEM".

The list below describes instructional and mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%

Finding out about students' learning styles at the beginning of the program	**82**	**62**	**76%**	**20**	**24%**
Interacting with all students in the same way regardless of their gender or race and ethnicity	**82**	**79**	**96%**	**3**	**4%**
Using gender neutral language	**81**	**75**	**93%**	**6**	**7%**
Using diverse teaching/mentoring activities to address a broad spectrum of students	**82**	**79**	**96%**	**3**	**4%**
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	**82**	**39**	**48%**	**43**	**52%**
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	**82**	**47**	**57%**	**35**	**43%**
Directing students to other individuals or programs if I can only provide limited support	**81**	**62**	**77%**	**19**	**23%**
Other, (specify):	**18**	**3**	**17%**	**15**	**83%**

Note. Other = "Build a positive rapport with each of my students each week", "Learning is not diverse over the lines you provide above", and "Using approaches for students who learn visually, orally, and with written material".

The list below describes instructional and mentoring strategies that are effective ways to support students' development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

		Yes – I used this strategy		**No – I did not use this strategy**	
	n	**Freq.**	**%**	**Freq.**	**%**
Having students tell others about their backgrounds and interests	**80**	**70**	**88%**	**10**	**13%**
Having students explain difficult ideas to others	**80**	**75**	**94%**	**5**	**6%**
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	**81**	**76**	**94%**	**5**	**6%**
Having students participate in giving and receiving feedback	**81**	**76**	**94%**	**5**	**6%**
Having students work on collaborative activities or projects as a member of a team	**81**	**79**	**98%**	**2**	**2%**
Having students listen to the ideas of others with an open mind	**81**	**78**	**96%**	**3**	**4%**
Having students pay attention to the feelings of all team members	**81**	**77**	**95%**	**4**	**5%**
Having students develop ways to resolve conflict and reach agreement among the team	**80**	**76**	**95%**	**4**	**5%**
Other, (specify):	**20**	**7**	**35%**	**13**	**65%**

Note. Other = "Review safety policy and procedures", and "creating a true team".

The list below describes instructional and mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Teaching (or assigning readings) about specific STEM subject matter	80	59	74%	21	26%
Having students access and critically review technical texts or media to support their work	80	34	43%	46	58%
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	80	77	96%	3	4%
Helping students practice STEM skills with supervision	80	79	99%	1	1%
Giving constructive feedback to improve students' STEM competencies	80	76	95%	4	5%
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	80	71	89%	9	11%
Encouraging students to seek support from other team members	80	79	99%	1	1%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	80	68	85%	12	15%
Other, (specify):	18	6	33%	12	67%

Note. Other = "Provide team building exercises".

The list below describes instructional and mentoring strategies that are effective ways to support students' STEM educational and career pathways. The list also includes items that reflect AEOP and Army priorities. From the list below, please indicate which strategies you used when working with your student(s) in GEMS.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Asking about students' educational and career interests	80	79	99%	1	1%
Recommending extracurricular programs that align with students' educational goals	80	68	85%	12	15%
Recommending Army Educational Outreach Programs that align with students' educational goals	79	53	67%	26	33%
Providing guidance about educational pathways that would prepare students for a STEM career	79	72	91%	7	9%
Sharing personal experiences, attitudes, and values pertaining to STEM	80	78	98%	2	3%
Discussing STEM career opportunities with the DoD or other government agencies	80	59	74%	21	26%
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	79	56	71%	23	29%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	80	54	68%	26	33%

Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	80	32	40%	48	60%
Recommending student and professional organizations in STEM	80	61	76%	19	24%
Helping students build effective STEM networks	79	56	71%	23	29%
Critically reviewing students' résumé, application, or interview preparations	80	20	25%	60	75%
Other, (specify):	16	2	13%	14	88%

Note. Other = "Discuss resume writing, completing applications, interviewing skills, and public speaking techniques, and how to write an informative paragraph".

How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during GEMS?

	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	48 (62%)	4 (5%)	11 (14%)	8 (10%)	7 (9%)	78	2.60	1.00
AEOP website	20 (26%)	3 (4%)	15 (19%)	16 (21%)	24 (31%)	78	3.05	0.94
AEOP social media	43 (55%)	12 (15%)	10 (13%)	10 (13%)	3 (4%)	78	2.11	0.99
AEOP brochure	28 (35%)	6 (8%)	6 (8%)	17 (21%)	23 (29%)	80	3.10	1.01
Program manager or site coordinators	11 (14%)	0 (0%)	4 (5%)	10 (13%)	55 (69%)	80	3.74	0.56
Invited speakers or "career" events	11 (14%)	2 (3%)	2 (3%)	11 (14%)	53 (67%)	79	3.69	0.67
Participation in GEMS	2 (3%)	0 (0%)	2 (3%)	6 (8%)	70 (88%)	80	3.87	0.41
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	10 (13%)	1 (1%)	4 (5%)	12 (15%)	53 (66%)	80	3.67	0.65

Note. Response scale: 0 = "Did Not Experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Which of the following AEOPs did you EXPLICITLY DISCUSS with your student(s) during GEMS?

		Yes - I discussed this program with my student(s)		No - I did not discuss this program with my student(s)	
	n	Freq.	%	Freq.	%
Camp Invention	79	7	9%	72	91%
eCYBERMISSION	79	19	24%	60	76%
Junior Solar Sprint (JSS)	79	17	22%	62	78%
West Point Bridge Design Contest (WPBDC)	78	21	27%	57	73%
Junior Science & Humanities Symposium (JSHS)	78	18	23%	60	77%
Gains in the Education of Mathematics and Science (GEMS)	79	74	94%	5	6%
GEMS Near Peers	80	69	86%	11	14%
UNITE	79	14	18%	65	82%

Science & Engineering Apprenticeship Program (SEAP)	79	39	49%	40	51%
Research & Engineering Apprenticeship Program (REAP)	79	20	25%	59	75%
High School Apprenticeship Program (HSAP)	79	21	27%	58	73%
College Qualified Leaders (CQL)	80	28	35%	52	65%
Undergraduate Research Apprenticeship Program (URAP)	79	19	24%	60	76%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	78	19	24%	59	76%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	79	9	11%	70	89%
I discussed AEOP with my student(s) but did not discuss any specific program	70	30	43%	40	57%

How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during GEMS?

	0	1	2	3	4	n	Avg.	SD
American Society for Engineering Education website	49 (63%)	5 (6%)	6 (8%)	12 (15%)	6 (8%)	78	2.66	1.01
AEOP website	29 (37%)	6 (8%)	6 (8%)	18 (23%)	20 (25%)	79	3.04	1.01
AEOP social media	45 (57%)	9 (11%)	7 (9%)	13 (16%)	5 (6%)	79	2.41	1.05
AEOP brochure	27 (34%)	4 (5%)	11 (14%)	16 (20%)	22 (28%)	80	3.06	0.97
Program manager or site coordinator	12 (15%)	1 (1%)	3 (4%)	12 (15%)	52 (65%)	80	3.69	0.63
Invited speakers or "career" events	10 (13%)	0 (0%)	5 (6%)	11 (14%)	53 (67%)	79	3.70	0.60
Participation in GEMS	3 (4%)	2 (3%)	2 (3%)	9 (11%)	64 (80%)	80	3.75	0.63
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	12 (15%)	3 (4%)	8 (10%)	20 (25%)	37 (46%)	80	3.34	0.86

Note. Response scale: 0 = "Did Not Experience," 1 = "Not at all," 2 = "A little," 3 = "Somewhat," 4 = "Very much".

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	0 (0%)	1 (1%)	1 (1%)	24 (30%)	54 (68%)	80	4.64	0.58
DoD researchers develop new, cutting edge technologies	0 (0%)	1 (1%)	4 (5%)	17 (21%)	58 (73%)	80	4.65	0.64
DoD researchers support non-defense related advancements in science and technology	1 (1%)	0 (0%)	7 (9%)	20 (25%)	52 (65%)	80	4.53	0.76
DoD researchers solve real-world problems	0 (0%)	1 (1%)	2 (3%)	20 (25%)	57 (71%)	80	4.66	0.59
DoD research is valuable to society	0 (0%)	1 (1%)	4 (5%)	13 (16%)	62 (78%)	80	4.70	0.62

Note. Response scale: 1 = "Strongly Disagree," 2 = "Disagree," 3 = "Neither Agree nor Disagree," 4 = "Agree," 5 = "Strongly Agree".

How often did YOUR STUDENT(S) have opportunities to do each of the following in GEMS?								
	1	2	3	4	5	n	Avg.	SD
Learn new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	0 (0%)	2 (3%)	6 (8%)	71 (90%)	79	4.87	0.40
Apply STEM knowledge to real life situations	0 (0%)	1 (1%)	4 (5%)	12 (15%)	62 (78%)	79	4.71	0.62
Learn about cutting-edge STEM research	0 (0%)	2 (3%)	11 (14%)	14 (18%)	52 (66%)	79	4.47	0.83
Learn about different STEM careers	0 (0%)	0 (0%)	2 (3%)	14 (18%)	63 (80%)	79	4.77	0.48
Interact with STEM professionals	0 (0%)	2 (3%)	6 (8%)	13 (16%)	58 (73%)	79	4.61	0.74
Practice using laboratory or field techniques, procedures, and tools	0 (0%)	1 (1%)	1 (1%)	7 (9%)	70 (89%)	79	4.85	0.48
Participate in hands-on STEM activities	0 (0%)	0 (0%)	2 (3%)	5 (6%)	72 (91%)	79	4.89	0.39
Work as part of a team	0 (0%)	0 (0%)	1 (1%)	8 (10%)	70 (89%)	79	4.87	0.37
Communicate with other students about STEM	0 (0%)	0 (0%)	2 (3%)	9 (11%)	68 (86%)	79	4.84	0.44
Draw conclusions from an investigation	1 (1%)	0 (0%)	5 (6%)	11 (14%)	62 (78%)	79	4.68	0.71
Build (or simulate) something	1 (1%)	0 (0%)	4 (5%)	18 (23%)	56 (71%)	79	4.62	0.70
Pose questions or problems to investigate	1 (1%)	3 (4%)	5 (6%)	12 (15%)	58 (73%)	79	4.56	0.87
Design an investigation	12 (15%)	5 (6%)	19 (24%)	8 (10%)	34 (44%)	78	3.60	1.48
Carry out an investigation	3 (4%)	2 (3%)	10 (13%)	12 (15%)	52 (66%)	79	4.37	1.05
Analyze and interpret data or information	2 (3%)	1 (1%)	5 (6%)	11 (14%)	60 (76%)	79	4.59	0.87
Come up with creative explanations or solutions	2 (3%)	2 (3%)	5 (6%)	9 (12%)	60 (77%)	78	4.58	0.92

Note. Response scale: 1 = “Not at all,” 2 = “At least once,” 3 = “A few times,” 4 = “Most days,” 5 = “Every day”.

Which category best describes the focus of your GEMS program?		
	Freq.	%
Science	58	73%
Technology	3	4%
Engineering	18	23%
Mathematics	1	1%
Total	80	100%

AS A RESULT OF THE GEMS EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Knowledge of a STEM topic or field in depth	1 (1%)	0 (0%)	7 (9%)	37 (46%)	35 (44%)	80	4.31	0.74

Knowledge of research conducted in a STEM topic or field	0 (0%)	2 (3%)	9 (11%)	35 (44%)	34 (43%)	80	4.26	0.76
Knowledge of research processes, ethics, and rules for conduct in STEM	2 (3%)	4 (5%)	15 (19%)	28 (35%)	31 (39%)	80	4.03	1.01
Knowledge of how professionals work on real problems in STEM	0 (0%)	1 (1%)	4 (5%)	35 (44%)	40 (50%)	80	4.43	0.65
Knowledge of what everyday research work is like in STEM	1 (1%)	1 (1%)	13 (16%)	32 (40%)	33 (41%)	80	4.19	0.84

Note. Response scale: 1 = "No gain," 2 = "A little gain," 3 = "Some gain," 4 = "Large gain," 5 = "Extreme gain".

AS A RESULT OF YOUR GEMS EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Asking a question that can be answered with one or more investigations	0 (0%)	2 (3%)	19 (24%)	37 (47%)	21 (27%)	79	3.97	0.78
Applying knowledge, logic, and creativity to propose scientific explanations or engineering solutions that can be tested with investigations	1 (1%)	3 (4%)	12 (15%)	34 (43%)	29 (37%)	79	4.10	0.89
Making a model to represent the key features and functions of an object, process, or system	3 (4%)	8 (10%)	18 (23%)	25 (32%)	25 (32%)	79	3.77	1.12
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	4 (5%)	6 (8%)	16 (20%)	32 (41%)	21 (27%)	79	3.76	1.09
Carrying out procedures for an investigation and recording data accurately	1 (1%)	2 (3%)	10 (13%)	32 (41%)	33 (42%)	78	4.21	0.86
Considering different ways to analyze or interpret data when answering a question	2 (3%)	5 (6%)	12 (15%)	26 (33%)	33 (42%)	78	4.06	1.04
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	4 (5%)	10 (13%)	12 (15%)	32 (41%)	20 (26%)	78	3.69	1.14
Using mathematics or computers to analyze numeric data	11 (14%)	14 (18%)	11 (14%)	24 (31%)	18 (23%)	78	3.31	1.38
Supporting a scientific explanation or engineering solution with data from investigations	2 (3%)	6 (8%)	8 (10%)	35 (44%)	28 (35%)	79	4.03	1.00
Supporting a scientific explanation or engineering or engineering solution with relevant scientific, mathematical, and/or engineering knowledge	3 (4%)	5 (6%)	14 (18%)	34 (43%)	23 (29%)	79	3.87	1.03
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically)	2 (3%)	3 (4%)	10 (13%)	32 (41%)	32 (41%)	79	4.13	0.95

Note. Response scale: 1 = "No gain," 2 = "A little gain," 3 = "Some gain," 4 = "Large gain," 5 = "Extreme gain".

AS A RESULT OF THE GEMS EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Sticking with a task until it is complete	0 (0%)	4 (5%)	10 (13%)	39 (49%)	26 (33%)	79	4.10	0.81
Making changes when things do not go as planned	0 (0%)	3 (4%)	14 (18%)	29 (37%)	33 (42%)	79	4.16	0.85
Working collaboratively with a team	0 (0%)	2 (3%)	2 (3%)	21 (27%)	54 (68%)	79	4.61	0.67
Communicating effectively with others	0 (0%)	1 (1%)	4 (5%)	23 (29%)	51 (65%)	79	4.57	0.65
Including others' perspectives when making decisions	0 (0%)	1 (1%)	10 (13%)	32 (41%)	36 (46%)	79	4.30	0.74
Sense of being part of a learning community	0 (0%)	1 (1%)	8 (10%)	31 (39%)	39 (49%)	79	4.37	0.72
Building relationships with professionals in a field	0 (0%)	5 (6%)	11 (14%)	32 (41%)	30 (38%)	78	4.12	0.88
Connecting a topic or field and their personal values	0 (0%)	6 (8%)	8 (10%)	29 (37%)	35 (45%)	78	4.19	0.91

Note. Response scale: 1 = "No gain," 2 = "A little gain," 3 = "Some gain," 4 = "Large gain," 5 = "Extreme gain".

Which of the following statements describe your student(s) AFTER PARTICIPATING IN GEMS?							
	1	2	3	4	n	Avg.	SD
More confident in STEM knowledge, skills, and abilities	0 (0%)	0 (0%)	50 (63%)	29 (37%)	79	3.37	0.49
More interested in participating in STEM activities outside of school requirements	1 (1%)	2 (3%)	48 (61%)	28 (35%)	79	3.30	0.59
More aware of other AEOPs	6 (8%)	3 (4%)	34 (44%)	35 (45%)	78	3.26	0.86
More interested in participating in other AEOPs	7 (9%)	2 (3%)	33 (42%)	37 (47%)	79	3.27	0.89
More interested in taking STEM classes in school	2 (3%)	3 (4%)	52 (66%)	22 (28%)	79	3.19	0.62
More interested in attending college	1 (1%)	15 (19%)	45 (57%)	18 (23%)	79	3.01	0.69
More interested in earning a STEM degree in college	1 (1%)	4 (5%)	52 (66%)	22 (28%)	79	3.20	0.59
More interested in pursuing a STEM career	1 (1%)	2 (3%)	53 (67%)	23 (29%)	79	3.24	0.56
More aware of Department of Defense (DoD) STEM research and careers	1 (1%)	3 (4%)	29 (37%)	46 (58%)	79	3.52	0.64
Greater appreciation of DoD STEM research and careers	2 (3%)	2 (3%)	31 (40%)	43 (55%)	78	3.47	0.68
More interested in pursuing a STEM career with the DoD	4 (5%)	3 (4%)	34 (44%)	36 (47%)	77	3.32	0.79

Note. Response scale: **1** = "Disagree – This did not happen," **2** = "Disagree – This happened but not because of GEMS," **3** = "Agree – GEMS contributed," **4** = "Agree – GEMS was the primary reason".

Appendix D

FY14 GEMS Student Focus Group Protocol

2014 Army Educational Outreach Program

Student Focus Group

Facilitator: "Thank you for meeting with us today so that we can learn more about your experiences in [X] program. We'd like to suggest some basic ground rules to help the group's discussion proceed smoothly and respectfully for everyone:

- What is shared in the room stays in the room.
- Only one person speaks at a time.
- It is important for us to hear everyone's ideas and opinions. If you disagree, be respectful.
- It is important for us to hear all sides of an issue—both the positive and negative.
- Your participation is voluntary--you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for notetaking purposes and will delete the email after the notes have been taken."

Key Questions

1. Why did you choose to participate in [X] this year?
    - How did you hear about [X]?

2. One AEOP objective is to increase your awareness of the AEOP's pipeline of STEM programs. Did you learn about other AEOPs in [X]?
    - Which ones did you learn about?
    - How did you learn about them?
    - Which AEOPs are you interested in pursuing?

3. One AEOP objective is to increase your awareness of STEM research and career opportunities within the Department of Defense. Did you learn about DoD STEM research and careers in [X]?
    - Which ones did you learn about?
    - How did you learn about them?
    - Which AEOPs are you interested in pursuing?

4. Overall, were you happy that you chose to participate in [X]?
    - How have you benefited from participating in [X]?

5. What would you suggest for improving [X] in the future?

Ending questions:

6. Have we missed anything? Tell us anything you want us to know that we didn't ask about.

Appendix E

FY14 GEMS Mentor Focus Group Protocol

2014 Army Educational Outreach Program
Adult Focus Group

Facilitator: "Thank you for meeting with us today so that we can learn more about your experiences in [X] program. We'd like to suggest some basic ground rules to help the group's discussion proceed smoothly and respectfully for everyone:

- What is shared in the room stays in the room.
- Only one person speaks at a time--we'll call on sites, if you have something to add or wish to build on another's idea, just type 'add' in the chat window and we'll come back to you.
- It is important for us to hear everyone's ideas and opinions. If you disagree, be respectful.
- It is important for us to hear all sides of an issue—both the positive and negative.
- Your participation is voluntary--you may choose not to answer any question, or stop participating at any time.
- We will be audio recording the session for notetaking purposes and will delete the email after the notes have been taken."

Key Questions

1. What do you perceive as the value of [X]?
    - How do you think students benefit from participating?
    - How have you benefited?

2. One AEOP objective is to increase participation of underserved and underrepresented populations in STEM. What strategies have you used this year to increase the diversity of participants in [X]?
    - What strategies seem to work the best?
    - What do you need in order to achieve greater success?

3. One AEOP objective is to increase participants' awareness of the AEOP's pipeline of STEM programs. What strategies have you used this year to educate participants about other AEOP initiatives?
    - What strategies seem to work the best?
    - What do you need in order to achieve greater success?

4. One AEOP objective is to increase participants' awareness of STEM research and career opportunities within the Department of Defense. What strategies have you used this year to expose participants to DoD STEM research and careers?
    - What strategies seem to work the best?
    - What do you need in order to achieve greater success?

5. What suggestions do you have for improving [X]?

Ending questions:

6. Have we missed anything? Tell us anything you want us to know that we didn't ask about.

Appendix F

APR Template

Program Overview

Provide a one or two paragraph overview of your program.

Accomplishments

Provide the following for *each* program objective listed in the Proposed Work section of the FY14 Annual Program Plan.

1. **What were the major activities conducted to accomplish the FY14 target for the objective. Report major activities undertaken by of the program adninistrator as well as a selection of 3-5 different site-level activities.**

2. **What were the results of those activities? Specifically, what progress was made toward achieving the FY14 target for the objective?**

3. **What is the proposed FY15 target for for the objective, considering the 5-year target?**

4. **What is planned to accomplish the FY15 target for the objective?**

The following structure can be used for each program objective (replicate as needed). Information in the top two rows ("Objective" and "FY14 Target") should be copied directly from the approved FY14APP.

Objective: [STATE OBJECTIVE] (Supports AEOP Goal [STATE GOAL #], Objectives [STATE OBJECTIVE LETTERS]) **Proposed Plan:** **[STATE PROPOSED PLAN]**
FY14 Target: **[STATE TARGET]**
Major activities: **[REPORT ACTIVITIES OF PROGRAM ADMISTRATOR]** **[REPORT SELECTED SITE-LEVEL ACTIVITIES]**
Results: **[REPORT RESULTS]** **[REPORT PROGROSS TOWARD ACHEIVEING FY14 TARGET]**
FY15 Target: **[STATE TARGET]**
FY15 Plan: **[STATE PLAN TO ACCOMPLISH FY15 TARGET]**

Changes/Challenges

1. **What changes (if any) were made to the plan for meeting FY14 targets for each objective? What were the reasons for the changes?**

2. **Do any of these changes have significant impact on budget/expenditures?**

3. **What challenges or delays (if any) prevented the program from meeting FY14 targets for each objective? What actions or plans were implemented to resolve those challenges or delays?**

4. **Do any of these challenges or delays require the assistance of the Army, the Consortium, or the Lead Organization to resolve? Please specify.**

Products

1. **For all programs, list and briefly describe any products resulting from the administration of the program (program administrator or site coordinator) during FY14.**
   - **Websites and social media (provide website urls, social media handles, etc.)**
   - **Instructional materials and other educational aids or resources**
   - **Audio or video products**
   - **Guiding documents**
   - **Marketing or promotional materials**
   - **Presentations[42] (provide citations)**
   - **Publications[43] (provide citations)**
   - **Educational research or evaluation assessments**
   - **Other**

2. **In addition to the above, how many of each product resulted from the Army/AEOP-sponsored research conducted by students participating in apprenticeship programs?**
   - **Abstracts**
   - **Presentations**
   - **Publications**
   - **Patents**
   - **Other**

[42] Presentations include things like conference contributions (oral or poster) or presentations to the public, news media, educational agencies, and other associations. Conference booths may also be reported.
[43] Publications include things like peer reviewed articles, technical papers and reports, books or book chapters, news media releases.

Participants

Recruitment and selection of participants

1. **Who is the audience(s) targeted by your program and how was the program was marketed to the audience(s)? Report major activities undertaken by of the program administrator as well as a selection of 3-5 different site-level activities toward marketing and recruitment.**

2. **What criteria were used to select participants for the program? Report any efforts of the program administrator (including guidance provided to sites) as well as a selection of 3-5 different site-level criteria.**

3. **AEOP Pipeline: Explain any efforts that were made to specifically recruit alumni of other AEOP initiatives into your program? Explain any efforts to specifically recruit alumni of your program into other AEOP initiatives?**

Participant numbers and demographic characteristics

1. **How many of each participant group enrolled in the program? How many of each group applied and/or were selected/invited to participate? Report data using the following categories and enter "NA" where not applicable.**

	Applied	Selected	Enrolled
Participant Group	**No.**	**No.**	**No.**
Elementary school students (grades K-5)			
Middle school students (grades 6-8)			
High school students (grades 9-12)			
Undergraduate students (including community college)			
Graduate students (including post-baccalaureates)			
In-service K-12 teachers			
Pre-service K-12 teachers			
College/university faculty or other personnel			
Army/DoD Scientists & Engineers			
Other volunteers (e.g., if a competition program)			

2. **For the target audience(s) listed in the previous section (replicate the table as needed), how many were enrolled in the program per program site? How many of each group applied and/or were selected/invited to participate per program site?**

[Identify Participant Group]	Applied	Selected	Enrolled
Site	**No.**	**No.**	**No.**
(List each site by name)			

3. **For the target audience(s) listed in the previous section (replicate the table as needed), what are the demographic characteristics of the applicants and enrolled participants? Report data using the following categories:**

[Identify Participant Group]	Applied		Enrolled	
Demographic Category	**No.**	**%**	**No.**	**%**
Gender				
Male				
Female				
Choose not to report				
Race/ethnicity				
Native American or Alaskan Native				
Asian				
Black or African American				
Hispanic or Latino				
Native Hawaiian or Other Pacific Islander				
White				
Choose not to report				
School setting (students and teachers)				
Urban (city)				
Suburban				
Rural (country)				
Frontier or tribal School				
DoDDS/DoDEA School				
Home school				
Online school				
Choose not to report				
Receives free or reduced lunch (students only)				
Yes				
No				
Choose not to report				
English is a first language (students only)				
Yes				
No				
Choose not to report				
One parent/guardian graduated from college (students only)				
Yes				
No				
Choose not to report				
Documented disability (students only)				
Yes				

No				
Choose not to report				

4. **For the target audience(s) listed in the previous section (replicate the table as needed), what are the rates of past AEOP participation of the applicants and enrolled participants? Report data using the following categories:**

[Identify Participant Group]	Applied		Enrolled	
AEOP element	**No.**	**%**	**No.**	**%**
Camp Invention				
Junior Solar Sprint				
eCYBERMISSION				
West Point Bridge Design Competition				
Junior Science & Humanities Symposium				
Gains in the Education of Mathematics and Science				
UNITE				
Science and Engineering Apprentice Program				
Research and Engineering Apprenticeship Program				
High School Apprenticeship Program				
College Qualified Leaders				
Undergraduate Research Apprenticeship Program				
STEM Teachers Academy				
SMART Scholarship				
NDSEG Fellowship				

Organizations participating or served

1. How many of each organization are served by the program? Report data in the following categories:

Organizations	No.
K-12 schools	
Title 1 K-12 schools	
Colleges/universities (including community colleges)	
Army/DoD laboratories	
Other collaborating organizations (educational agencies, professional associations, external sponsors, etc.)	

2. Please list all colleges/universities served by the program.

3. Please list all Army/DoD laboratories served by the program.

4. Please list other collaborating organizations served by the program.

Other Impacts

Have the FY14 program activities impacted human and/or infrastructure resources in any additional areas beyond the primary objectives of the program? If so, please describe any activities and results of those activities, especially pertaining to the following:

- **Engagement opportunities for the public (beyond those persons typically considered program participants) to increase interest in STEM, perception of STEM's value to their lives, or their ability to participate in STEM**
- **Professional development for pre-service or in-service STEM teachers to improve their content knowledge and pedagogical skills**
- **Development and/or dissemination of instructional materials or educational resources**
- **Support for the development or advancement of STEM personnel (i.e., Army Scientists & Engineers, Army-sponsored university faculty and other personnel), programs, or other physical infrastructure**
- **Contributions having intellectual merit or broader impact to the field of informal science education and outreach**

If any of these activities are conducted through websites and/or social media, the summary of results should include the analysis of key website or social media analytics.

Funding, Budget, and Expenditures

1. Provide an overview of FY14 funding

FY14 Funding Overview	Amount
Carry-forward funding from FY13	
New funding received in FY14	
Total budget for FY14 (FY13 carry-over plus FY14 new funding)	
Total FY14 expenses (estimate for 30 Sept)	
Carry-forward funding from FY14 into FY15 (total FY14 budget minus estimate of total FY14 expenses)	

2. Funding to the cooperative agreement comes from a variety of sources (general purpose funds, laboratory specific stipend funds, and Navy and Air Force funds for JSHS, etc.). The type of funding is indicated on AEOP CA modifications. What type of funds supported your program in FY14 (include funding carried over from FY13 in your totals)?

FY14 AEOP CA Funding Type/Source	Amount
General purpose funds	
Laboratory specific stipend funds - [Indicate Laboratory and replicate row as needed so that each contributing laboratory is represented on a separate line]	
Total laboratory specific stipend funds	
Air Force/ Navy JSHS funds	
Total FY14 funding (add types of funding, should be equivalent to "Total budget for FY14" in table above)	

3. **How do your actual FY14 expenditures (estimate for 30 Sept cut-off) compare with your approved FY14 budget? Report totals in the following categories:**

	Approved FY14 Budget (includes FY13 carry-over and new FY14 funding)	Actual FY14 Expenditures (estimate through 30 Sept)	Carry-over from FY14 into FY15
Marketing & Outreach (include additional funding received through special AEOP Cross-Marketing RFP process)			
National Event (where applicable)			
Scholarships/awards			
Stipends			
Other direct costs (including salary & fringe); Number of FTEs =[Indicate number of FTEs including PT wage workers]			
Overhead – Indirect Rate= [Indicate Indirect Rate and to which costs the indirect applies (i.e. labor, direct costs, etc.)]			
TOTALS (should match totals provided in tables above)			

4. **Calculate average cost per student and explain how the calculation was made.**

Fast Facts

Complete the summary chart below. Report data using the following categories and enter "NA" where not applicable.

FY14 [Enter Program Name]	No.
Applications & Participants	
Student Applications	
Student Participants	
Student Participation Rate (no. participants/no. applications x 100)	%
Teacher Applications	
Teacher Participants	
Teacher Participation Rate	%
Near-Peer Mentor Applications	
Near-Peer Mentor Participants	
Near-Peer Mentor Participation Rate	%
Partners	
Participating Colleges/Universities (including community colleges)	
Participating Army/DoD Laboratories	
Science & Engineer Participants	
Apprenticeships, Awards & Stipends	
Apprenticeships Provided	
Scholarships/Awards Provided	
Expenses Toward Scholarships/Awards	$
Expenses Toward Stipends	$
Budget & Expenses	
FY14 Total Budget (including carry-over from FY13 and new FY14 funding)	$
FY14 Total Expenses (estimate through 30 Sept)	$
Carry-Over from FY14 to FY15	$
Average cost per student	$