Army Educational Outreach Program

Research & Engineering Apprenticeship Program

2015 Annual Program Evaluation Report

ARMY EDUCATIONAL OUTREACH PROGRAM

REAP_04_05112016

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Executive Summary

REAP is a summer internship program focused on the development of high school students' STEM competencies, with particular emphasis on groups historically underrepresented and underserved in STEM. For over 30 years, REAP has placed talented high school students in research apprenticeships at colleges and universities throughout the nation. Each REAP student (herein referred to as apprentice) are provided a minimum of 200 hours (over a 5 to 8 week period) of research experience under the direct supervision of a university scientist or engineer on a hands-on research project. REAP apprentices are exposed to the real world of research, gain valuable mentorship, and learn about education and career opportunities in STEM through a challenging STEM experience that is not readily available in high schools.

This report documents the evaluation of the FY15 REAP program. Virginia Tech, in collaboration with ASEE, collected the FY2015 evaluation data for the REAP program. Purdue University, the new evaluation lead, prepared the FY 2015 evaluation reports, which addressed questions related to program strengths and challenges, benefits to participants, and REAP's overall effectiveness in meeting AEOP and program objectives.

For FY15, there were 101 REAP apprentices at 37 different colleges and universities. This was a decrease in participation of 14% from FY14 enrollment (117). In FY14 there were 117 apprentices to 74 mentors, and for the FY15 year, the ratio is approximately equal. The FY15 evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The evaluation plan for REAP was comprised of questionnaires for apprentices and mentors, interviews with apprentices and mentors, and review of the FY15 annual program report compiled by the Academy of Applied Science (AAS).

2015 REAP Fast Facts	
Major Participant Group	Rising 10th, 11th, and 12th grade high school students, rising first-year college students
Number of applications (Cvent)	270
Number of applicants (applied directly to Universities)	268
Apprentices	101: 78 REAP; 23 REAP/UNITE
Placement rate	37%
Placement Rate using all applicants/Univ and AEOP (total 556)	18%
Mentors	68
Sites	37
Total Cost	$349,690
Total Stipends (apprentices & mentors)	$200,699
Cost Per Student Participant	$3,462.28

Summary of Findings

The FY15 evaluation of REAP collected data about participants, their perceptions of program processes, resources, and activities, and indicators of achievement related to AEOP's and REAP's objectives and intended outcomes. A summary of findings is provided in the following table.

2015 REAP Evaluation Findings	
Participant Profiles	
REAP continues to have success in serving historically underrepresented and underserved populations.	REAP experienced continued success in recruiting female students at a high rate. In fact, 61% of participants in FY15 were female, a population that is historically underrepresented in engineering fields. There was a slight decrease in participants (14%) and mentors (8%) in FY15 compared to FY14.
	REAP was very successful in meeting the program requirement of providing outreach to students from historically underrepresented and underserved groups as defined in admission requirements (students must self-identify as meeting at least two of the following requirements: qualifies for free or reduced-price lunch; is a minority historically underrepresented in STEM (Alaskan Native, Native American, Black or African American, Hispanic, Native Hawaiian, or other Pacific Islander); is a female pursuing research in physical science, computer science, mathematics, or engineering; receives special education services; has a disability; speaks English as a second language; or is a potential first-generation college student). In fact, 34% of apprentices identify as Black or African American, 23% as Hispanic or Latino, and 61% as female. Further, 91% of the participating apprentices attend Title I schools (students from Title I schools typically come from underrepresented and underserved populations).
	Most apprentices reported attendance at public schools (91%) and schools in suburban settings (56%). However, a third of students came from schools in urban areas (35%), which tend to have higher numbers or proportions of underrepresented and underserved groups.
	REAP continued to implement the bridge with UNITE, another AEOP program that serves students from underrepresented and underserved groups. In 2015, 24 alumni of UNITE participated in REAP apprenticeships.
The diversity of the mentors continues to grow.	FY15 mentors were remained predominantly male (76%) and White (38%). This did represent a decrease in the percentage of White mentors overall.
	A comparison of apprentice and mentor demographics suggested that many apprentices of underserved or underrepresented populations are not likely to have mentors sharing the same gender or race/ethnicity. Having a mentor who shares an apprentice's gender or race/ethnicity is a potential motivator for reducing stereotypes and increasing students' performance and persistence in STEM.

Apprentices demonstrated a greater interest in pursuing a career in a STEM-related field after participating in REAP.	97% of the 85 apprentice respondents indicated their intent to pursue a career in a STEM-related field. More respondents intended to pursue careers in Medicine/Health (32%) than any other field, with Engineering (27%) and Physical Science (8%) being the next most frequently reported fields.
Actionable Program Evaluation	
REAP marketing and recruitment was focused at the local level.	Mentors reported using connections with local school teachers (44%) to recruit participants, as well as school based communications (31%), and communications by universities and faculty (24%). Applications solicited by the AAS and general AEOP marketing were also used to recruit apprentices (51%).
	Apprentices most frequently learned about REAP from teachers and professors (56%), school newsletters, emails, or websites (20%), from a REAP mentor (15%), or from the AEOP website (15%).
	Mentors learned about REAP from the AAS website (33%), from a superior (29%), such as a Department Chair, Center Director, or Dean, and 24% from a past REAP participant.
REAP is strongly marketed to students from historically underrepresented and underserved groups.	The RFP specified to university directors/mentors that the targeted participants were underrepresented and underserved high school students. In addition, the REAP administrator worked with all of the directors and mentors to ensure that the students being considered for the apprenticeships identified as coming from an underrepresented and underserved groups.
Participation in REAP helps students identify knowledge and skills for STEM careers.	Many apprentices received encouragement to participate from others, including friends, family members, and school staff, often who have current or past connections to the REAP program. Apprentices who participate in REAP report having clear understandings of the knowledge and skills it takes to succeed in a STEM career.
REAP apprentices engage in meaningful STEM learning through team-based and hands-on activities.	Most apprentices (84-97%) reported learning about new STEM topics, communicating with other students about STEM, and interacting with STEM professionals.
	Apprentices had many opportunities to engage in a variety of STEM practices during their REAP experience. For example, 81% participating in hands-on activities, 82% working as part of a team, 80% analyzing or interpreting data or information, and 73% drawing conclusions from an investigation on most days or every day.
	Apprentices reported greater opportunities to learn about STEM and greater engagement in STEM practices in their REAP experience than they typically have in school.
	Many mentors reported using strategies to help make learning activities to students relevant, support the needs of diverse learners, develop students' collaboration and interpersonal skills, and engage students in "authentic" STEM activities.
REAP promotes STEM research and careers but can continue to improve mentors' awareness of and resources for promoting	Mentors reported limited awareness of or past participation in an AEOP initiative beyond REAP. Twenty-four percent of responding mentors had past experience with REAP but with the exception of UNITE, 90% of responding mentors indicated they had not participated in the other AEOP programs. Nearly half of the responding mentors had participated in UNITE (49%). In addition, most apprentices reported an increase in

AEOP opportunities and DoD STEM careers.	awareness of other AEOPs, and only 17% of the apprentices reported that their mentors never recommended any AEOP programs, down from 68% in 2014.
	Mentors reported sharing information with apprentices about STEM majors and careers (75% of apprentices reported learning about three or more STEM careers), but few of those were DoD STEM careers. Some mentors stated that they were unaware of DoD STEM careers, and 45% of apprentices reported that their mentors never discussed STEM career opportunities with the DoD (down from 68% in 2014).
The REAP experience is greatly valued by apprentices and mentors.	Apprentices indicated satisfaction with the REAP research experience overall. Open-ended responses about the overall experience highlighted apprentices' opportunity to do hands-on research and learn about STEM content and research. Apprentices also commented on how REAP provided opportunities they do not get in school and would not otherwise have.
	A majority of responding mentors reported positive experiences. Further, many commented on the benefits the program provides apprentices, including hands-on research experience and increases in STEM content knowledge.
Outcomes Evaluation	
REAP apprentices reported gains in STEM knowledge and competencies.	Apprentices 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 apprentice groups.
	Apprentices reported impacts on their abilities to do STEM, including such things as reading technical or scientific texts to learn about the natural or designed worlds, designing and carrying out procedures for investigations, asking questions to understand data, and deciding what kind of data to collect to answer a question.
REAP apprentices' reported gains in 21st Century Skills.	Apprentices reported large or extreme gains on their patience for the slow pace of research, making changes when things do not go as planned, and sticking with a task until it is complete.
REAP apprentices reported increased confidence and identity in STEM, as well as increased interest in future STEM engagement.	Apprentices reported a large or extreme gain on their preparedness for new STEM activities (78%), their confidence in trying out new ideas or procedures (77%), desire to build relationships with mentors (87%), and connecting a STEM topic to their personal interests (78%). In addition, 82% reported an increase in their sense of accomplishing something in STEM, and 68% reported deciding on a path to pursue a STEM career.
	A majority of apprentices indicated that as a result of REAP, they were more likely to work on a STEM project in a university or professional setting; participate in a STEM club, student organization, or professional organization; work on solving mathematical or scientific puzzles; or help with a community service project related to STEM.
REAP apprentices reported increased higher education aspirations and interest in pursuing STEM careers.	After participating in REAP, apprentices indicated being more likely to go further in their schooling than they would have before REAP, with the greatest change being in the proportion of apprentices who expected to continue their education beyond a Bachelor's degree (81% before REAP, 92% after) and get a Ph.D. (15% before and 24% after).
	Apprentices 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. The majority of the apprentices were interested in STEM-related careers before participating in REAP, and almost all were interested in STEM-related careers after participating in REAP.
A substantial portion of apprentices expressed interest in future AEOP opportunities. However, many REAP apprentices and mentors were largely unaware of other AEOP initiatives.	At the end of their apprenticeship, many apprentices reported that they had never heard of any of the AEOPs except for REAP (77-99% of apprentices, depending on the program). However, after participating in REAP, a large proportion of apprentices were somewhat to very interested in participating in other AEOP initiatives in the future (83% of apprentices). This ongoing trend continues to occur despite communication efforts to apprentices, mentors and directors such as sending apprentices AEOP materials, a welcome letter, brochures, suggestions to review the AEOP website, and additional materials to take back to schools.
REAP apprentice reported awareness and appreciation of DoD STEM research and careers increased. REAP apprentices also expressed interest in pursuing a STEM career with the DoD.	A majority of apprentices reported that they had a greater interest (84%) and awareness (69%) of DoD STEM research and careers. Apprentices cited their participation in REAP (52%), their REAP mentor (45%), and the AEOP instructional supplies (42%) as having the most impact on their awareness of DoD STEM careers.
Participation in evaluation surveys have increased, providing more complete information about REAP outcomes	A recommendation from the 2014 Evaluation Report included the need for increased participation in REAP evaluation efforts. The REAP program had an 84% return rate for apprentice surveys and a 74% return rate for mentor surveys. FY 15 had a 36% increase in apprentice surveys and a 21% increase in mentor survey responses from FY 14.

Recommendations

Evaluation findings indicate that FY15 was a successful year overall for the REAP program. The REAP program has the goal of broadening the talent pool in STEM fields, and, overall, the program has been successful at attracting students from groups historically underrepresented and underserved in these fields. A primary area of growth for REAP has been in broadening diversity of participants. In particular, there has been a steady increase in the number of female apprentices. There has also been an increase in the number of African American mentors from 2014, providing more exposure to role models from historically underserved and underrepresented in STEM careers. Strategies that have been shown to be effective for encouraging historically underserved and underrepresented students in STEM careers include providing role models for students, exposing them to different education and career possibilities, providing guidance on how to pursue specific education and career paths (e.g., what courses they need to take in school, how to navigate the college application process), and providing coaching on the "soft skills" (e.g., time management, communication skills) needed to be successful in STEM careers. This is an encouraging trend and it is expected that having more role models

will continue to encourage students from groups historically underrepresented and underserved in STEM to participate in REAP.

A second area of strength for REAP was the growth in number of apprentices who intended to pursue a STEM career after participation in the program. REAP apprentices who did not intend to pursue a career in STEM before participating clearly change their mind to pursue a STEM career after the REAP experience. This positive momentum in diversity the STEM pipeline presents an opportunity to inform apprentices of tangible career goals in Army/DoD STEM careers.

A third area of strength for REAP is reported meaningful STEM learning in the REAP program. Both mentors and apprentices reported increased confidence in pursuing STEM activities. Most of the REAP apprentices intend to continue to pursue STEM activities outside of school, and outreach to these apprentices about other opportunities is encouraged. One example of a positive trend is the UNITE/REAP partnership. 24 students from UNITE received REAP apprenticeships in 2015, up from 18 in 2014.

While these successes for REAP are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY16 and beyond:

AEOP Priority: Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base

1. Although the REAP mentor group was more diverse ethnically, there were fewer female mentors than in 2014. Efforts should be made to focus on increasing the number of female mentors, perhaps by encouraging junior faculty (typically more female professors are in the lower ranks in STEM fields) to partner with senior faculty to submit proposal to be a REAP site. This could be marketed as professional development for both the junior and senior faculty members. Additionally, if each mentor/apprentice pair occasionally met in groups with other mentor/apprentice pairs, not only could they share resources, apprentices would be exposed to a more diverse range of mentor backgrounds.

2. A number of apprentices suggested that the REAP program could be improved by extending the length of the experience. Similar to responses from FY14, many apprentices in FY 15 noted that 5-8 weeks was not enough time to learn about and get involved with a research project. Some of the mentors also said that the apprenticeship experience should be lengthened. Suggestions were made by both mentors and apprentices to extend the apprenticeship into the school year and/or to continue working with the same project for at least two summers. Another option for intensified mentorship is to train mentors in the key elements of a cognitive apprenticeship model: introductory tasks that are familiar to students, breakdown of the problem, and introduction of precise rules that are used by scientists/engineers (Brown, Collins & Duguid, 1989). Mentors mentioned in the interviews that working with high school students is a different situation than working with undergraduates, and needed some training in working with younger students.

3. Efforts should be made to help mentors and apprentices become more aware of DoD STEM research and careers. Forty-five percent of apprentices reported not learning about any DoD STEM careers during their REAP experience. Comments from mentors in the focus group and open-ended questionnaire items suggest that they are not familiar with DoD STEM careers and did not spend very much time discussing DoD STEM careers with apprentices. The program should continue to provide mentors and apprentices with new materials and resources (website links, articles, etc.) that describe current DoD STEM research and careers which can be easily passed on to all REAP apprentices. Creating a network for mentors to form a community of practice where mentors can share their research activities with other mentors could be a first step to informing apprentices about other Army/DoD STEM careers.

4. Mentors and apprentices mentioned that the amount of the stipend was too small. One mentor mentioned that they never paid themselves out of the funding, and rather they made sure the students had an appropriate stipend. One mentor mentioned that the magnitude of the stipend was below the minimum wage for the state in which the REAP program was located, and elaborated that paying such a low amount was actually against the state law. If REAP intends to encourage awareness of Army/DoD STEM careers, the compensation should be aligned to the compensation of the career in which the apprentice is participating. The program is encouraged to revisit the funding structure to address the small stipend to the students. SEAP students receive on average $1400/month of their apprenticeship, using a stipend scale based on education and experience. Perhaps AAS could look into a similar approach to student stipends.

AEOP Priority: Support and empower educators with unique Army research and technology resources

1. REAP should continue to focus on growing the number of mentors participating in the program to work toward a 1:1 mentor/apprentice ratio. One potential strategy for consideration is to increase the amount of the mentor stipend (currently $1,000).

2. As was found in 2014, REAP apprentices report having little previous experience with AEOP and limited knowledge of other AEOP programs, even after participating in REAP. Given the goal of having apprentices progress from REAP into other AEOP programs, the program may want to have a systematic method to inform mentors in tangible ways to increase apprentices' exposure to AEOP. Only 54% of mentors recommended other AEOPs to apprentices. For example, mentors mentioned that they were vaguely aware of other programs and provided some accurate descriptions of the programs. However, they could not name the programs or provide information that might lead an interested student to a website. The program should work with each site to ensure that all apprentices have access to structured opportunities—such as invited speakers, presentations, and career events—that both describe the other AEOPs and provide information to apprentices on how they can apply to them.

3. Exposure to DoD STEM careers and research are also areas targeted for improvement for REAP. Some strategies that the program may consider are having webinars for students, creating DoD STEM career information and

materials, and recruiting speakers in different STEM disciplines to enhance the program. Currently the program is exploring the possibility of all students talking with each other through a webinar format. The program should also provide mentors with materials (website links, printed materials) that can be easily shared with interested apprentices. AAS is encouraged to find a way to provide a forum for REAP PIs and mentors to share best practices and experiences with other AEOPs and DoD careers/research. The AEOP CAM or Consortium Lead could develop and make available Power Point slides promoting both AEOP and DoD STEM careers and research.

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, the Research and Engineering Apprenticeship Program (REAP). REAP is managed by the Academy of Applied Science (AAS). The evaluation study was performed by Purdue University in cooperation with Battelle, the Lead Organization (LO) in the AEOP CA consortium. Data analyses and reports were prepared using data collected by the former LO, Virginia Tech (VT).

Program Overview

REAP is a paid, summer internship program that focuses on developing STEM competencies among high school students from groups historically underrepresented and underserved in STEM. For more than 30 years, REAP has placed talented high school students in research apprenticeships at colleges and universities throughout the nation. Each REAP student (herein referred to as apprentice) works a minimum of 200 hours (over a 5 to 8 week period) under the direct supervision of a university scientist or engineer on a hands-on research project. REAP apprentices are exposed to the real world of research, gain valuable mentorship, and learn about education and career opportunities in STEM through a challenging STEM experience that is not readily available in high schools.

REAP is guided by the following objectives:

1. Provide high school students from groups historically underrepresented and underserved in STEM, including alumni of AEOP's UNITE program, with an authentic science and engineering research experience;

2. Introduce students to the Army's interest in science and engineering research and the associated opportunities offered through the AEOP;
3. Provide participants with mentorship from a scientist or engineer for professional and academic development purposes; and,
4. Develop participants' skills to prepare them for competitive entry into science and engineering undergraduate programs.

A total of 531 students applied for the REAP program in 2015, which shows an increase of 25% in student applications. REAP provided funding for 101 apprenticeships under the supervision of 68 mentors at 37 colleges and universities in 29 states and US territories (shown in Table 1). Of the 37 colleges and universities involved in REAP, 21 institutions identified as historically black colleges and universities (HBCUs) or minority serving institutions (MSIs). As part of a pipeline pilot program, REAP funded 23 apprenticeships for UNITE alumni at 9 universities. UNITE is an AEOP-sponsored pre-collegiate summer program for talented high school students from historically underrepresented and underserved groups. There were also 4 REAP alumni and 3 REAP mentors from JSHS. The 101 apprenticeships in 2015 represent a 14% decrease from the 117 apprenticeships in 2014. However, there was also an 8% decrease of participating mentors from 74 in 2014 to 68 in 2015.

According to the Annual Program Report (APR) prepared by AAS, only 49% of REAP potential participants (270) applied using the Cvent site. When the apprentices apply through the university initially, they are also expected to apply through the AEOP website (Cvent). Students at universities not applying through Cvent are not considered for inclusion. REAP is working to increase the number of students applying through Cvent (this is an expectation for the program sites for FY16). Table 1 shows the REAP Site applicant and enrollment numbers. If funding for mentor and participant stipends could be increased, university sites with large number of applicants could increase placement rate.

Table 1. 2015 REAP Site Applicant and Enrollment Numbers

2015 REAP Site	No. of Applicants	No. of Enrolled Participants
Alabama State University (UNITE/REAP)	12	4
Alabama State University	14	2
Ball State University	3	1
Clark Atlanta	5	2
Colorado State University	6	2
Delaware State University	19	3
Georgia State University	19	2
Jackson State University (UNITE/REAP)	12	2
Jackson State University	13	3
Loyola University	38	4
Miami Dade University (UNITE/REAP)	15	5
Michigan Technological University	8	2

Montana State University	4	2
New Jersey Institute of Technology (UNITE/REAP)	6	2
New Jersey Institute of Technology	6	3
New Mexico State University	4	2
North Carolina A&T University (UNITE/REAP)	2	3
North Carolina Central University	11	2
Oakland University (Michigan)	4	2
Savannah State University (UNITE/REAP)	6	2
South Dakota School of Mines and Technology	2	2
Texas Southern University (UNITE/REAP)	19	2
Texas Southern University	14	2
Texas Tech University	11	2
University of Alabama – Huntsville	5	2
University of Arkansas at Pine Bluff	10	2
University of California – Berkeley	17	2
University of Central Florida	28	4
University of Colorado- Colorado Springs (UNITE/REAP)	8	1
University of Houston (Texas)	9	2
University of Iowa	2	2
University of Maryland-Baltimore	61	5
University of Massachusetts-Lowell	4	2
University of New Hampshire	7	1
University of Puerto Rico - Hu Macao	11	2
University of Puerto Rico	12	3
University of South Florida	60	8
University of Texas – El Paso	12	2
University of Utah	17	2
University of Washington	7	2
Xavier University of Louisiana (UNITE/REAP)	8	2
TOTAL	**531**	**101**

The total cost of the 2015 REAP program was $349,690. The average cost per apprentice was $3,462.28. Aligned with the rates of similar AEOP initiatives, REAP provides participants with a stipend of $1500 for the 200 hours. REAP mentors receive a stipend of $1,000 for their participation regardless of the number of students they mentored. Table 2 summarizes these and other 2014 REAP program costs.

Table 2. 2015 REAP Program Costs	
2015 REAP - Cost Per Participant	
Total Participants	101
Total Cost	$349,690
Cost Per Participant	**$3,462**
2015 REAP - Cost Breakdown Per Participant	
Average Administrative Cost to AAS	$1,455
Average Apprentice and Mentor Stipends	$2,007
Average Cost Per Participant	**$3,462**

***NOTE:** Universities that host REAP students are provided with $1,000. Often this funding goes to support the mentor. In some cases this funding is reallocated to afford an additional REAP apprenticeship. In 2014, 100 grants were originally provided and 17 additional apprenticeships were supported through this process.*

Evidence-Based Program Change

Based on recommendations from the FY14 summative evaluation report, the AEOP identified three key priorities for programs in FY15: (1) increase outreach to populations that are historically underserved and underrepresented in STEM; (2) increase participants' awareness of Army/DoD STEM careers; and (3) increase participants' awareness of other AEOP opportunities. AAS initiated the following program changes/additions to the FY15 administration of the REAP program in light of programmatic recommendations from the Army and LO, the key AEOP priorities, and the FY14 REAP evaluation study:

I. **Expand REAP opportunities in cooperation with Historically Black Colleges/Universities and Minority Serving Institutions (HBCUs/MSIs).**
   a. Collaborate with UNITE program managers to place former UNITE students in REAP.
   b. Increase participation from schools with high percentages of free/reduced lunch.

II. **Inform REAP participants and potential participants of AEOP opportunities.**
   a. Supply students, directors and mentors with AEOP materials in amounts that will allow disseminating to students' schools and university labs.
   b. Encourage students, directors, and mentors to follow AEOP social media channels.

FY15 Evaluation At-A-Glance

Purdue University, in collaboration with AAS and using data collected by Virginia Tech, conducted a comprehensive evaluation of the REAP program. The REAP logic model below presents a summary of the expected outputs and outcomes for the REAP program in relation to the AEOP and REAP-specific priorities. This logic model provided guidance for the overall REAP evaluation strategy.

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• Army sponsorship • AAS providing oversight of site programming • Operations conducted by 37 universities • Students participating in 101 REAP apprenticeships • STEM professionals and educators serving as REAP mentors • Stipends for apprentices to support meals and travel • Stipends for faculty to support meals and travel • Centralized branding and comprehensive marketing • Centralized evaluation	• Apprentices engage in authentic science and engineering research experiences through hands-on summer apprenticeships at REAP-sponsored colleges and universities • STEM professionals supervise and mentor apprentices' research • Program activities that expose apprentice to AEOP programs and/or STEM careers in the Army or DoD	• Number and diversity of apprentice participants engaged in programs • Number and diversity of STEM professionals serving as mentors for programs • Number and diversity of Army/DoD scientists and engineers and other military personnel engaged in programs • Number and Title 1 status of high schools served through participant engagement • Apprentices, STEM professionals, site coordinators, and AAS contributing to evaluation	• Increased participation in authentic STEM activities • Increased participant STEM competencies (confidence, knowledge, skills, and/or abilities to do STEM) • 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 REAP programs	• Increased apprentice participation in other AEOP opportunities and Army/DoD-sponsored scholarship/ fellowship programs • Increased apprentice pursuit of STEM coursework in secondary and post-secondary schooling • Increased apprentice pursuit of STEM degrees • Increased apprentice pursuit of STEM careers • Increased apprentice pursuit of Army/DoD STEM careers • Continuous improvement and sustainability of REAP

The REAP evaluation gathered information from apprentice and mentor participants about REAP 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 REAP program objectives.

Key Evaluation Questions

- What aspects of REAP programs motivate participation?
- What aspects of REAP program structure and processes are working well?
- What aspects of REAP programs could be improved?
- Did participation in REAP programs:
  - Increase apprentices' STEM competencies?
  - Increase apprentices' positive attitudes toward STEM?
  - Increase apprentices' interest in future STEM learning?
  - Increase apprentices' awareness of and interest in other AEOP opportunities?
  - Increase apprentices' awareness of and interest in Army/DoD STEM careers?

The assessment strategy for REAP included apprentice and mentor questionnaires, seven interviews with apprentices, five interviews with mentors, and one APR prepared by AAS. Tables 3-8 outline the information collected in apprentice

and mentor questionnaires, focus groups, apprentice interviews, and information from the APR that is relevant to this evaluation report.

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.

From FY14 to FY15, questionnaire assessments have been revised and shorted while maintaining alignment 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., implementation and outcomes evaluation, outcomes evaluation of STEM-specific competencies, transferrable competencies, identifying with STEM, intentions to engage in STEM-related activities, and educational/career pathways);
- Best practices and published assessment tools in STEM education, informal STEM education, STEM outreach, and evaluation research communities;
- AEOP's vision to improve the quality of the data collected, focusing on changes in intended student outcomes and contributions of AEOPs like REAP effecting those changes.

Table 3. 2015 Apprentice Questionnaires

Category	Description
Profile	**Demographics:** Participant gender, grade level, race/ethnicity, and socioeconomic status indicators
	Education Intentions: Degree level, confidence to achieve educational goals, field sought
AEOP Goal 1	**Capturing the Apprentice Experience:** In-school vs. In-program experience; Mentored research experience and products
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	AEOP Opportunities: Past participation, awareness of, and interest in participating in other AEOP programs; contribution of AEOP, 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 AEOP, impact of AEOP resources
AEOP Goal 2 and 3	**Mentor Capacity:** Perceptions of mentor/teaching strategies
	Comprehensive Marketing Strategy: How apprentices learn about AEOP, 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 4. 2015 Mentor Questionnaires	
Category	**Description**
Profile	**Demographics:** Participant gender, race/ethnicity, occupation, past participation
Satisfaction & Suggestions	Awareness of REAP, motivating factors for participation, satisfaction with and suggestions for improving REAP programs, benefits to participants
AEOP Goal 1	**Capturing the Apprentice Experience:** In-program experience
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	AEOP Opportunities: Past participation, awareness of other AEOP programs; efforts to expose apprentices to AEOPs, impact of AEOP resources on efforts; contribution of AEOP in changing apprentice AEOP metrics
	Army/DoD STEM: attitudes toward Army/DoD STEM research and careers, efforts to expose apprentices to Army/DoD STEM research/careers, impact of AEOP resources on efforts; contribution of AEOP in changing apprentice Army/DoD career metrics
	Mentor Capacity: Local Educators – Strategies used to establish relevance of learning activities for apprentices, support diverse needs of apprentices as learners, support development if interpersonal skills/collaboration, support engagement in authentic STEM activities, and support STEM education and career pathways
AEOP Goal 2 Program Efforts	**Mentor Capacity:** Perceptions of mentor/teaching strategies
	Comprehensive Marketing Strategy: How mentors learn about AEOP, usefulness of AEOP resources on awareness of AEOPs and Army/DoD STEM research and careers

Table 5. 2015 Apprentice Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in REAP, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of REAP, motivating factors for participation, involvement in other science competitions in addition to REAP, satisfaction with and suggestions for improving REAP programs, benefits to participants
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Extent to which apprentices were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Extent to which apprentices were exposed to STEM and Army/DoD STEM jobs

Table 6. 2015 Mentor Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, occupation, organization, role in REAP, past participation in REAP, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of REAP, benefits to participants suggestions for improving REAP programs
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Efforts to expose apprentices to AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Efforts to expose apprentices to STEM and Army/DoD STEM jobs
	Mentor Capacity: Local Educators – Strategies used to increase diversity/support diversity in REAP

Table 7. 2015 Apprentice Interviews	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in REAP, past participation in other AEOP programs
Satisfaction & Suggestions	Motivating factors for participation in REAP, satisfaction with and suggestions for improving REAP programs
AEOP Goal 1 and 2 Program Efforts	**Army STEM: AEOP Opportunities –** Extent to which apprentices were exposed to other AEOP opportunities
	Army STEM: Army/DoD STEM Careers – Extent to which apprentices were exposed to STEM and Army/DoD STEM jobs

Table 8. 2015 Annual Program Report (APR)	
Category	**Description**
Program	Description of course content, activities, and academic level (high school or college)
AEOP Goal 1 and 2 Program Efforts	**Underrepresented and Underserved Populations:** mechanisms for marketing to and recruitment of apprentices from underrepresented and 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 (apprentices) and Appendix C (mentors). Focus group and interview protocols are provided in Appendix D (apprentices) and Appendix E (mentors); the APR template is located in Appendix F. Major trends in data and analyses are reported herein.

Study Sample

A total of 88 apprentices from 30 REAP sites responded to questionnaires, as did 55 mentors from 22 of the sites. Table 9 includes the number of apprentice and mentor respondents by site. **Mentor data by site was not made available to the evaluation team.**

Table 9. 2015 REAP Site Survey Respondent Numbers

2015 REAP Site	Apprentices		Mentors	
	No. of Participants	No. of Survey Respondents	No. of Participants	No. of Survey Respondents
Alabama State University (UNITE/REAP)	6	4	3	2
Ball State University	1	0	1	1
Clark Atlanta	2	1	2	0
Colorado State University	2	2	2	1
Delaware State University	3	3	2	1
Georgia State University	2	0	2	0
Jackson State University (UNITE/REAP)	5	4	4	2
Loyola University	4	5	4	0
Miami Dade University (UNITE/REAP)	5	4	5	0
Michigan Technological University	2	1	2	0
Montana State University	2	1	1	0
New Jersey Institute of Technology (UNITE/REAP)	3	4	4	0
New Mexico State University	2	1	4	0
North Carolina A&T University (UNITE/REAP)	3	0	3	0
North Carolina Central University	2	2	1	1
Oakland University (Michigan)	2	2	2	0
Savannah State University (UNITE/REAP)	2	2	2	0
South Dakota School of Mines and Technology	2	0	2	1
Texas Southern University (UNITE/REAP)	2	2	3	1
Texas Tech University	2	2	2	1
University of Alabama – Huntsville	2	2	1	0
University of Arkansas at Pine Bluff	2	2	3	1
University of California – Berkeley	2	2	2	1
University of Central Florida	4	4	3	1
University of Colorado- Colorado Springs (UNITE/REAP)	1	0	1	1
University of Houston (Texas)	2	6	2	0
University of Iowa	2	2	2	3

University of Maryland-Baltimore	5	4	4	2
University of Massachusetts-Lowell	2	2	4	0
University of New Hampshire	1	1	1	0
University of Puerto Rico - Hu Macao	2	2	1	1
University of Puerto Rico	3	0	2	1
University of South Florida	8	3	8	0
University of Texas – El Paso	2	2	2	4
University of Utah	2	2	2	3
University of Washington	2	2	2	2
Xavier University of Louisiana	2	2	2	2
No site selected	n/a	6	n/a	22
TOTAL	**101**	**86**	**93**	**55**

Table 10 provides an analysis of apprentice and mentor participation in the REAP 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 both the apprentice and mentor surveys is larger than generally acceptable, indicating that the samples may not be representative of their respective populations. Note that the 2015 apprentice response rate is higher than in 2014 (which had a response rate of 48%). The mentor response rate (81%) is much higher than in 2014 (53%).

Table 10. 2014 REAP Questionnaire Participation

Participant Group	Respondents (Sample)	Total Participants (Population)	Participation Rate	Margin of Error @ 95% Confidence[1]
Apprentices	88	101	87%	±3.77%
Mentors	55	68	81%	±10.9%

Phone interviews were also conducted with three female and two male apprentices from rising grades 10, 11, 12, and entering college. The ethnicities represented were Hispanic, African American, and White. Although Virginia Tech evaluators had planned to conduct virtual focus groups with more than 15 female and male apprentices, myriad logistical issues prevented execution of the plan. Of note, finding common times for students in different time zones to gather in a virtual environment proved difficult. Additionally, many sites did not have administrative privileges required to install the technology necessary on available computers, making it technologically infeasible to conduct virtual focus groups. As a stopgap, phone interviews were conducted with the remaining available apprentices to supplement

[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% confidence is calculated to be 5%, if to the question had been asked of 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.

logistical shortcomings. Four phone interviews were completed with mentors, who included 3 male mentors and one female mentor. The mentors were all university faculty members. The focus groups and interviews were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of apprentice and mentor questionnaire data. They add to the overall narrative of REAP's efforts and impact, and highlight areas for future exploration in programming and evaluation.

Respondent Profiles

Apprentice Demographics

Demographic information collected from REAP questionnaire respondents is summarized in Table 11.[2] More females (60%) than males (40%) completed the questionnaire. More responding apprentices identified with the race/ethnicity category of Black or African American (39%) than any other single race/ethnicity category, though there is substantial representation of Hispanic or Latino (16%) and Asian (19%) populations. The race/ethnicity proportions of respondents is very similar to the population of participating apprentices reported in the 2015 REAP Data Brief (17% Asian, 41% Black or African America, 22% Hispanic or Latino, and 17% White). The gender proportions are similar in the 2015 REAP Data Brief and the REAP apprentice survey (66% of the total apprentice population was female and 34% was male).

Forty-five percent of respondents were rising 12th graders; the remaining apprentices who answered this item were rising 10th (10%) and 11th (26%) graders, as well as rising college freshmen (20%). Almost half of the respondents (42%) reported qualifying for free or reduced-price lunch (FRL)—a common indicator of low-income status. As can be seen in Table 12, the vast majority of respondents attended public schools (91%); most attended schools in suburban areas (56%). This represents a shift from 2014 (64%) to 35% of the apprentices came from schools in urban locations. The APR does not contain complete data on these characteristics to allow for comparison between the respondents and the population; however, comparisons can be made between the respondents to the 2014 and 2015 apprentice questionnaires. There was a greater percentage of female respondents in 2014 than in 2015 (61% vs 73%), a greater percentage of Black or African American respondents in 2014 (47% compared with 34% in 2015), and a larger percentage of respondents from suburban schools (56% in 2015 vs. 27% in 2014). Other reported demographic characteristics appear to be similar between the two years.

In summary, REAP was successful in attracting participation from female students—a population that is historically underrepresented in some STEM fields. REAP also had success in providing outreach to students from historically underrepresented and underserved race/ethnicity and low-income groups. REAP served students who regularly attended school in a variety of settings, including urban and rural, which historically have lower or limited resources than suburban schools.

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

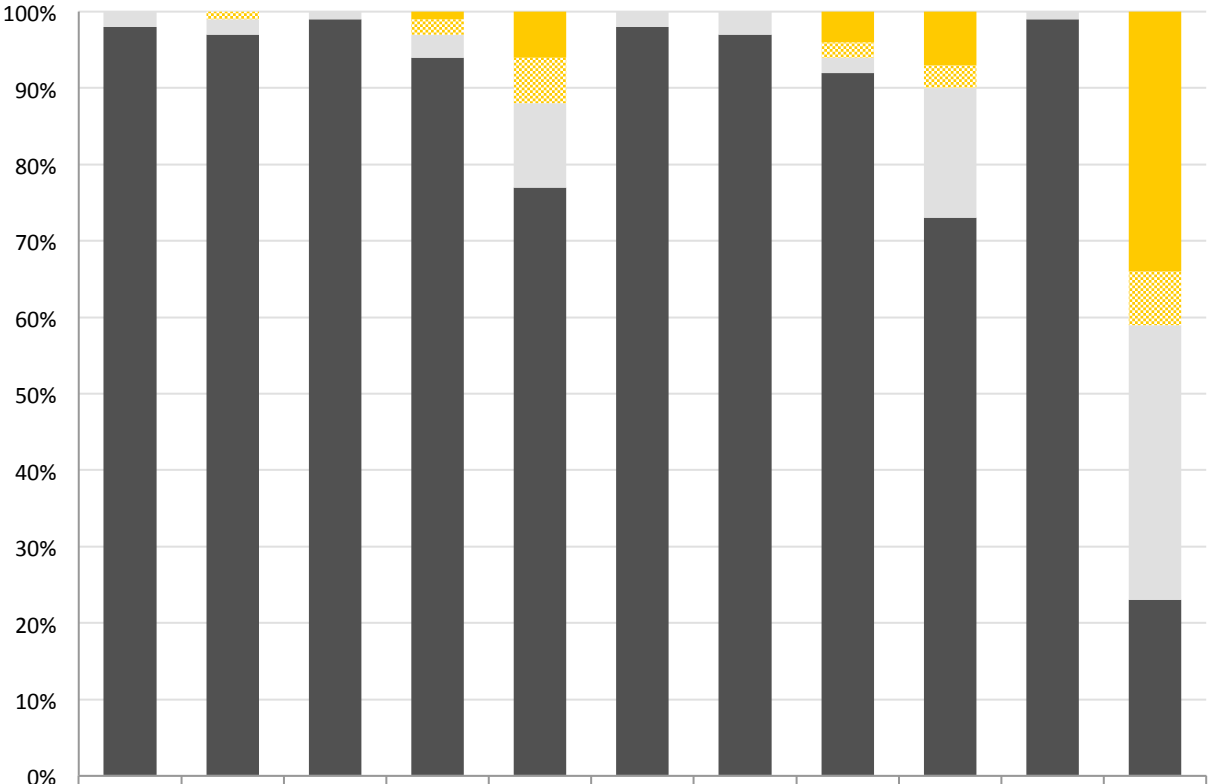
Table 11. 2015 REAP Apprentice Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 88)		
Female	54	61%
Male	26	30%
No Response	8	9%
Respondent Race/Ethnicity (n = 88)		
Asian	13	15%
Black or African American	30	34%
Hispanic or Latino	20	23%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	3	3%
White	13	15%
No Response	9	10%
Respondent Grade Level (n = 88)		
Rising 10th	9	10%
Rising 11th	22	26%
Rising 12th	40	45%
Rising first-year college students	17	20%
No Response	0	0%
Respondent Eligible for Free/Reduced-Price Lunch (n = 88)		
Yes	37	42%
No	35	40%
No Response	16	18%

Table 12. 2015 REAP Apprentice Respondent School Information		
Demographic Category	**Questionnaire Respondents**	
Respondent School Location (n = 88)		
Urban (city)	31	35%
Suburban	49	56%
Rural (country)	8	9%
Frontier or tribal school	0	0%
Respondent School Type (n = 88)		
Public school	80	91%
Private school	8	9%

In addition, apprentices were asked how many times they participated in each of the AEOP programs. As can be seen in Chart 1, 77% of responding apprentices reported participating in REAP at least once. Few apprentices (23% or less) reported participating in any of the other AEOP programs. The program that REAP apprentices most attended was the

GEMS program. The percentage of REAP apprentices who have participated in UNITE was larger in 2015 than was the case in 2014. This represents a continued increased attendance in UNITE by REAP apprentices since 2013.

Chart 1: Apprentice Participation in AEOP Programs (n = 88)



	eCYBERMISSION	GEMS Near Peers	JSS	Camp Invention	GEMS	SEAP	HSAP	JSHS	UNITE	WPBDC	REAP
Three or more times	0%	0%	0%	1%	6%	0%	0%	4%	7%	0%	34%
Twice	0%	1%	0%	2%	6%	0%	0%	2%	3%	0%	7%
Once	2%	2%	1%	3%	11%	2%	3%	2%	17%	1%	36%
Never	98%	97%	99%	94%	77%	98%	97%	92%	73%	99%	23%

Mentor Demographics

Table 13 summarizes demographic data on 2015 participating mentors. The majority of responding mentors were male (67% vs. 33%). In 2014, almost half (49%) of the responding mentors responded that they were white, but in 2015 this decreased to 42%. Twenty-one percent of the responding mentors were Black or African American, 2% were Hispanic or Latino, and 9% chose not to report. The majority of the respondents were university educators (54%) or scientists, engineers, or mathematics professionals (29%). The responding mentors come from a variety of research areas, including physical science (25%), biological science (33%), engineering (22%), and mathematics or statistics (7%). Additional characteristics of the mentors are included in Appendix C.

Table 13. 2015 REAP Mentor Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 43)		
Female	14	33%
Male	29	67%
Respondent Race/Ethnicity (n = 43)		
Asian	11	26%
Black or African American	9	21%
Hispanic or Latino	1	2%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	18	42%
Other race or ethnicity, (specify):	0	0%
Choose not to report	4	9%
Respondent Occupation (n = 59)		
Teacher	1	2%
Other school staff	1	2%
University educator	32	54%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	17	29%
Scientist, Engineer, or Mathematics professional	5	8%
Other, (specify):	3	5%
Primary Area of Research (n = 56)		
Physical science (physics, chemistry, astronomy, materials science, etc.)	14	25%
Biological science	18	33%
Earth, atmospheric, or oceanic science	0	0%
Environmental science	1	2%
Computer science	1	2%
Technology	3	5%
Engineering	12	22%
Mathematics or statistics	4	7%
Medical, health, or behavioral science	1	2%
Social Science (psychology, sociology, anthropology)	1	2%
Other, (specify):	0	0%

Actionable Program Evaluation

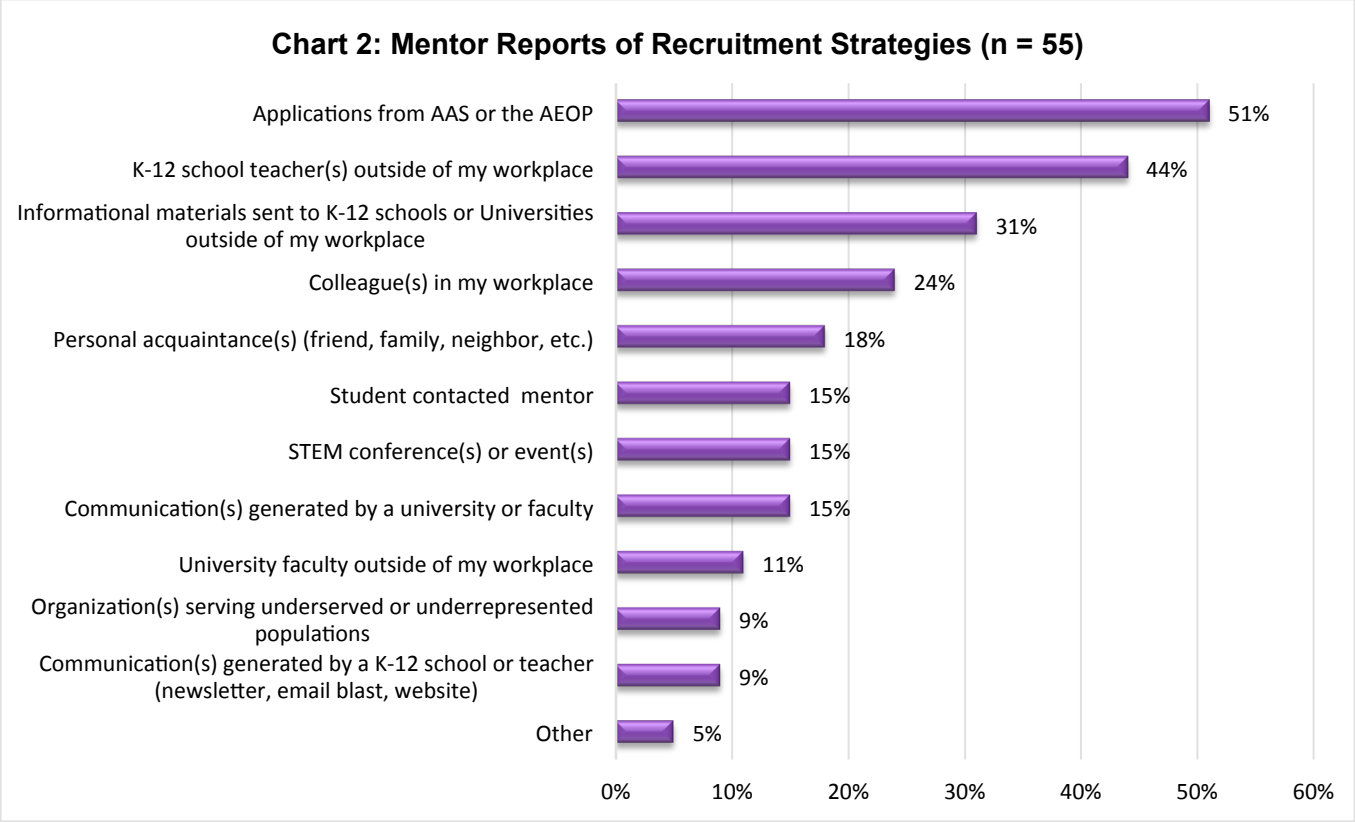
The intent of the Actionable Program Evaluation is to provide assessment and evaluation of program processes, resources, and activities for the purpose of recommending improvements as the program moves forward. This section highlights information outlined in the Satisfaction & Suggestions sections of Tables 3-7.

The Actionable Program Evaluation examines the long-term goal of REAP 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. REAP sites reach out to students from traditionally underrepresented and underserved populations. Thus, it is important to consider how REAP is marketed and ultimately recruits student participants, the factors that motivate students to participate in REAP, apprentices perceptions of and satisfaction with activities, what value apprentices place on program activities, and what recommendations apprentices have for program improvement. The following sections report perceptions of apprentices and mentors that pertain to current programmatic efforts and recommend evidence-based improvements to help REAP achieve outcomes related to AEOP programs and objectives. Specifically, to help REAP continue to expand participation from and support STEM education for students from underrepresented and underserved groups.

Marketing and Recruiting Underrepresented and Underserved Populations

The focus for REAP for FY15, in addition to continuing ongoing efforts to market the program to underrepresented and underserved populations, was to focus specifically on expanding REAP opportunities in cooperation with HBCUs and MSIs. Specifically, REAP collaborated with UNITE program managers to place former UNITE students in REAP. There was a secondary focus on increasing participation in REAP for students from schools with high percentages of free/reduced lunch. Data were collected from mentors and apprentices to determine REAP progress in this area.

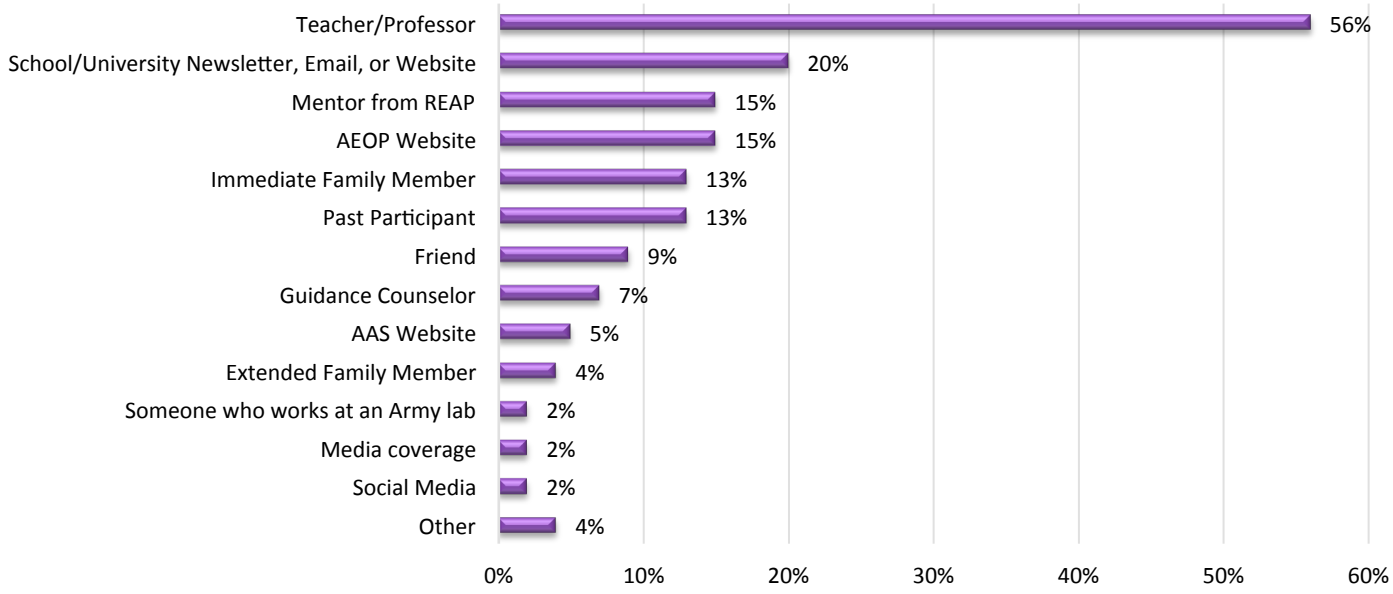
The mentor questionnaire included an item asking how students were recruited for apprenticeships. As can be seen in Chart 2, many mentors indicated recruiting their apprentice(s) through applications from AAS or AEOP (51%), K-12 teachers at the local schools (44%), and informational materials sent to a K-12 setting (31%). About a quarter indicated colleagues from the workplace (24%) and personal acquaintances (18%) helped with recruitment. About the same amount of students were recruited from contacting a mentor (15%), STEM conferences (15%), and communications generated by a university faculty (15%).



Other: Through supervisor, Former UNITE students

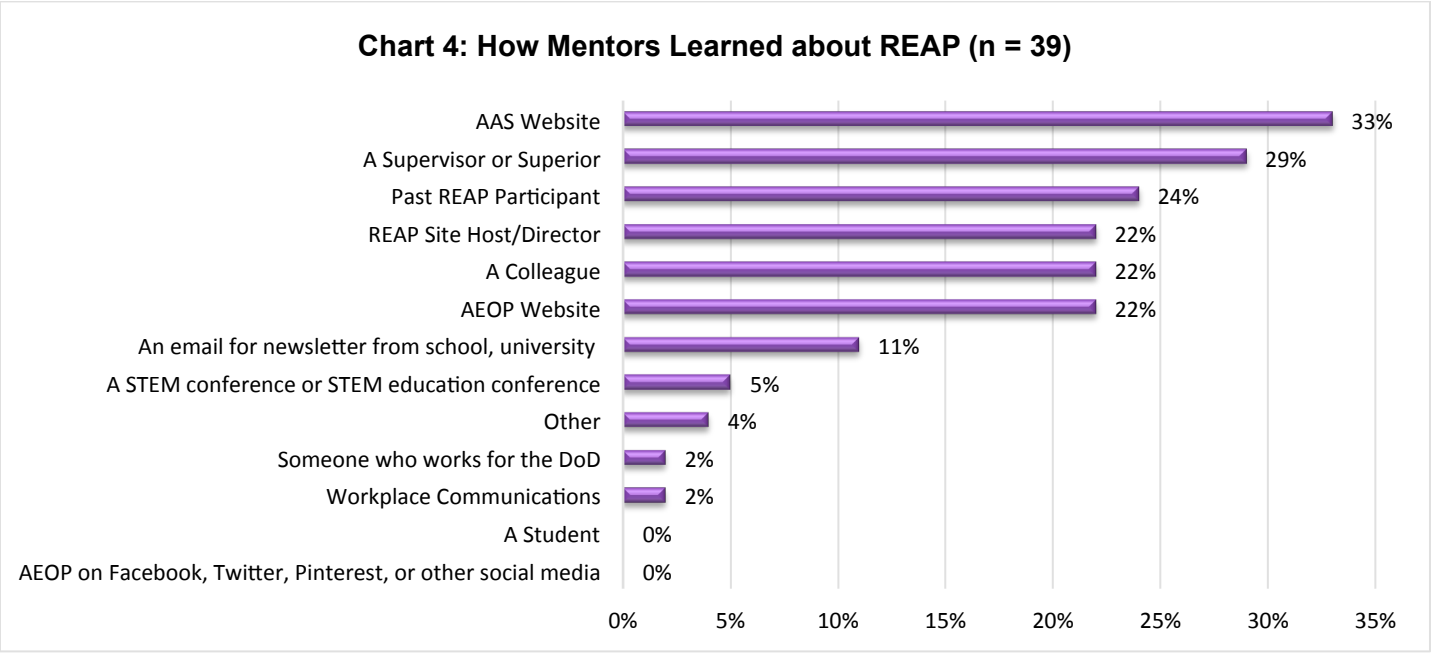
Online questionnaires and phone interviews all included items addressing how apprentices originally learned about REAP, including any personal connections that led them to the program or to the university site, and past experience participating in the program. Chart 3 summarizes apprentices' questionnaire responses. The most frequently mentioned source of information about the local REAP program was teachers and professors (56%). Other sources mentioned relatively frequently were school or university newsletter, email, or website (20%), the AEOP website (15%), REAP mentors (15%), immediate family members (13%), and past REAP participants (13%). The "Other" category included references to existing programs at the sites such as Student and Landowner Education and Watershed Stewardship (SLEWS).

Chart 3: How Apprentices Learned about REAP (n = 55)



Mentors were also asked how they learned about REAP (see Chart 4). The sources that the responding mentors most frequently identified were the Academy of Applied Science (AAS) (33%), a supervisor or superior (29%), a past REAP participant (24%), a REAP site host or director (22%), a colleague (22%), and the AEOP website (22%). An email (11%) and a STEM or STEM education conference (5%) were also relatively frequently identified.

Many of the REAP mentors have had previous experience with the program. Forty percent of the mentors reported participating in REAP three or more times, with more than another third participating one or two times (20% and 16% respectively). To examine whether mentors are expanding their participation in AEOP programs beyond REAP, the questionnaire asked how many times they participated in each of the AEOP programs. With the exception UNITE, 90% or more of responding mentors indicated never hearing of or never participating in the other AEOP programs. Although REAP has a relationship with UNITE and is hosted in many of the same sites as UNITE, more than a third of the REAP mentors reported being unfamiliar with the UNITE program (36%) and more than half reported never participating in UNITE (51%).



Other: A previous host, Did not hear about REAP until this survey

Factors Motivating Apprentice Participation

Apprentice questionnaires, interviews, and focus groups included questions to explore what motivated the apprentices to participate in REAP. Specifically, the questionnaire asked how motivating a number of factors were in their decision to participate. As can be seen in Table 14, 80% or more of responding apprentices indicated that interest in STEM (91%), desire to learn something new or interesting (85%), desire to expand laboratory or research skills (81%), and learning in ways that are not possible in school (80%) were "very much" motivating. The opportunity to use advanced laboratory technology (75%), exploring a unique work environment (75%), building their college application or résumé (70%), networking opportunities (62%), and having fun (62%) were each indicated as very much motivating by a majority of respondents.

Table 14. Factors Motivating Apprentices "Very Much" to Participate in REAP (n = 74)	
Item	**Questionnaire Respondents**
Interest in science, technology, engineering, or mathematics (STEM)	91%
Desire to learn something new or interesting	85%
Desire to expand laboratory or research skills	81%
Learning in ways that are not possible in school	80%
Opportunity to use advanced laboratory technology	75%
Exploring a unique work environment	75%
Building college application or résumé	70%
Networking opportunities	62%
Having fun	62%
Earning stipend or award while doing STEM	56%
Teacher or professor encouragement	55%
Serving the community or country	47%
The program mentor(s)	40%
Interest in STEM careers with the Army	38%
Opportunity to do something with friends	19%
An academic requirement or school grade	15%
Parent encouragement	14%

The apprentices in the focus group and phone interviews mentioned being encouraged to participate in REAP by personal interactions. As two apprentices explained:

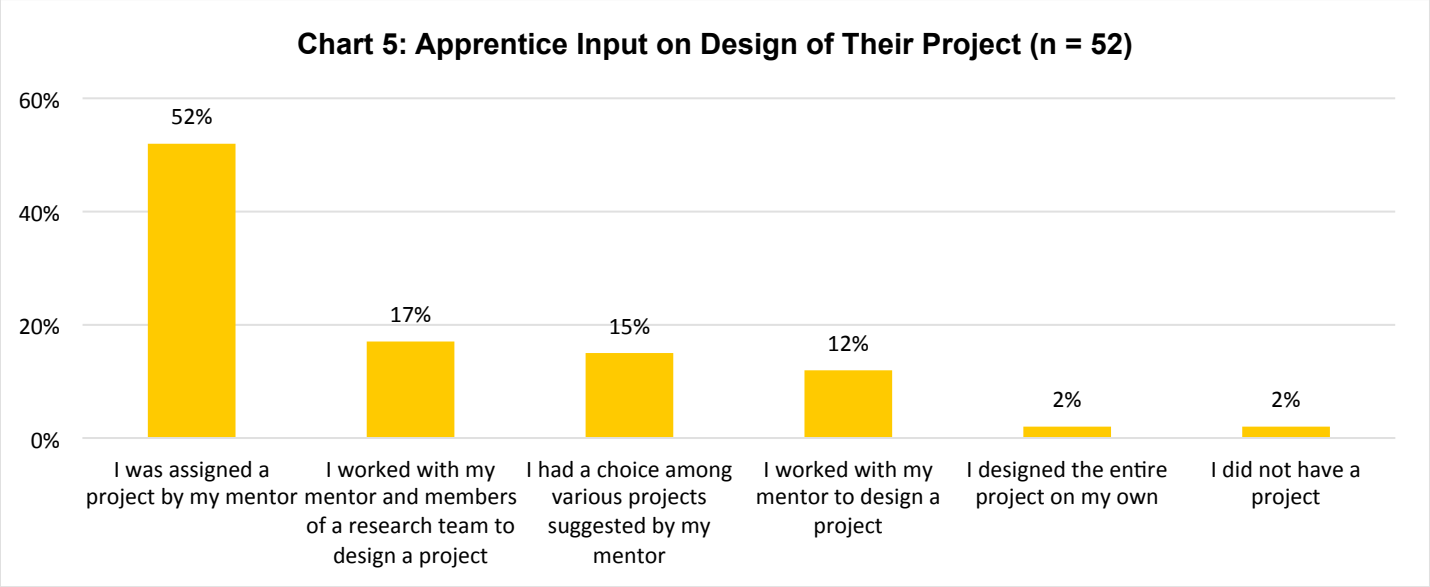
> *I have a teacher actually who told me about the REAP. I found out through Internet after she told me. I guess she got informed because we were in the Science Olympiad, and she heard it from another judge.* (REAP Apprentice)

> *I watched in on one of his operations and I met him there and I asked him if I could work at his lab this year because the age is 14. That's when I decided to work at his lab and then I decided to work on the apprenticeship as well. It gave me a lot of experience with working in a lab and the scholarships and how you can apply those to what you're doing with research and for students my age especially.* (REAP Apprentice)

The REAP Experience

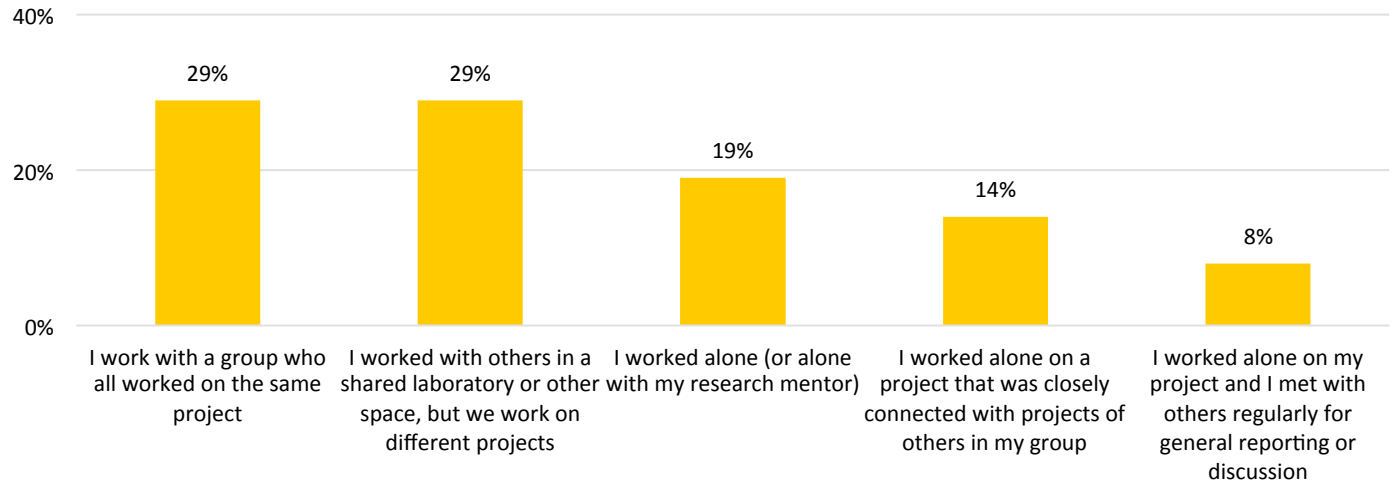
In order to gather data on the overall program experience for REAP participants, several items focused on the nature of apprentices' experience in REAP, and how that experience compared to their STEM learning opportunities in school. When asked what field their REAP experience focused on, 55% of responding apprentices selected science, 15% engineering, 13% technology, and 3% mathematics. As can be seen in Chart 5, about half indicated that they were assigned a project for the experience by their mentor (45%), 21% worked with their mentor and members of a research team to design a project, and 17% had a choice among various projects suggested by their mentor. The remaining

apprentices reported working with their mentor to design a project (12%), designing a project on their own (4%), or not having a project at all (2%). It is possible that the one student who reported not having a project did not fill out the survey properly.



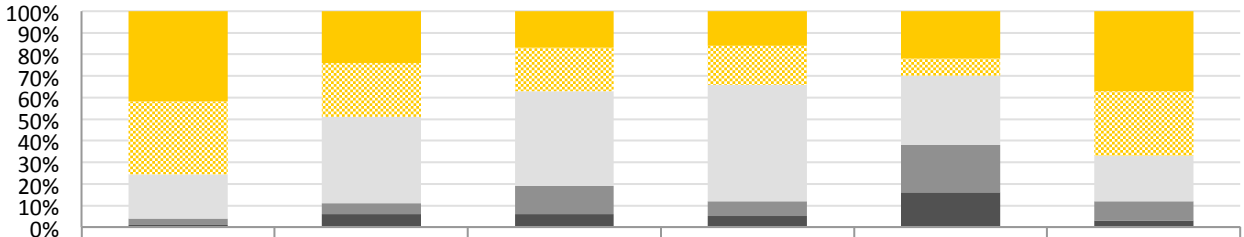
Less than a third of apprentices worked with a group on the same project during the REAP experience (see Chart 6). Most apprentices tended to work independently on their projects, with 29% reporting working in a shared laboratory/space with others, but on different projects. Similarly, 19% indicated working alone (or alone with their research mentor), while 14% reported working alone on a project closely connected to other projects in their group, and 8% reported working alone on a project and meeting regularly with others for general reporting or discussion.

Chart 6: Apprentice Participation in a Research Group (n = 85)



As can be seen in Chart 7, respondents indicated learning about new STEM topics, communicating with other students about STEM, and interacting with STEM professionals at least a few times or more during the REAP program. Mentors were asked similar questions about the nature of the apprentices' experiences. Overall, their responses paint a similar picture of the REAP experience (responses to these items can be found in Appendix C).

Chart 7: Nature of Apprentice Activities in REAP (n = 87)



	Learn about different STEM topics	Apply STEM learning to real-life situations	Learn about new discoveries in STEM	Learn about different careers that use STEM	Interact with scientists or engineers	Communicate with other students about STEM
Every day	41%	24%	17%	16%	22%	37%
Most days	33%	25%	20%	18%	8%	30%
A few times	20%	40%	44%	54%	32%	21%
At least once	3%	5%	13%	7%	22%	9%
Not at all	1%	6%	6%	5%	16%	3%

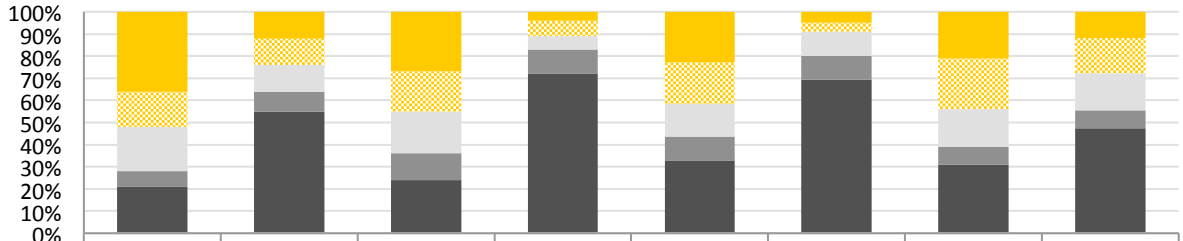
Aligned with the focus of REAP to increase the number and diversity of students who pursue STEM careers, the questionnaire also asked apprentices to share how many jobs/careers in STEM in general, and STEM jobs/careers in the DoD more specifically, apprentices learned about during their experience. Table 15 provides the data related to this item. In fact, nearly all apprentices reported learning about at least one STEM job/career, and the majority (75%) reported learning about three or more. In contrast, 45% of apprentices reported that they did not learn about any DoD STEM jobs/careers (however, this number is down from 68% in 2014), although 37% reported learning about five or more STEM jobs/careers in the DoD.

Table 15. Number of STEM Jobs/Careers Apprentices Learned about During REAP (n = 86)

	STEM Jobs/Careers	DoD STEM Jobs/Careers
None	2%	45%
1	6%	18%
2	13%	12%
3	27%	4%
4	11%	9%
5 or more	37%	9%

There are many resources provided to REAP participants focused on increasing their awareness of DoD STEM careers. REAP apprentices reported that participation in REAP (52%), mentors (45%), AEOP website (44%) and AEOP instructional supplies (42%) were somewhat or very much responsible for their growing awareness of AEOP (see Chart 8).

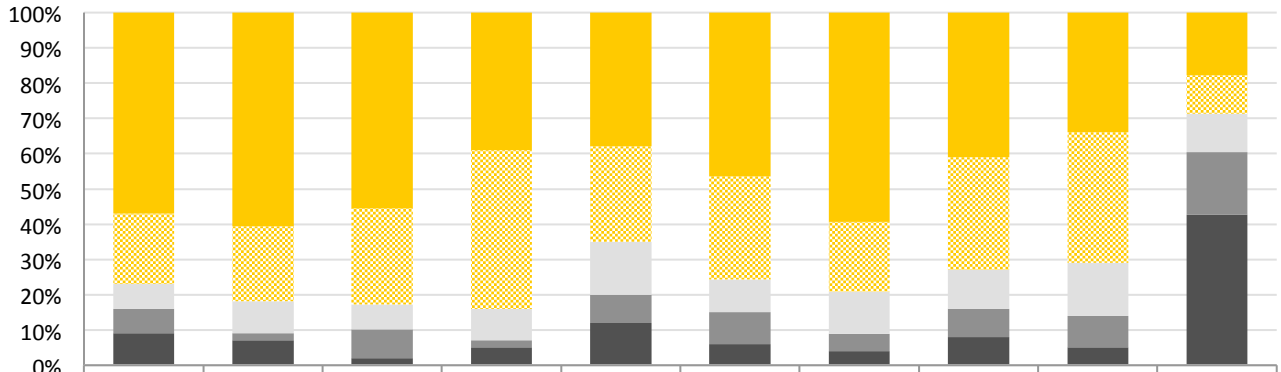
Chart 8: Impact of Resources on Apprentice Awareness of DoD STEM Careers (n = 86)



	Participation in REAP	Invited speakers or "career" events	My REAP mentor(s)	It Starts Here! Magazine	AEOP brochure	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP website	Academy of Applied Science (AAS) website
Very Much	36%	12%	27%	4%	23%	5%	21%	12%
Somewhat	16%	12%	18%	7%	19%	4%	23%	16%
A little	20%	12%	19%	6%	15%	11%	17%	17%
Not at all	7%	9%	12%	11%	11%	11%	8%	8%
Did not experience	21%	55%	24%	72%	33%	70%	31%	48%

The evaluation of REAP included a comparison of engagement in STEM during the program – as compared to their typical experience at school. Results indicate that apprentices were very actively engaged in doing STEM during the program (see Chart 9). For example, 80% of responding apprentices indicated analyzing or interpreting data on most days or every day; 75% reported carrying out investigations; and 84% reported posing questions to investigate. In addition, apprentices indicated being integrally involved the work of STEM on most days or every day, including drawing conclusions from an investigation (73%), coming up with creative explanations/solutions (71%), and designing an investigation (65%). Data from the mentor questionnaire about apprentice engagement in STEM practices (shown in Appendix C) are very well aligned with data from the apprentice questionnaire.

Chart 9: Apprentice Engagement in STEM Practices in REAP (n = 86)



	Use laboratory procedures and tools	Participate in hands-on STEM activities	Work as part of a team	Identify questions or problems to investigate	Design an investigation	Carry out an investigation	Analyze data or information	Draw conclusions from an investigation	Come up with creative explanations /solutions	Build or make a computer model
Every day	57%	60%	55%	39%	38%	46%	60%	41%	34%	18%
Most days	20%	21%	27%	45%	27%	29%	20%	32%	37%	11%
A few times	7%	9%	7%	9%	15%	9%	12%	11%	15%	11%
At least once	7%	2%	8%	2%	8%	9%	5%	8%	9%	18%
Not at all	9%	7%	2%	5%	12%	6%	4%	8%	5%	43%

A composite score[3] was calculated for each of these two sets of items, the first titled "Learning about STEM in REAP,"[4] and the second "Engaging in STEM Practices in REAP."[5] Response categories were converted to a scale of 1 = "Not at all" to 5 = "Every day," and the average across all items in the scale was calculated. The composite scores were used to test whether there were differences in apprentice experiences by gender, race/ethnic group (minority vs. non-minority), FRL status, and school location. There were no significant differences for any of the groups on either composite.

To examine how the REAP experience compares to their typical school experience, apprentices 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,"[6] and "Engaging in STEM Practices in

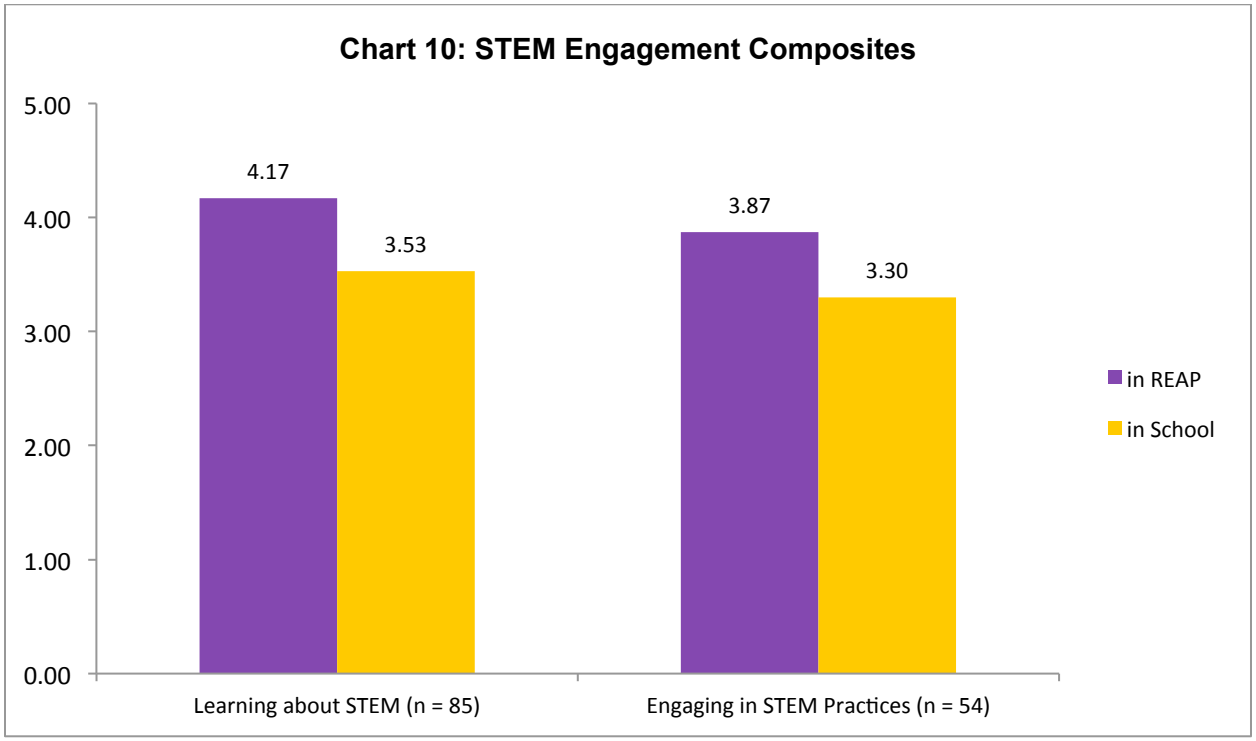
[3] Using multiple statistical tests on related outcomes requires the use of a Type I error rate adjustment to reduce the likelihood of false positives (i.e., detecting a difference when one does not truly exist). However, Type I error rate adjustments lead to a reduction in statistical power (i.e., 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.

[4] The Cronbach's alpha reliability for these 6 items was 0.872.

[5] The Cronbach's alpha reliability for these 10 items was 0.910.

[6] Cronbach's alpha reliability of 0.862.

School"[7] that are parallel to the ones asking about REAP. As can be seen in Chart 10, scores were significantly higher on the "in REAP" versions of both composites than on the "in school" versions (large effect of d = 1.44 standard deviations d = 1.26 standard deviations, respectively).[8] These data indicate that REAP provides apprentices with more intensive STEM learning experiences than they would typically receive in school.



The Role of Mentors

A key component of the REAP and other apprenticeship programs in the AEOP are mentors. The nature and quality of mentoring is an important factor in maximizing apprentice participation in these opportunities, and sustaining or inspiring their interest in future STEM work. Consequently, both the apprentice and mentor questionnaires asked about the role of mentors in the program. Because of the nature of the program, it is not surprising that 86% of responding mentors reported working with 1-2 apprentices, with the remaining working with 3 to 5 apprentices.

Mentors were questioned regarding their use of strategies when working with apprentices (referred to as students in the mentor questionnaire items and in the descriptions of those items throughout this section of the report). These strategies comprised five main areas of effective mentoring:

[7] Cronbach's alpha reliability of 0.928.

[8] Two-tailed dependent samples *t*-tests: Learning about STEM, $t(84) = 6.58$, $p < 0.001$; Engaging in STEM Practices, $t(84) = 5.78$, $p < 0.001$.

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.

Several strategies were reportedly used by mentors to help make the learning activities relevant to students (see Table 16). For example, all mentors reported finding out about students' backgrounds and interests at the beginning of the program (100%), and most game students real-life problems to investigate or solve (93%). Over 80% of the mentors reported asking students to relate outside events or activities to topics covered in the program and selecting readings or activities that relate to students' backgrounds. The majority of mentors also reported helping students understand how STEM can help them improve their communities (72%), encouraging students to suggest new readings, activities, or projects (72%), and helping students understand how STEM can help them improve their own community (72%). Mentors also suggested other ways that they establish relevance, such as demonstrating how skills learned in the laboratory are pertinent to other fields.

Table 16. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 54)

Item	Questionnaire Respondents
Become familiar with my student(s) background and interests at the beginning of the REAP experience	100.00%
Giving students real-life problems to investigate or solve	92.60%
Helping students become aware of the role(s) that STEM plays in their everyday lives	83.30%
Selecting readings or activities that relate to students' backgrounds	81.50%
Encouraging students to suggest new readings, activities, or projects	72.20%
Helping students understand how STEM can help them improve their own community	72.20%
Asking students to relate real-life events or activities to topics covered in REAP	64.80%

Mentors also reported using a variety of strategies to support the diverse needs of students as learners. As can be seen in Table 17, 91% of mentors reported treating all students the same way, regardless of gender or race/ethnicity, 91% indicated using diverse teaching/mentoring activities that meet the needs of all students. Many also helped students find additional support if needed (91%) and tried to find out about student learning styles (70%). Other strategies mentioned included having students participate in meetings and seminars and accommodating students' busy schedules.

Table 17. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 53-54)	
Item	**Questionnaire Respondents**
Use a variety of teaching and/or mentoring activities to meet the needs of all students	90.70%
Providing extra readings, activities, or learning support for students who lack essential background knowledge	90.70%
Interact with students and other personnel the same way regardless of their background	90.60%
Identify the different learning styles that my student (s) may have at the beginning of the REAP experience	70.40%
Directing students to other individuals or programs for additional support as needed	69.80%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	58.50%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	56.60%

Further, 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 (90%). The vast majority had students listen to the ideas of others with an open mind (89%), participate in giving and receiving feedback (90%), tell others about their backgrounds and interests (77%), and explain difficult ideas to others (76%).

Table 18. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 51-53)	
Item	**Questionnaire Respondents**
Having my student(s) give and receive constructive feedback with others	90.40%
Having students work on collaborative activities or projects as a member of a team	90.20%
Having my student(s) listen to the ideas of others with an open mind	88.70%
Having my student(s) tell other people about their backgrounds and interests	77.40%
Having my student(s) explain difficult ideas to others	75.50%
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	73.60%
Allowing my student(s) to resolve conflicts and reach agreement within their team	55.80%

The majority of responding mentors (96%) reported allowing students to work independently as appropriate for their self-management abilities and STEM competencies. Additionally, 93% of mentors reported demonstrating the use of

laboratory/field techniques, procedures, and tools, and 94% reported helping students practice STEM skills with supervision (see Table 19). The strategies of encouraging opportunities in which students could learn from others, encouraging students to seek support from other team members, and giving constructive feedback to improve students' STEM competencies were each used by 94% of the mentors. More than three-quarters or more of the mentors reported teaching/assigning readings about specific STEM subject matter (87%) and having students access and critically review technical texts or media (94%).

Table 19. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 52-53)

Item	Questionnaire Respondents
Allowing students to work independently to improve their self-management abilities	96.20%
Having my student(s) search for and review technical research to support their work	94.30%
Providing my student(s) with constructive feedback to improve their STEM competencies	94.30%
Encouraging students to seek support from other team members	94.30%
Supervising my student(s) while they practice STEM research skills	94.20%
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	92.50%
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	90.60%
Teaching (or assigning readings) about specific STEM subject matter	86.80%

Mentors also used strategies focused on supporting students' STEM educational and career pathways (see Table 20).[9] All of the responding mentors reported asking students about their educational and career interests and nearly all reported providing guidance about educational pathways that will prepare their students for a STEM Career (89%). Many also discussed STEM career opportunities in private industry or academia (81%).

Only 55-60% of the responding mentors reported using strategies to link STEM careers with the greater needs of society including: (1) discussing STEM career opportunities inside and outside of the DoD or other government agencies and (2) discussing the economic, political, ethical, and/or social context of a STEM career. In addition, given the interest in having students graduate into other AEOP opportunities, it is surprising that only 54% of mentors recommended other AEOP programs to students.

Table 20. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 51-53)

Item	Questionnaire Respondents
Asking my student(s) about their educational and/or career goals	100.0%
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	88.7%

[9] The apprentice questionnaire included subset of these items (found in Appendix B). The apprentices reported lower percentages of use of strategies to support STEM educational and career pathways than did mentors.

Discussing STEM career opportunities in private industry or academia	81.1%
Discussing STEM career opportunities within the DoD or other government agencies	60.4%
Recommending student and professional organizations in STEM to my student(s)	58.5%
Helping students build a professional network in a STEM field	58.5%
Recommending extracurricular programs that align with students' goals	54.7%
Discussing the economic, political, ethical, and/or social context of a STEM career	54.7%
Recommending Army Educational Outreach Programs that align with students' goals	53.8%
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	43.1%

Mentors were asked which of the AEOP programs mentors explicitly discussed with their students during REAP. Not surprisingly, the most frequently discussed program was REAP (74%), as can be seen in Table 21. Other programs discussed with students by roughly a quarter or more of responding mentors were URAP (33%), SMART (24%), HSAP (24%), and SEAP (26%). A surprisingly low number of mentors discussed UNITE (17%). A third of the mentors reported discussing AEOP generally with students, but not discussing any specific programs (33%).

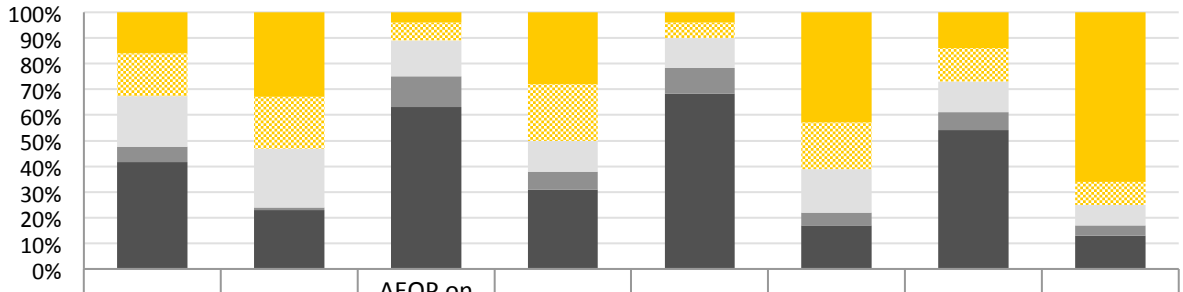
Table 21. Mentors Explicitly Discussing AEOPs with Students (n = 47-53)

Item	Questionnaire Respondents
Gains in the Education of Mathematics and Science (GEMS)	16.0%
UNITE	17.0%
Research & Engineering Apprenticeship Program (REAP)	73.6%
Undergraduate Research Apprenticeship Program (URAP)	33.3%
I discussed AEOP with my student(s) but did not discuss any specific program	33.3%
Science & Engineering Apprenticeship Program (SEAP)	26.0%
High School Apprenticeship Program (HSAP)	23.5%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	23.5%
Junior Science & Humanities Symposium (JSHS)	18.4%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	12.0%
GEMS Near Peer Mentor Program	10.4%
College Qualified Leaders (CQL)	10.2%

Mentors' perception of usefulness of AEOP resources was also examined. As can be seen in Chart 11, participation in REAP (66%), REAP mentors (43%), and the AEOP website (33%) were most often rated as "very much" useful. Invited speakers, It Starts Here! Magazine, or "career" events and AEOP social media tended not to be seen as very useful, with large proportions of mentors indicating they did not experience these resources. For example, 54% of responding mentors reported not experiencing invited speakers or "career" events, and only 14% rated them as "very much" useful.

Similarly, 63% of responding mentors did not experience AEOP social media and only 4% found it very useful, and 69% of respondents did not experience AEOP programs in It Starts Here! Magazine, while only 4% found it useful for exposing students to AEOP.

Chart 11: Usefulness of Resources for Exposing Students to AEOPs (n = 83-85)



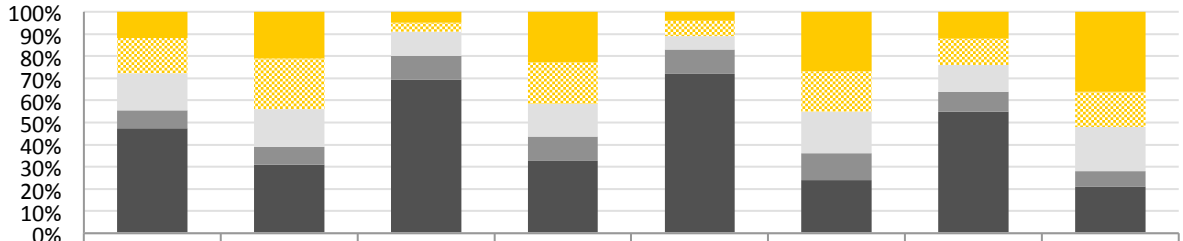
	Academy of Applied Science (AAS)	AEOP website	AEOP on Facebook, Twitter, Pinterest or other social medi	AEOP brochure	It Starts Here! Magazine	My REAP mentor(s)	Invited speakers or "career" events	Participation in REAP
Very Much	16%	33%	4%	28%	4%	43%	14%	66%
Somewhat	17%	20%	7%	22%	6%	18%	13%	9%
A little	20%	23%	14%	12%	12%	17%	12%	8%
Not at all	6%	1%	12%	7%	10%	5%	7%	4%
Did not experience	42%	23%	63%	31%	69%	17%	54%	13%

Phone interviews with mentors provided some additional context for strategies they used for informing students about AEOP opportunities, including brochures from AEOP and AEOP instructional supplies. As stated by one mentor:

> *I think it* [recruitment] *is effective, because I've actually sent brochures as far as Florida to people that I know that are looking for opportunities.* (Mentor 1)

Mentors reported on how useful AEOP resources were for exposing students to DoD STEM careers (see Chart 12). As with the previous item, mentors were most likely to rate participation in REAP as useful, with 36% selecting "very much." The AAS website (21%), program managers or site coordinators (27%), and the AEOP brochure and/or presentation (23%) were most often rated as "very much" useful. Again, invited speakers or "career" events, It Starts Here! Magazine, and AEOP social media were less likely to be seen as very useful for this purpose (4-12%), with large proportions of mentors indicating they did not experience these resources (33-72%).

Chart 12: Usefulness of Resources for Exposing Students to DoD STEM Careers (n = 83-85)



	AAS website	AEOP website	AEOP social media	AEOP brochure	It Starts Here! Magazine	My REAP mentors	Invited speakers or "career" events during REAP	Participation in REAP
Very Much	12%	21%	5%	23%	4%	27%	12%	36%
Somewhat	16%	23%	4%	19%	7%	18%	12%	16%
A little	17%	17%	11%	15%	6%	19%	12%	20%
Not at all	8%	8%	11%	11%	11%	12%	9%	7%
Did not experience	48%	31%	70%	33%	72%	24%	55%	21%

Unfortunately, mentors interviewed were mostly unfamiliar with DoD STEM careers. As stated by two:

> *I am, only from what I've read. I don't know if any of those programs are available in our state, but I'm familiar with the SEAP Program. I'm familiar with GEMS. We have GEMS in Delaware through the Armed Forces Medical Examiner's office or the Dover Air Force Base. Like I said, our university hosted the GEMS Program in conjunction with the Air Force Base*. (Mentor 1)

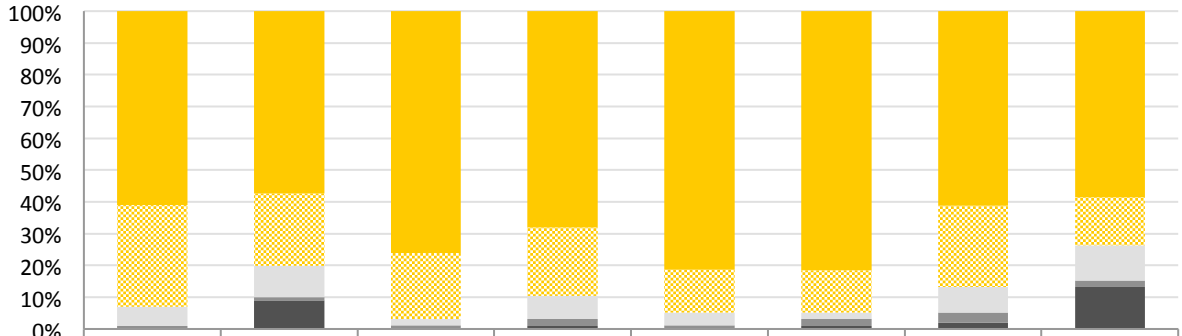
> *I'm familiar with a couple of them. There's one that's for undergraduates. Another one, the face of it sounds very similar to REAP. A lot of the other ones, I've heard the names but I have no idea what they're about beside the interest of some of the people here in starting ones were undergraduates but they really didn't want to run with it. I think if you look at it this way, if you have a high school student that's completed three years, their outlook is, "I'm going to graduate from high school next year and go to college and I don't know that I have time for another program like this, or maybe something a little different."* (Mentor 2)

Satisfaction with REAP

Apprentice and mentor satisfaction with the program was also a focus of the evaluation. As can be seen in Chart 13, the vast majority of responding apprentices were somewhat or very much satisfied with each of the listed program features. For example, 93% of apprentices were at least somewhat satisfied with the stipend, 81% with the communications from

their REAP site, 91% with instruction or mentorship during program activities, and 93% with the location of the program activities.

Chart 13: Apprentice Satisfaction with REAP Program Features (n = 83-85)



	Applying or registering for the program	Communicating with your REAP host site organizers	The physical location(s) of REAP activities	The variety of STEM topics available to you in REAP	Teaching or mentoring provided during REAP activities	Stipends (payment)	Research abstract preparation requirements	Development opportunities beyond conducting research
Very Much	61%	58%	73%	66%	78%	80%	60%	58%
Somewhat	32%	23%	20%	21%	13%	13%	25%	15%
A little	6%	10%	2%	7%	4%	2%	8%	11%
Not at all	1%	1%	1%	2%	1%	2%	3%	2%
Did not experience	0%	9%	0%	1%	0%	1%	2%	13%

Apprentices were also asked about their satisfaction with access to their mentor. As can be seen in Table 22, 34% of responding apprentices indicated their mentor was always available, and 19% that their mentor was available more than half of the time. Few apprentices indicated that their mentor was available half of the time or less.

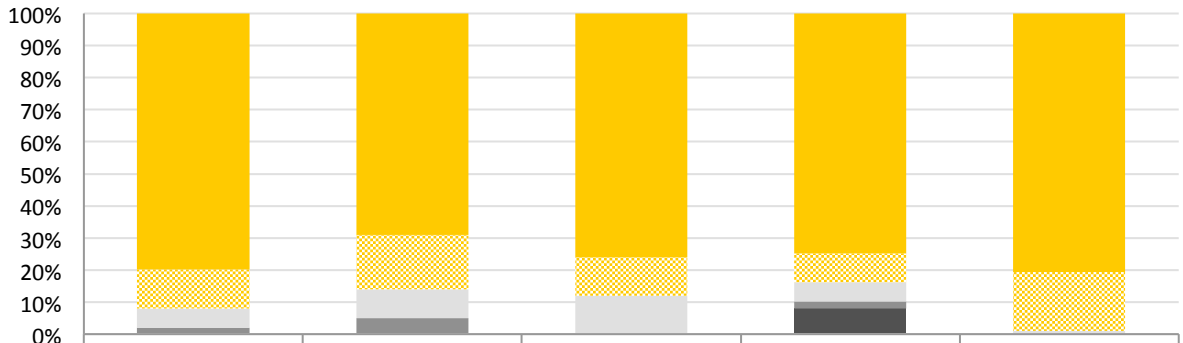
Table 22. Apprentice Reports of Availability of Mentors (n = 86)

Item	Questionnaire Respondents
The mentor was available more than half of the time	18.60%
The mentor was available about half of the time of my project	12.79%
The mentor was never available	1.16%
The mentor was available less than half of the time	1.16%

Similarly, apprentices were asked about their satisfaction with their mentors and the research experience (see Chart 14). The majority of apprentices indicated being "very much" satisfied with each of the features, with the vast majority being

at least somewhat satisfied with each feature. For example, 79% of apprentices indicated "very much" when asked about their research experience overall, with another 18% indicating "somewhat." Similarly, 74% were at least somewhat satisfied with their working relationship with their group or team; 88% reported being at least somewhat satisfied with the time spent doing meaningful research, and 86% with the time spent with their mentor.

Chart 14: Apprentice Satisfaction with Their Experience (n = 84-85)



	My working relationship with the group or team	The amount of time I spent with my research mentor	The amount of time I spent doing meaningful research	My working relationship with my group or team	The research experience overall
Very Much	79%	69%	76%	74%	79%
Somewhat	12%	17%	12%	9%	18%
A little	6%	9%	12%	6%	1%
Not at all	2%	5%	0%	2%	0%
Did not experience	0%	0%	0%	8%	0%

Apprentices were provided an opportunity to provide additional feedback on their overall satisfaction with their REAP experience in an open-ended item on the survey. Of the 80 apprentices who answered this question, 76 (95%) commented on only positive aspects of the program. These responses were sometimes as simple as, "I was very satisfied with my experience with REAP and I will recommend it to my younger brother." Other times, they provided more detail about what they enjoyed, such as in the following examples:

> *This REAP program has provided me with a one in a lifetime opportunity, especially as a high school student. This program has given me the ability to work within a lab setting. This, overall, gave me the idea of what I want to pursue in the future career wise, whether it's becoming a medical doctor or a genetic researcher. I very much enjoyed working with the other students in this program, and also getting a chance to work with a microbiology professor as my mentor. I would have worked this program, even without the stipend, but it's an added bonus and will go towards gas money so I will be able to go to most of my school events and participate in more*

afterschool activities. Moreover, this REAP program has given me memories and an experience that I will never forget and hopefully will be able to use the knowledge I have gained from completing the REAP program in the future. (REAP Apprentice)

REAP has helped me find new ways to find solution and solve a problem if it doesn't go the way you expect. Also to collect data to get the result you want to help out for your research. Reap is a good program to be a part of if your major contributes with science. Really helps a lot on research such as pesticides, insects, and plants. Overall this program is really helpful and makes you gains skills you wouldn't imagine getting. (REAP Apprentice)

I am very happy to be a part of REAP because it has helped me become better at working on labs/experiments and has exposed me to topics in STEM that I was not aware of before REAP. It is very nice that even though this is my first job I am contributing to meaningful research about a topic that is important to me and my family. (REAP Apprentice)

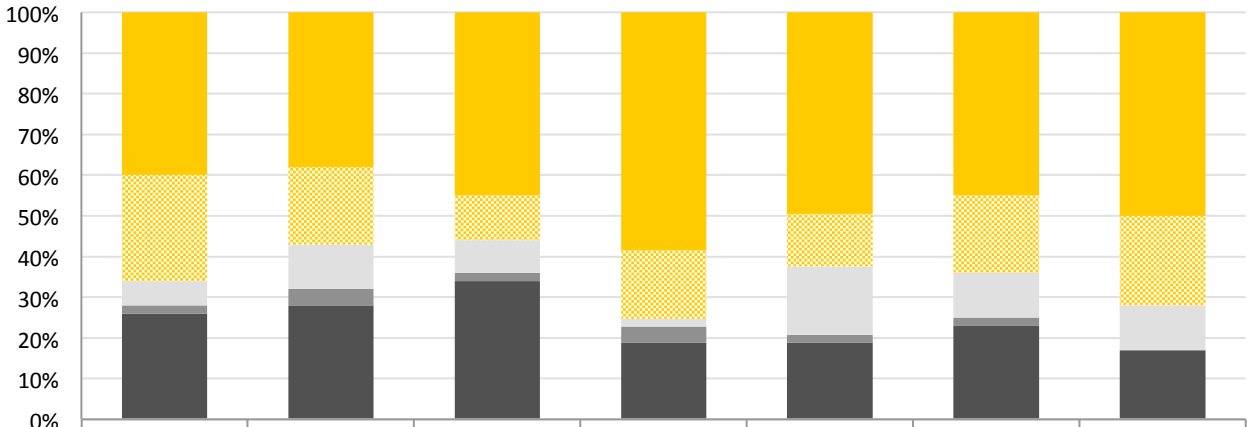
Other responses included positive comments, but had some caveats. For example, one apprentice indicated that it was overall an educational experience, but they wanted to do more hands-on work than reading research. Another apprentice felt that his/her work was too piecemeal as he/she had to put in captions for 4000 diagrams. In this apprentice's words:

REAP was an amazing experience as i learned fascinating new lab procedures. Overall, I have learned protein purification techniques (centerfuge, column), Biacore 3000 (binding analysis), Gel electrophoresis of Bis-Tris gel/Agarose Gel, Western Blotting, Bacterial culture optimization, bacterial transformation, and many others. I hope to present a part of my research for my science fair project. Overall, however, I do wish I was given a core solid project so the presentation process could be optimized. My mentor Patty was excellent, caring, and gave great information, as did other members of the lab. I am now more aware of different aspects of STEM research and I have REAP to thank for that. (REAP Apprentice)

Input into how to improve the REAP program was also sought. The most common theme in the responses to this open-ended item, described by 21 (26%), was that the apprentices wanted more hands-on or meaningful work in STEM. The second most common response, mentioned by 10 (13%) had to do with communication between program and apprentice. Six of these 10 apprentices mentioned only the need for better communication between the program and the apprentice, although others gave specific examples such as explain the expectations of the program to apprentices by email before beginning hours. Other suggestions included providing a variety of projects or choice in a topic by the apprentice (13%), extend the time period (10%), learning more about STEM and DoD careers (6%) and time for REAP apprentices to interact with each other across projects (6%). These comments are similar to sentiments expressed about the 2014 program.

Mentors reported being somewhat satisfied with the program components they experienced (see Chart 15). For example, 76% were at least somewhat satisfied with communications from the local REAP site, 72% with the research abstract and preparation requirements, and 64% with the participation stipends.

Chart 15: Mentor Satisfaction with REAP Program Features (n = 84-85)



	Application or registration process	Other administrative tasks	Communicating with Academy of Applied Science	Communicating with REAP organizers	Support for instruction or mentorship during program activities	Participation stipends (payment)	Research abstract preparation requirements
Very Much	40%	38%	45%	59%	50%	45%	50%
Somewhat	26%	19%	11%	17%	13%	19%	22%
A little	6%	11%	8%	2%	17%	11%	11%
Not at all	2%	4%	2%	4%	2%	2%	0%
Did not experience	26%	28%	34%	19%	19%	23%	17%

The mentor questionnaire also included open-ended items asking for their opinions about the program. Mentors were asked to identify the three most important strengths of REAP; 43 out of 56 mentors (77%) responded to this question. Although several important aspects of the program were listed, the most frequently described was providing apprentices with hands-on research experiences (30 mentors, or 54%). Mentors wrote things like "gives students practical experience with STEM project" and "understand the context of research and working in a lab environment." This sentiment was echoed in the mentor focus group. As two mentors said:

> *First of all, I think the experience itself is phenomenal for the students, because we are in Central Delaware, and there is not a lot here for our students to do to get those academic experiences that students would have in larger, more urban areas*. (REAP Mentor)

> *If they're interested in studying science as an undergraduate, it gives them an exposure to close to the real world of scientific research in terms of the kinds of experiments you might do and the kinds of techniques and how*

people interact in a research situation. I guess some of them could be benefiting financially, but I don't think that's a major driver from what I've seen in recent years. It gives them a feeling of how experiments are done in the laboratory, and how the kind of information that's gleaned in the laboratory is used and interpreted in the broader context. (REAP Mentor)

Other responses to the open-ended questionnaire item focused on the benefit to the students because of REAP's apprentice stipend (24%), the opportunity for teamwork/collaboration among apprentices and scientists (11%), and that the experience built confidence in the apprentice (9%).

Mentors were also asked to provide three ways in which REAP should be improved for future participants. Of the 43 individuals who responded to this question, 49% indicated the need for additional funding. Many of the mentors specified the purpose for the funding, such as "stipend must be raised to at least meet minimum wage requirements in all states," "Increase the wage (we cannot inspire students to have a career in STEM if REAP pays minimum wage!)," and "larger stipends for students." Like the apprentices, several mentors suggested increasing the length of the apprenticeship (12%). Other suggestions, though none made by a large number of mentors, included holding a REAP conference/science fair (9%), making improvements to the REAP website (9%), increasing the advertising for the program (7%), providing more information to mentors about STEM and DoD careers (9%), and providing clearer expectations for apprentices and mentors (9%).

Mentors shared their overall satisfaction with their REAP experience in the final open-response item. Of the 28 individuals who responded to this question, 93% described having a positive experience. Nearly all of these responses included a positive comment about the program, along with listing one or more ways in which the program was beneficial to apprentices. For example:

I certainly enjoyed working with the students. Involving them in the choice of project allowed them to own their work and also increased their interest and enthusiasm. Their overall satisfaction of their Research project and outcome made my summer meaningful. I will certainly do this again! (REAP Mentor)

I have a number of REAP students work in my laboratory over the last 10 years. They have always been outstanding students who have a real thirst for knowledge. By giving them a research experience early in their careers the REAP program strongly encourages them to pursue a career into science. By enabling to work with others at various levels (undergraduates, graduate students and professors) it gives them a view of what it takes to become a professional scientist and the path that they can take to obtain that goal. I'm very happy with the REAP program and consider it to be a very valuable one for encouraging American youth to go into STEM fields. (REAP Mentor)

My student was enthusiastic, but uniquely unprepared for the work I do--all the more reason someone from a less-privileged background should be involved in this program. I feel I was able to offer my REAP student and another high school student a really great experience in biochemistry and molecular biology. (REAP Mentor)

"I have a number of REAP students work in my laboratory over the last 10 years. They have always been outstanding students who have a real thirst for knowledge. By giving them a research experience early in their careers the REAP program strongly encourages them to pursue a career into science. By enabling to work with others at various levels (undergraduates, graduate students and professors) it gives them a view of what it takes to become a professional scientist and the path that they can take to obtain that goal. I'm very happy with the REAP program and consider it to be a very valuable one for encouraging American youth to go into STEM fields." – REAP Mentor

> *I was more than satisfied with my REAP experience. My student is very hard working, and is more confident in her abilities within the laboratory setting. All my supervisors were more than helpful, and professional with every aspect throughout the entire period. This being my first experience within the program as a mentor, I would highly recommend this opportunity to anyone interested in science/engineering or looking to further developing their skills.* (REAP Mentor)

In summary, findings from the Actionable Program Evaluation demonstrate success for REAP in providing a program that actively engages students from underrepresented backgrounds in authentic STEM experiences, including opportunities to learn important STEM practices. In FY15, REAP continued to build on previous years' progress of providing apprentices with opportunities to learn about DoD or STEM job/careers. Apprentices and mentors continue to be very satisfied with the program and their overall experiences.

Outcomes Evaluation

The FY15 evaluation of REAP continued to include measures of several outcomes relating to AEOP and program objectives, including impacts on apprentices' STEM competencies (e.g., knowledge and skills), STEM identity and confidence, interest in and intent for future STEM engagement (e.g., further education, careers), attitudes toward research, and their knowledge of and interest in participating in additional AEOP opportunities.[10] STEM competencies

[10] 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.

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 for 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 REAP measured apprentices' 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

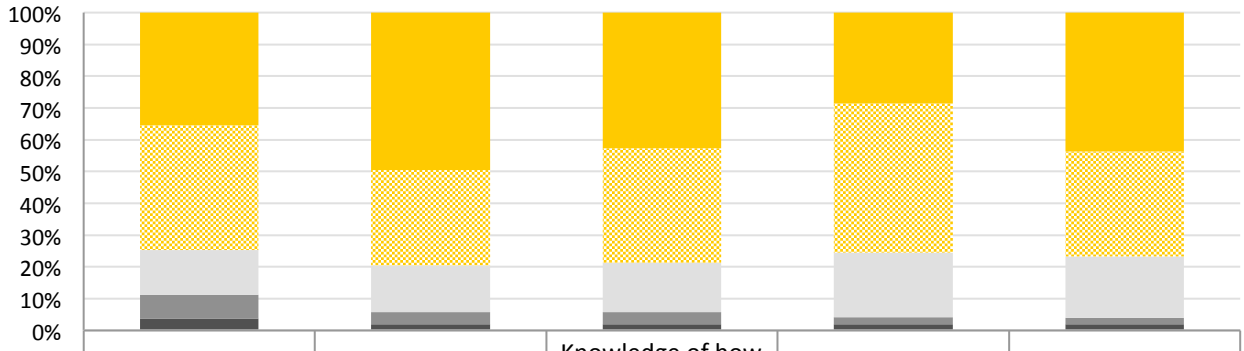
Nearly all responding apprentices reported gains in their STEM knowledge as a result of the REAP program, with large majorities indicating large or extreme gains in each area (see Chart 16). Large or extreme gains were reported by 88% of apprentices on their knowledge of research conducted in a STEM topic/field, and 74% on their knowledge of a STEM topic/field in depth. Similar impacts were reported on knowledge of how professionals work on real problems in STEM (81%), knowledge of what everyday research work is like in STEM (82%), and knowledge of research processes, ethics, and rules for conduct in STEM (80%). Mentors reported similar impacts on their apprentices' STEM knowledge (see Appendix C).

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 16: Apprentice Report of Impacts on STEM Knoweldge (n = 84-85)



	Knowledge of research processes, ethics, and rules for conduct in STEM	Knowledge of what everyday research work is like in STEM	Knowledge of how scientists and engineers work on real problems in STEM	Knowledge of a STEM topic or field in depth	Knowledge of research conducted in a STEM topic or field
Extreme gain	38%	51%	44%	28%	45%
Large gain	42%	31%	37%	46%	34%
Some gain	15%	15%	16%	20%	20%
A little gain	8%	4%	4%	2%	2%
No gain	4%	2%	2%	2%	2%

For further analysis, these apprentice questionnaire items were combined into a composite variable[11] to test for differential impacts across subgroups of apprentices (based on gender, race/ethnicity, FRL status, and school location). There were no significant differences between any of the subgroups; in other words, the subgroups of apprentices reported similar impacts of the program on their STEM knowledge.

Perceived impacts on STEM skills—i.e., apprentices' abilities to use STEM practices, were also examined in the survey. Apprentices were presented with different sets of items depending on the focus of their REAP experience (science vs. technology, engineering, or mathematics). Table 23 displays the percentage of responding apprentices reporting large or extreme gains in science-related practice. Apprentices reported large or greater gains on their ability to support an explanation for an observation with data from experiments (83%), carry out procedures for an investigation and record data properly (82%), identify the limitations of the methods and tools used for data collection (80%), design appropriate procedures for an experiment (72%), support an explanation with relevant STEM knowledge (72%), ask a scientific question (69%), consider different interpretations of data (69%), and use knowledge and creativity to suggest a testable explanation (67%). Less than half of responding apprentices reported large gains on only three items in the survey, their

[11] The Cronbach's alpha reliability for these 5 items was 0.895.

ability to make a model of an object or system showing it parts and how they work (48%), defending an argument (44%), and using computer models (37%).

Table 23. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Science Practices (n = 54)	
Item	**Questionnaire Respondents**
Supporting an explanation for an observation with data from experiments	83%
Carrying out procedures for an experiment and recording data accurately	82%
Identifying the limitations of the methods and tools used for data collection	80%
Designing procedures for an experiment that are appropriate for the question to be answered	72%
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	72%
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	72%
Asking a question that can be answered with one or more scientific experiments	69%
Considering different interpretations of data when deciding how the data answer a question	69%
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	67%
Organizing data in charts or graphs to find patterns and relationships	63%
Integrating information from technical or scientific texts and other media to support your explanation of an observation	61%
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	61%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	54%
Making a model of an object or system showing its parts and how they work	48%
Defending an argument that conveys how an explanation best describes an observation	44%
Using computer models of objects or systems to test cause and effect relationships	37%

Table 24 shows data for apprentices whose experience focused on the other STEM areas (technology, engineering, and mathematics), specifically self-reported impacts on their abilities related to key engineering practices. The data collected for the apprentices focusing on engineering practices roughly parallels the data collected for the apprentices focusing on science. The apprentices with technology, engineering, and mathematics focused experiences reported large gains in supporting a solution with relevant knowledge (65%) and carrying out procedures for an experiment (65%), just as those whose experiences focused on science. However, overall the percentages of gains in STEM competencies for the engineering apprentices were slightly lower than for the science apprentices. Mentors reported similar gains in apprentices' engineering practices (see Appendix C).

Table 24. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Engineering Practices (n = 57-58)	
Item	**Questionnaire Respondents**
Using knowledge and creativity to propose a testable solution for a problem	68%
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	65%
Carrying out procedures for an experiment and recording data accurately	65%
Defining a problem that can be solved by developing a new or improved object, process, or system	58%
Identifying the limitations of the methods and tools used for data collection	58%
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	57%
Considering different interpretations of the data when deciding if a solution works as intended	52%
Integrating information from technical or scientific texts and other media to support your solution to a problem	52%
Supporting a solution for a problem with data from experiments	48%
Making a model of an object or system to show its parts and how they work	45%
Using computer models of an object or system to investigate cause and effect relationships	45%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	43%
Designing procedures for an experiment that are appropriate for the question to be answered	42%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	42%
Defend an argument that conveys how a solution best meets design criteria	40%
Organizing data in charts or graphs to find patterns and relationships	29%

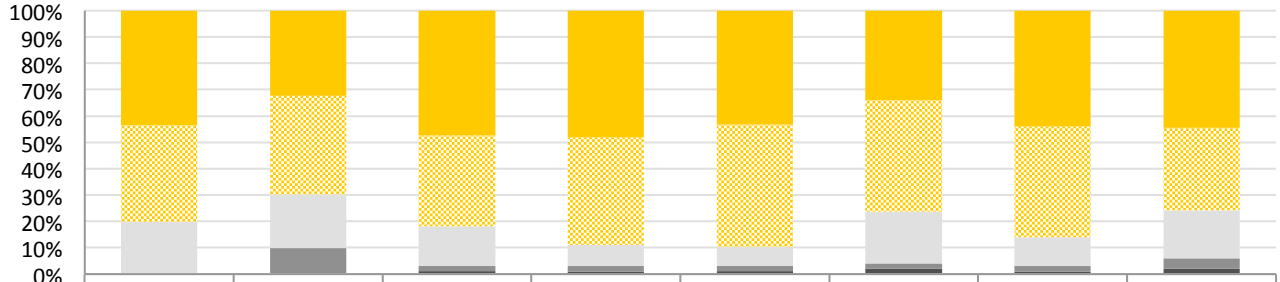
Composite scores were calculated for each set of practices items[12] on the apprentice questionnaire to examine whether the REAP program had differential impacts on subgroups of apprentices. There were no significant differences between males and females, minority and non-minority apprentices, school location, or FRL status on either composite.

The impact of REAP on "21st Century Skills"[13] that are necessary across a wide variety of fields were also examined in the survey. As can be seen in Chart 17, more than three quarters of responding apprentices reported large or extreme gains

[12] The science practices composite has a Cronbach's alpha reliability of 0.941; the engineering practices composite has a Cronbach's alpha reliability of 0.964.

on each of these skills, including working well with people from all backgrounds (87%), making changes with things do not go as planned (89%), communicating effectively with others (86%), learning to work independently (81%), and viewing failure as an opportunity to learn (75%). Apprentices reported similar gains regardless of race/ethnicity, gender, FRL status, or school location. In addition, mentor reports of apprentice gains in this area are generally similar to those of the apprentices, although the mentors often reported greater apprentice gains.

Chart 17: Apprentice Report of Impacts on 21st Century Skills (n = 84-85)



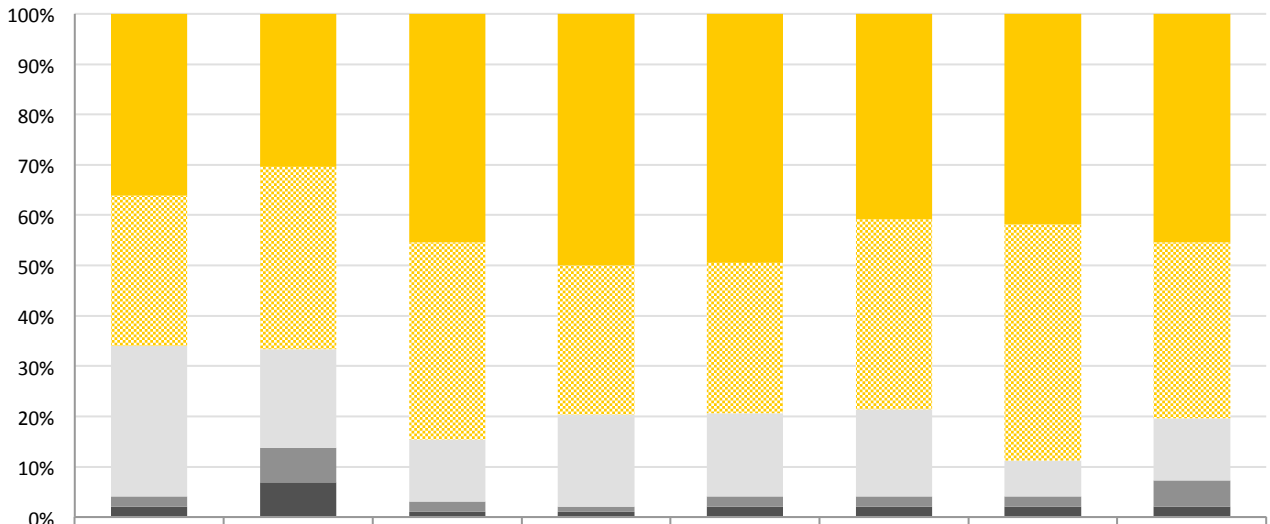
	Learning to work independently	Setting goals and reflecting on performance	Sticking with a task until it is complete	Making changes when things do not go as planned	Working well with people from all backgrounds	Including others' perspectives when making decisions	Communicating effectively with others	Viewing failure as an opportunity to learn
Extreme gain	44%	33%	47%	48%	42%	33%	44%	44%
Large gain	37%	38%	34%	41%	45%	41%	42%	31%
Some gain	20%	21%	15%	8%	7%	19%	11%	18%
A little gain	0%	10%	2%	2%	2%	2%	2%	4%
No gain	0%	0%	1%	1%	1%	2%	1%	2%

[13] The Cronbach's alpha reliability for these 8 items was 0.813.

STEM Identity and Confidence

Increasing REAP participants' 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.[14] Consequently, the apprentice questionnaire included a series of items intended to measure the impact of REAP on apprentices' STEM identity.[15] These data are shown in Chart 18 and strongly suggest that the program has had a positive impact in this area. For example, 82% of responding apprentices reported a large or extreme gain in send of accomplishing something in STEM. Similarly, substantial proportions of apprentices reported large or greater gain in their desire to build relationships with their mentors (87%), connecting a STEM topic to a personal interest (78%), and feeling prepared for more challenging STEM activities (78%). In addition, 77% reported an increase in their confidence to try out new ideas or procedures, and 68% reported that REAP was influential in deciding on a path to pursue a STEM career. There were no differences in impact based on gender, race/ethnicity, FRL eligibility, or school location.

Chart 18: Apprentice Report of Impacts on STEM Identity (n = 84-85)



	Interest in a new STEM topic or field	Deciding on a path to pursue a STEM career	Sense of accomplishing something in STEM	Feeling prepared for more challenging STEM activities	Confidence to try out new ideas or procedures	Patience for the slow pace of STEM research	Desire to build relationships with mentors	Connecting a STEM topic or field to my personal interests
Extreme gain	35%	31%	44%	49%	48%	40%	41%	44%
Large gain	29%	37%	38%	29%	29%	37%	46%	34%
Some gain	29%	20%	12%	18%	16%	17%	7%	12%
A little gain	2%	7%	2%	1%	2%	2%	2%	5%
No gain	2%	7%	1%	1%	2%	2%	2%	2%

[14] 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.

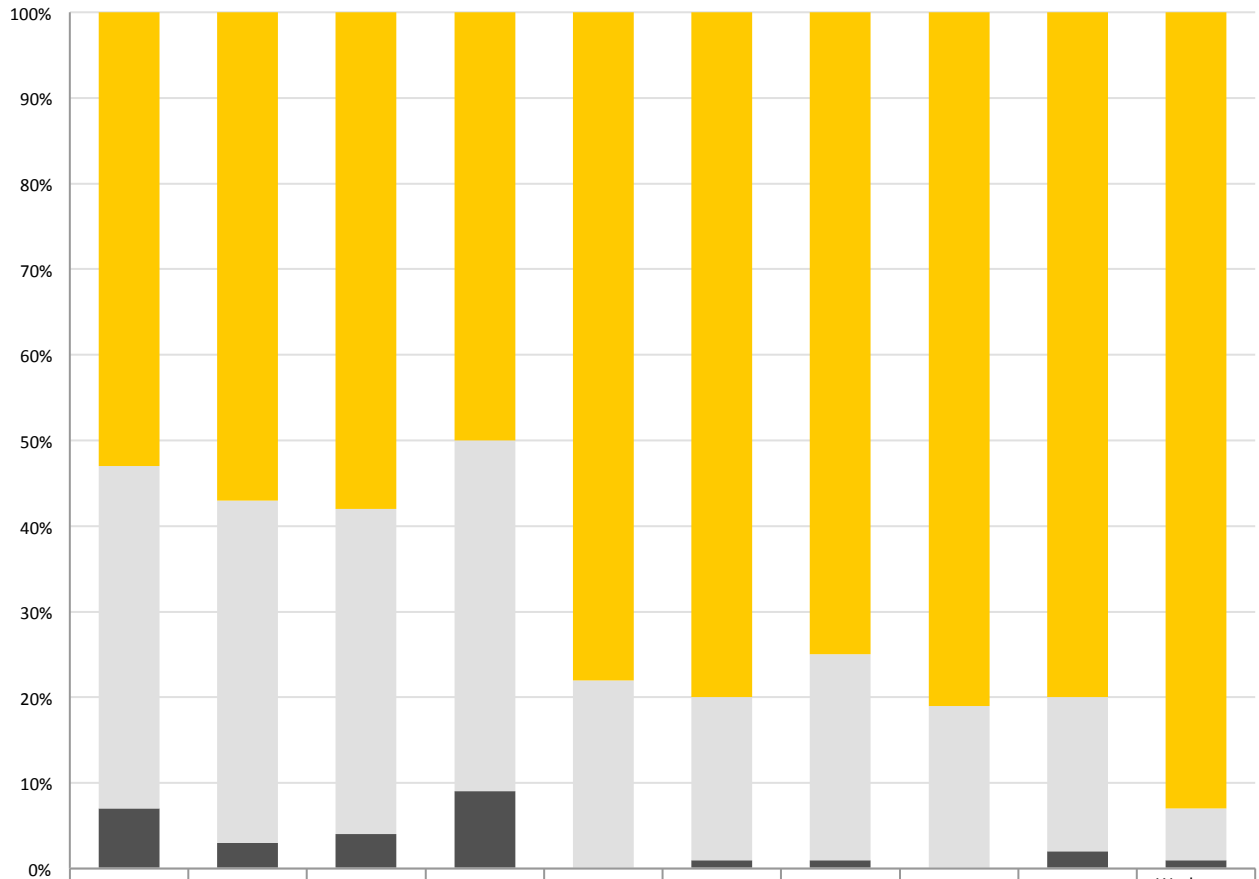
[15] The Cronbach's alpha reliability for these 6 items was 0.902.

Interest and Future Engagement in STEM

The REAP evaluation included a focus on the AEOP key goal to develop a STEM-literate citizenry. In order to examine the impact of REAP on apprentices' interest in future engagement in STEM, participants were asked to reflect on their intentions to engage in STEM activities outside of school, as well as their interest level in participating in future AEOP programs. As can be seen in Chart 19, apprentices indicated they were more likely to engage in many of these activities as a result of REAP. For example, 93% reported being more likely to work on a STEM project or experiment in a university or professional setting; 80% to take an elective STEM class; 81% to participate in a STEM camp, club, or competition; and 80% to mentor or teach other students about STEM. A composite score was created from these items,[16] and composite scores were compared across subgroups of apprentices. There were no statistically significant differences by race/ethnicity or FRL status; however, there was one significant difference by gender. As a result of participating in REAP, significantly more males than females reported being more likely to use a computer to design or program something[17] (a medium effect size of d = 0.575 standard deviations).

[16] These 10 items had a Cronbach's alpha reliability of 0.861.
[17] Two-tailed independent samples t-test, $t(75) = 2.49$, $p = 0.015$.

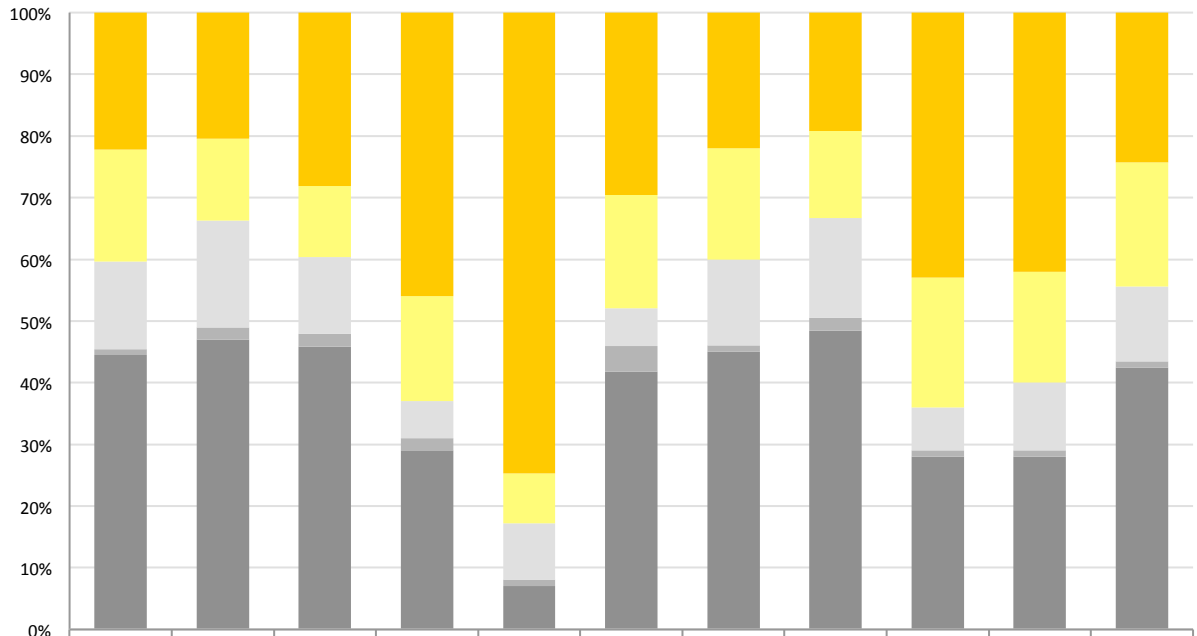
Chart 19: Change in Likelihood Apprentices Will Engage in STEM Activities Outside of School (n = 85)



	Watch or read non-fiction STEM	Tinker (play) with a mechanical or electrical device	Work on solving mathematical or scientific puzzles	Use a computer to design or program something	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 STEM camp, fair, or competition	Take an elective (not required) STEM class	Work on a STEM project/ experiment in a university/ professional setting
More likely	53%	57%	58%	50%	78%	80%	75%	81%	80%	93%
About the same	40%	40%	38%	41%	22%	19%	24%	19%	18%	6%
Less likely	7%	3%	4%	9%	0%	1%	1%	0%	2%	1%

A large majority (82%) of participants indicated being interested in participating in REAP again; 64% in URAP, and 60% in SMART (see Chart 20). These results are encouraging as SMART and URAP were among the programs mentors most frequently discussed with their apprentices. Roughly equal proportions of apprentices (~10-20%) expressed having no interest or a little interest in JSHS, GEMS Near Peers, and UNITE. The large percentages (28-48%) of REAP apprentices that have not heard of the other programs is notable, as is the 7% of REAP apprentices that reported they had never heard of the REAP program.

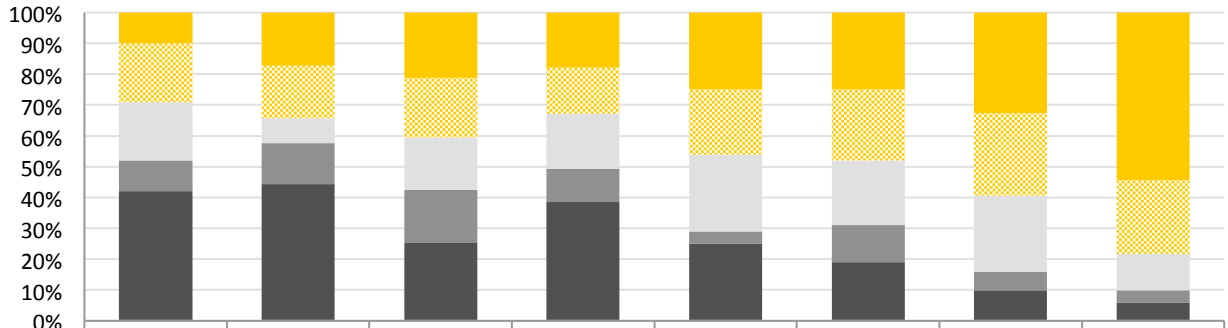
Chart 20: Apprentice Interest in Future AEOP Programs (n = 83-85)



	GEMS	UNITE	JSHS	SEAP	REAP	HSAP	CQL	GEMS Near Peers	URAP	SMART College Scholarship	NDSEG Fellowship
Very Much	22%	20%	27%	46%	74%	29%	22%	19%	43%	42%	24%
Somewhat	18%	13%	11%	17%	8%	18%	18%	14%	21%	18%	20%
A little	14%	17%	12%	6%	9%	6%	14%	16%	7%	11%	12%
Not at all	1%	2%	2%	2%	1%	4%	1%	2%	1%	1%	1%
Never heard of program	44%	46%	44%	29%	7%	41%	45%	48%	28%	28%	42%

As can be seen in Chart 21, simply participating in REAP was most likely to be rated as impacting their awareness of AEOP "somewhat" or "very much" (79%). Their mentor (60%) was also rated by a majority of apprentices as having at least somewhat of an impact on their awareness of AEOP programs.

Chart 21: Impact of Resources on Apprentice Awareness of AEOPs (n = 84-85)

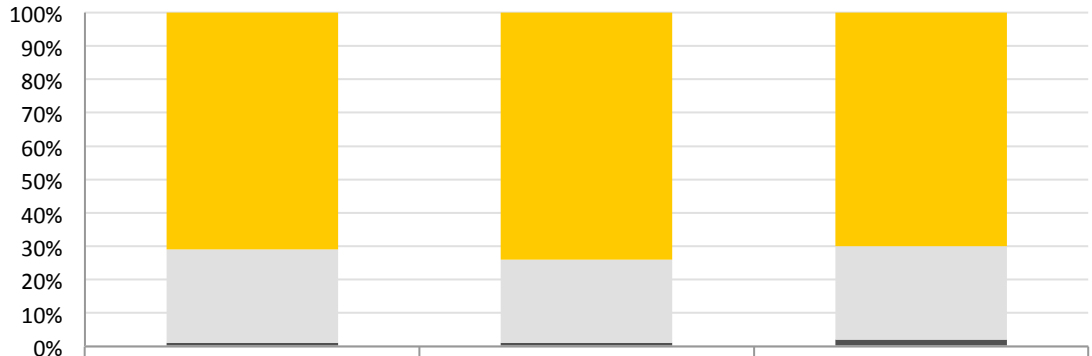


	AAS website	Invited speakers or "career" events	AEOP brochure and/or presentation	AEOP social media	AEOP website	AEOP instructional supplies (Rite in the Rain notebook, Lab Coat, etc.)	My mentor(s)	Participation in REAP
Very Much	10%	17%	21%	25%	25%	25%	33%	55%
Somewhat	19%	17%	19%	21%	21%	23%	27%	24%
A little	19%	8%	17%	25%	25%	21%	25%	12%
Not at all	10%	13%	17%	15%	4%	12%	6%	4%
Did not experience	42%	44%	25%	54%	25%	19%	10%	6%

Attitudes toward Research

A focus of the AEOP apprenticeship programs is to raise awareness of and improve attitudes and interest in the DoD research. In order to gauge apprentices' attitudes in this area, the questionnaire also asked about their opinions of what DoD researchers do and the value of DoD research more broadly. The data indicate that most responding apprentices have favorable opinions (see Chart 22). For example, 74% agreed or strongly agreed that DoD research develops cutting-edge technologies, 73% agree that DoD research is valuable to society, 70% that DoD researchers solve real-world problems, and 71% that DoD researchers advance science and engineering fields.

Chart 22: Apprentice Opinions about DoD Researchers and Research (n = 82-83)



	DoD researchers advance science and engineering fields	DoD researchers develop new, cutting edge technologies	DoD researchers solve real-world problems
Strongly agree or agree	71%	74%	70%
Neither agree nor disagree	28%	25%	28%
Strong disagree or disagree	1%	1%	2%

Education and Career Aspirations

The REAP program, like the other AEOP programs, is focused on positively impacting apprentices' future education and career aspirations. The participant questionnaire asked apprentices to share how far they wanted to go in school before and after participating in REAP. As can be seen in Table 25, the 1% of students who only wanted to graduate from high school had changed their mind to include post-high school education in their plans. Before the REAP experience, 19% of apprentices wanted to get as far as finishing college with a Bachelor's degree, and after REAP that number declined by 10%, indicating that REAP influenced more apprentices to graduate with a Bachelor's degree. Overall the percentages clearly shifted to the apprentices wanting to pursue terminal degrees, such as getting a Ph.D. (from 15% before REAP to 25% after REAP), a combined M.D./Ph.D. (from 12% to 19%), and other professional degrees (5% to 8%).

Table 25. Apprentice Education Aspirations (n = 86)		
	Before REAP	**After REAP**
Graduate from high school	1.16%	0.00%
Go to a trade or vocational school	0.00%	1.16%
Go to college for a little while	1.16%	1.16%
Finish college (get a Bachelor's degree)	18.60%	8.14%
Get more education after college	5.81%	4.65%
Get a master's degree	20.93%	15.12%
Get a Ph.D.	15.12%	24.42%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	20.93%	18.60%
Get a combined M.D. / Ph.D.	11.63%	18.60%
Get another professional degree (law, business, etc.)	4.65%	8.14%

REAP apprentices were asked what kind of work they expect to be doing at age 30, both reflecting on what their aspiration was before participating in REAP and after REAP (see Table 26). Some apprentices expressed interest in STEM-related careers both before and after participating in REAP. For example, 26% indicated aspiring to a career in engineering before REAP, with another 29% interested in medicine. After REAP, 27% of apprentices expressed interest in engineering, and 32% in medicine. To examine whether the REAP program increased apprentice interest in STEM-related careers; each career option was coded as being STEM related or non-STEM related. Although some apprentices switched their aspirations from a non-STEM field to a STEM field, there was not a statistically significant increase in the proportion of apprentices aspiring to a STEM-related career.

Table 26. Apprentice Career Aspirations (n = 85)		
	Before REAP	**After REAP**
Medicine (doctor, dentist, veterinarian, etc.)	29.4%	31.8%
Engineering	25.9%	27.1%
Physical science (physics, chemistry, astronomy, materials science)	7.1%	8.2%
Other, (specify):	4.7%	8.2%
Undecided	5.9%	3.5%
Science (no specific subject)	8.2%	2.4%
Biological science	2.4%	2.4%
Computer science	1.2%	2.4%
Technology	0.0%	2.4%
Health (nursing, pharmacy, technician, etc.)	4.7%	2.4%
Military, police, or security	1.2%	2.4%
Earth, atmospheric or oceanic science	0.0%	1.2%
Environmental science	0.0%	1.2%
Mathematics or statistics	0.0%	1.2%
Teaching, STEM	1.2%	1.2%
Business	1.2%	1.2%
Law	4.7%	1.2%
Social science (psychologist, sociologist, etc.)	1.2%	0.0%
Teaching, non-STEM	0.0%	0.0%
Art (writing, dancing, painting, etc.)	1.2%	0.0%
Skilled trade (carpenter	0.0%	0.0%

Apprentices were also asked how they expected to use their STEM knowledge, skills, and/or abilities in their work when they are age 30. As can be seen in Table 27, all apprentices expect to use STEM somewhat in their career. A majority (55%) expects to use STEM 75-100% of the time in their work, 28% expect to use STEM 51-75% of the time, and 14% expect to use STEM 26-50% of the time.

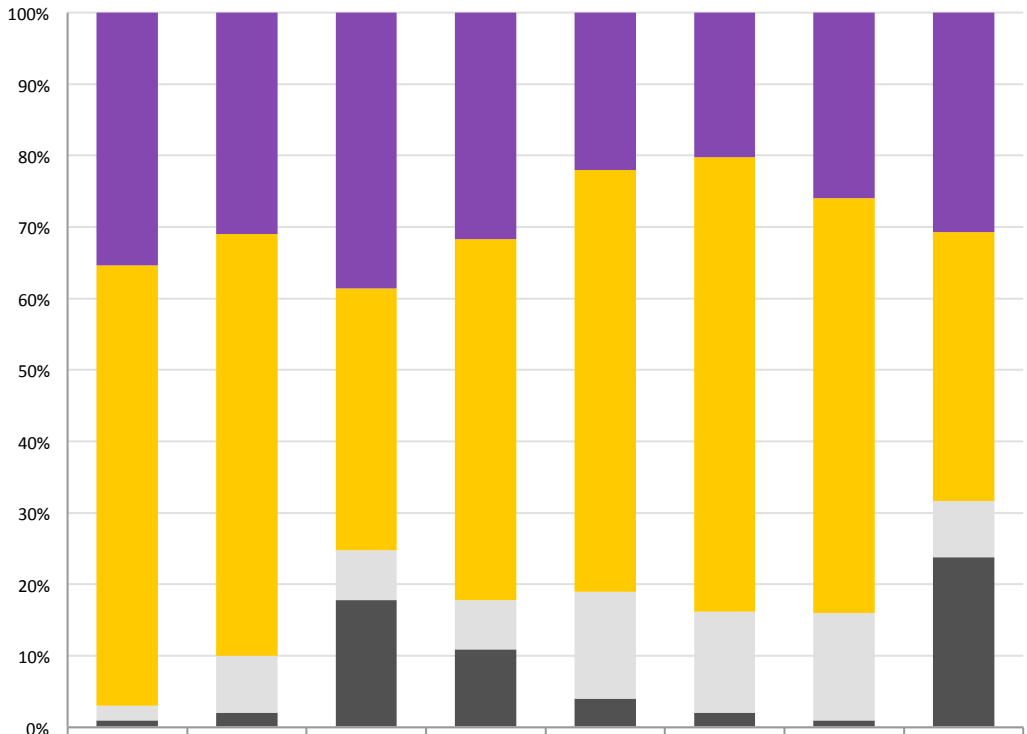
Table 27. Apprentices Expecting to use STEM in Their Work at Age 30 (n = 86)	
	Questionnaire Respondents
Not at all	0.00%
Less than 25% of the time	3.49%
26% to 50% of the time	13.95%
51% to 75% of the time	27.91%
75% to 100% of the time	54.65%

Overall Impact

Apprentices were asked about the overall impacts of participating in REAP on them personally. From these data, it is clear that apprentices thought the program had a substantial impact on them (see Chart 23). For example, a large majority of responding apprentices indicated being more confident in their STEM knowledge, skills, and abilities after participation, with 61% reporting that REAP contributed to this impact and another 35% reporting that REAP was the primary reason for this impact. Similarly, apprentices indicated increased interest in participating in STEM activities outside of school assignments (59% reporting that REAP contributed, 31% reporting that REAP was the primary reason) and more awareness of other AEOPs (37% and 39%). Apprentices also reported interest in participating in other AEOPs (51% and 32%), interest in taking STEM classes (59% and 22%), interest in earning a STEM degree (63% and 20%), and pursuing a STEM career (58% and 26%). These items were combined into a composite variable[18] to test for differences among subgroups of apprentices; there were no significant differences found related to gender, race/ethnicity, and FRL status. Mentors reported impacts were somewhat higher than those of the apprentices (see Appendix C).

[18] The Cronbach's alpha reliability for these 10 items was 0.802.

Chart 23: Apprentice Opinions of REAP Impacts (n = 84-85)



	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 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
Agree - REAP was primary resason	35%	31%	39%	32%	22%	20%	26%	31%
Agree - REAP contributed	61%	59%	37%	51%	59%	63%	58%	38%
Disagree - happened, but not because of REAP	2%	8%	7%	7%	15%	14%	15%	8%
Disagree - did not happen	1%	2%	18%	11%	4%	2%	1%	24%

Apprentices were asked to list the three most important ways they benefited from the REAP program. More than half of the responding apprentices (61%) wrote about the opportunity to do hands-on research/work in a laboratory; and named increased knowledge as a benefit, both general knowledge as well as specific content knowledge (60%). Other benefits mentioned by many apprentices included helping to make future career decisions (21%), building confidence and leadership skills (15%), and collaborating and expanding their networks (14%).

Apprentice comments from the interviews expand on some of these impacts. As four apprentices said:

Yes, I did learn a lot about STEM careers because my mentor is a pediatric cardiac surgeon, which is what I want to be when I grow up. I worked in his lab all summer and I learned a lot because a lot of his postdocs taught me about what they do and the research that they're doing. I learned how to stain over the summer. I did a lot of staining with a lot of different antibodies on all of the adapted and immune system cells to the staining. I learned how to section as well which is something that they thought it would be useful because it's a big part of the step. (REAP Apprentice)

I didn't really know what engineering was, a plastics engineering was, but once I saw the science side of it, it does involve a lot of chemistry. I didn't know plastics involved this much chemistry until now. (REAP Apprentice)

Yes, I pretty much confirmed what I wanted to do career-wise; I got to think how serious I was because I can't think of anything negative about this. (REAP Apprentice)

I will write it on my resume. They'll see that I've been doing something outside of school, and this has taught me more than school would, because lots of the lab equipment in the university, I've never even seen at school. (REAP Apprentice)

"It was really just the best option for me. It was the best way to go in terms of being in a genuine research experience." – REAP Apprentice

Summary of Findings

The FY15 evaluation of REAP collected data about participants, their perceptions of program processes, resources, and activities, and indicators of achievement related to AEOP's and REAP's objectives and intended outcomes. A summary of findings is provided in the following table.

2015 REAP Evaluation Findings	
Participant Profiles	
REAP continues to have success in serving historically underrepresented and underserved populations.	REAP experienced continued success in recruiting female students at a high rate. In fact, 61% of participants in FY15 were female, a population that is historically underrepresented in engineering fields. There was a slight decrease in participants (14%) and mentors (8%) in FY15 compared to FY14.
	REAP was very successful in meeting the program requirement of providing outreach to students from historically underrepresented and underserved groups as defined in admission requirements (students must self-identify as meeting at least two of the following requirements: qualifies for free or reduced-price lunch; is a minority historically underrepresented in STEM (Alaskan Native, Native American, Black or African American, Hispanic, Native Hawaiian, or other Pacific Islander); is a female pursuing research in physical science, computer science, mathematics, or engineering; receives special education services; has a disability; speaks English as a second language; or is a potential first-generation college student). In fact, 34% of apprentices identify as Black or African American, 23% as Hispanic or Latino, and 61% as female. Further, 91% of the participating apprentices attend Title I schools (students from Title I schools typically come from underrepresented and underserved populations).
	Most apprentices reported attendance at public schools (91%) and schools in suburban settings (56%). However, a third of students came from schools in urban areas (35%), which tend to have higher numbers or proportions of underrepresented and underserved groups.
	REAP continued to implement the bridge with UNITE, another AEOP program that serves students from underrepresented and underserved groups. In 2015, 24 alumni of UNITE participated in REAP apprenticeships.
The diversity of the mentors continues to grow.	FY15 mentors were remained predominantly male (76%) and White (38%). This did represent a decrease in the percentage of White mentors overall.
	A comparison of apprentice and mentor demographics suggested that many apprentices of underserved or underrepresented populations are not likely to have mentors sharing the same gender or race/ethnicity. Having a mentor who shares an apprentice's gender or race/ethnicity is a potential motivator for reducing stereotypes and increasing students' performance and persistence in STEM.

Apprentices demonstrated a greater interest in pursuing a career in a STEM-related field after participating in REAP.	97% of the 85 apprentice respondents indicated their intent to pursue a career in a STEM-related field. More respondents intended to pursue careers in Medicine/Health (32%) than any other field, with Engineering (27%) and Physical Science (8%) being the next most frequently reported fields.
Actionable Program Evaluation	
REAP marketing and recruitment was focused at the local level.	Mentors reported using connections with local school teachers (44%) to recruit participants, as well as school based communications (31%), and communications by universities and faculty (24%). Applications solicited by the AAS and general AEOP marketing were also used to recruit apprentices (51%).
	Apprentices most frequently learned about REAP from teachers and professors (56%), school newsletters, emails, or websites (20%), from a REAP mentor (15%), or from the AEOP website (15%).
	Mentors learned about REAP from the AAS website (33%), from a superior (29%), such as a Department Chair, Center Director, or Dean, and 24% from a past REAP participant.
REAP is strongly marketed to students from historically underrepresented and underserved groups.	The RFP specified to university directors/mentors that the targeted participants were underrepresented and underserved high school students. In addition, the REAP administrator worked with all of the directors and mentors to ensure that the students being considered for the apprenticeships identified as coming from an underrepresented and underserved groups.
Participation in REAP helps students identify knowledge and skills for STEM careers.	Many apprentices received encouragement to participate from others, including friends, family members, and school staff, often who have current or past connections to the REAP program. Apprentices who participate in REAP report having clear understandings of the knowledge and skills it takes to succeed in a STEM career.
REAP apprentices engage in meaningful STEM learning through team-based and hands-on activities.	Most apprentices (84-97%) reported learning about new STEM topics, communicating with other students about STEM, and interacting with STEM professionals.
	Apprentices had many opportunities to engage in a variety of STEM practices during their REAP experience. For example, 81% participating in hands-on activities, 82% working as part of a team, 80% analyzing or interpreting data or information, and 73% drawing conclusions from an investigation on most days or every day.
	Apprentices reported greater opportunities to learn about STEM and greater engagement in STEM practices in their REAP experience than they typically have in school.
	Many mentors reported using strategies to help make learning activities to students relevant, support the needs of diverse learners, develop students' collaboration and interpersonal skills, and engage students in "authentic" STEM activities.
REAP promotes STEM research and careers but can continue to improve mentors' awareness of and resources for promoting	Mentors reported limited awareness of or past participation in an AEOP initiative beyond REAP. Twenty-four percent of responding mentors had past experience with REAP but with the exception of UNITE, 90% of responding mentors indicated they had not participated in the other AEOP programs. Nearly half of the responding mentors had participated in UNITE (49%). In addition, most apprentices reported an increase in

AEOP opportunities and DoD STEM careers.	awareness of other AEOPs, and only 17% of the apprentices reported that their mentors never recommended any AEOP programs, down from 68% in 2014.
	Mentors reported sharing information with apprentices about STEM majors and careers (75% of apprentices reported learning about three or more STEM careers), but few of those were DoD STEM careers. Some mentors stated that they were unaware of DoD STEM careers, and 45% of apprentices reported that their mentors never discussed STEM career opportunities with the DoD (down from 68% in 2014).
The REAP experience is greatly valued by apprentices and mentors.	Apprentices indicated satisfaction with the REAP research experience overall. Open-ended responses about the overall experience highlighted apprentices' opportunity to do hands-on research and learn about STEM content and research. Apprentices also commented on how REAP provided opportunities they do not get in school and would not otherwise have.
	A majority of responding mentors reported positive experiences. Further, many commented on the benefits the program provides apprentices, including hands-on research experience and increases in STEM content knowledge.
Outcomes Evaluation	
REAP apprentices reported gains in STEM knowledge and competencies.	Apprentices 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 apprentice groups.
	Apprentices reported impacts on their abilities to do STEM, including such things as reading technical or scientific texts to learn about the natural or designed worlds, designing and carrying out procedures for investigations, asking questions to understand data, and deciding what kind of data to collect to answer a question.
REAP apprentices' reported gains in 21st Century Skills.	Apprentices reported large or extreme gains on their patience for the slow pace of research, making changes when things do not go as planned, and sticking with a task until it is complete.
REAP apprentices reported increased confidence and identity in STEM, as well as increased interest in future STEM engagement.	Apprentices reported a large or extreme gain on their preparedness for new STEM activities (78%), their confidence in trying out new ideas or procedures (77%), desire to build relationships with mentors (87%), and connecting a STEM topic to their personal interests (78%). In addition, 82% reported an increase in their sense of accomplishing something in STEM, and 68% reported deciding on a path to pursue a STEM career.
	A majority of apprentices indicated that as a result of REAP, they were more likely to work on a STEM project in a university or professional setting; participate in a STEM club, student organization, or professional organization; work on solving mathematical or scientific puzzles; or help with a community service project related to STEM.
REAP apprentices reported increased higher education aspirations and interest in pursuing STEM careers.	After participating in REAP, apprentices indicated being more likely to go further in their schooling than they would have before REAP, with the greatest change being in the proportion of apprentices who expected to continue their education beyond a Bachelor's degree (81% before REAP, 92% after) and get a Ph.D. (15% before and 24% after).
	Apprentices 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. The majority of the apprentices were interested in STEM-related careers before participating in REAP, and almost all were interested in STEM-related careers after participating in REAP.
A substantial portion of apprentices expressed interest in future AEOP opportunities. However, many REAP apprentices and mentors were largely unaware of other AEOP initiatives.	At the end of their apprenticeship, many apprentices reported that they had never heard of any of the AEOPs except for REAP (77-99% of apprentices, depending on the program). However, after participating in REAP, a large proportion of apprentices were somewhat to very interested in participating in other AEOP initiatives in the future (83% of apprentices). This ongoing trend continues to occur despite communication efforts to apprentices, mentors and directors such as sending apprentices AEOP materials, a welcome letter, brochures, suggestions to review the AEOP website, and additional materials to take back to schools.
REAP apprentice reported awareness and appreciation of DoD STEM research and careers increased. REAP apprentices also expressed interest in pursuing a STEM career with the DoD.	A majority of apprentices reported that they had a greater interest (84%) and awareness (69%) of DoD STEM research and careers. Apprentices cited their participation in REAP (52%), their REAP mentor (45%), and the AEOP instructional supplies (42%) as having the most impact on their awareness of DoD STEM careers.
Participation in evaluation surveys have increased, providing more complete information about REAP outcomes	A recommendation from the 2014 Evaluation Report included the need for increased participation in REAP evaluation efforts. The REAP program had an 84% return rate for apprentice surveys and a 74% return rate for mentor surveys. FY 15 had a 36% increase in apprentice surveys and a 21% increase in mentor survey responses from FY 14.

Recommendations

Evaluation findings indicate that FY15 was a successful year overall for the REAP program. The REAP program has the goal of broadening the talent pool in STEM fields, and, overall, the program has been successful at attracting students from groups historically underrepresented and underserved in these fields. A primary area of growth for REAP has been in broadening diversity of participants. In particular, there has been a steady increase in the number of female apprentices. There has also been an increase in the number of African American mentors from 2014, providing more exposure to role models from historically underserved and underrepresented in STEM careers. Strategies that have been shown to be effective for encouraging historically underserved and underrepresented students in STEM careers include providing role models for students, exposing them to different education and career possibilities, providing guidance on how to pursue specific education and career paths (e.g., what courses they need to take in school, how to navigate the college application process), and providing coaching on the "soft skills" (e.g., time management, communication skills) needed to be successful in STEM careers. This is an encouraging trend and it is expected that having more role models

will continue to encourage students from groups historically underrepresented and underserved in STEM to participate in REAP.

A second area of strength for REAP was the growth in number of apprentices who intended to pursue a STEM career after participation in the program. REAP apprentices who did not intend to pursue a career in STEM before participating clearly change their mind to pursue a STEM career after the REAP experience. This positive momentum in diversity the STEM pipeline presents an opportunity to inform apprentices of tangible career goals in Army/DoD STEM careers.

A third area of strength for REAP is reported meaningful STEM learning in the REAP program. Both mentors and apprentices reported increased confidence in pursuing STEM activities. Most of the REAP apprentices intend to continue to pursue STEM activities outside of school, and outreach to these apprentices about other opportunities is encouraged. One example of a positive trend is the UNITE/REAP partnership. 24 students from UNITE received REAP apprenticeships in 2015, up from 18 in 2014.

While these successes for REAP are commendable, there are some areas that remain with potential for growth and/or improvement. The evaluation team therefore offers the following recommendations for FY16 and beyond:

AEOP Priority: Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base

1. Although the REAP mentor group was more diverse ethnically, there were fewer female mentors than in 2014. Efforts should be made to focus on increasing the number of female mentors, perhaps by encouraging junior faculty (typically more female professors are in the lower ranks in STEM fields) to partner with senior faculty to submit proposal to be a REAP site. This could be marketed as professional development for both the junior and senior faculty members. Additionally, if each mentor/apprentice pair occasionally met in groups with other mentor/apprentice pairs, not only could they share resources, apprentices would be exposed to a more diverse range of mentor backgrounds.

2. A number of apprentices suggested that the REAP program could be improved by extending the length of the experience. Similar to responses from FY14, many apprentices in FY 15 noted that 5-8 weeks was not enough time to learn about and get involved with a research project. Some of the mentors also said that the apprenticeship experience should be lengthened. Suggestions were made by both mentors and apprentices to extend the apprenticeship into the school year and/or to continue working with the same project for at least two summers. Another option for intensified mentorship is to train mentors in the key elements of a cognitive apprenticeship model: introductory tasks that are familiar to students, breakdown of the problem, and introduction of precise rules that are used by scientists/engineers (Brown, Collins & Duguid, 1989). Mentors mentioned in the interviews that working with high school students is a different situation than working with undergraduates, and needed some training in working with younger students.

3. Efforts should be made to help mentors and apprentices become more aware of DoD STEM research and careers. Forty-five percent of apprentices reported not learning about any DoD STEM careers during their REAP experience. Comments from mentors in the focus group and open-ended questionnaire items suggest that they are not familiar with DoD STEM careers and did not spend very much time discussing DoD STEM careers with apprentices. The program should continue to provide mentors and apprentices with new materials and resources (website links, articles, etc.) that describe current DoD STEM research and careers which can be easily passed on to all REAP apprentices. Creating a network for mentors to form a community of practice where mentors can share their research activities with other mentors could be a first step to informing apprentices about other Army/DoD STEM careers.

4. Mentors and apprentices mentioned that the amount of the stipend was too small. One mentor mentioned that they never paid themselves out of the funding, and rather they made sure the students had an appropriate stipend. One mentor mentioned that the magnitude of the stipend was below the minimum wage for the state in which the REAP program was located, and elaborated that paying such a low amount was actually against the state law. If REAP intends to encourage awareness of Army/DoD STEM careers, the compensation should be aligned to the compensation of the career in which the apprentice is participating. The program is encouraged to revisit the funding structure to address the small stipend to the students. SEAP students receive on average $1400/month of their apprenticeship, using a stipend scale based on education and experience. Perhaps AAS could look into a similar approach to student stipends.

AEOP Priority: Support and empower educators with unique Army research and technology resources

1. REAP should continue to focus on growing the number of mentors participating in the program to work toward a 1:1 mentor/apprentice ratio. One potential strategy for consideration is to increase the amount of the mentor stipend (currently $1,000).

2. As was found in 2014, REAP apprentices report having little previous experience with AEOP and limited knowledge of other AEOP programs, even after participating in REAP. Given the goal of having apprentices progress from REAP into other AEOP programs, the program may want to have a systematic method to inform mentors in tangible ways to increase apprentices' exposure to AEOP. Only 54% of mentors recommended other AEOPs to apprentices. For example, mentors mentioned that they were vaguely aware of other programs and provided some accurate descriptions of the programs. However, they could not name the programs or provide information that might lead an interested student to a website. The program should work with each site to ensure that all apprentices have access to structured opportunities—such as invited speakers, presentations, and career events—that both describe the other AEOPs and provide information to apprentices on how they can apply to them.

3. Exposure to DoD STEM careers and research are also areas targeted for improvement for REAP. Some strategies that the program may consider are having webinars for students, creating DoD STEM career information and

materials, and recruiting speakers in different STEM disciplines to enhance the program. Currently the program is exploring the possibility of all students talking with each other through a webinar format. The program should also provide mentors with materials (website links, printed materials) that can be easily shared with interested apprentices. AAS is encouraged to find a way to provide a forum for REAP PIs and mentors to share best practices and experiences with other AEOPs and DoD careers/research. The AEOP CAM or Consortium Lead could develop and make available Power Point slides promoting both AEOP and DoD STEM careers and research.

Appendices

Appendix A

FY15 REAP Evaluation Plan

Purpose

Per the FY15 Army Education Outreach Program (AEOP) Annual Program Plan (APP), Virginia Tech will conduct an evaluation study of the Research and Engineering Apprenticeship Program (REAP) that includes two post-program questionnaires:

1. AEOP Youth Questionnaire to be completed by student participants of the REAP program at all university sites; and
2. AEOP Mentor Questionnaire to be completed by REAP mentors (typically a University Scientist or Engineer), and/or others who support students as they participate in the REAP program.

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.

From FY14 to FY15, questionnaire assessments have been revised and shorted while maintaining alignment 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., implementation and outcomes evaluation, outcomes evaluation of STEM-specific competencies, transferrable competencies, identifying with STEM, intentions to engage in STEM-related activities, and educational/career pathways);
- Best practices and published assessment tools in STEM education, informal STEM education, STEM outreach, and evaluation research communities;
- AEOP's vision to improve the quality of the data collected, focusing on changes in intended student outcomes and contributions of AEOPs like REAP effecting those changes.

Deployment of common questionnaires with items that are appropriate for all AEOP programs allows evaluators to compare findings across AEOPs and, if administered in successive years, to establish longitudinal studies of student outcomes through the pipeline of AEOP programming. Questionnaires incorporate batteries of items from established assessments that have been validated in published research making external comparisons possible.

All AEOPs are expected to administer a Youth and a Mentor questionnaire provided to them by VT. AEOP-wide Youth and Mentor questionnaires have two versions each; an "advanced" version (for JSHS and apprenticeship programs) and a "basic" version (for GEMS, JSS, and REAP). Similar item sets are used in both versions, with slight modifications to item wording or the number of items used to accommodate the needs of participants from each individual program. Additionally, program-specific questionnaires have been customized to gather information about programmatic structures, resources, and activities that are unique to each AEOP.

Youth Questionnaire Administration Details

- Distribute the survey near or after the conclusion of the students' REAP experience;

- Please encourage youth participants to participate in AEOP evaluation efforts. Before, during, and after the REAP program activities please mention that questionnaires are forthcoming. It is also helpful to remind Principal Investigators (PIs) and mentors about questionnaires so they can encourage students to participate as well as a reminder for themselves to participate in the surveys;
- If other, non-AEOP, survey(s) will be administered to REAP students please encourage them to prioritize the completion of AEOP's REAP evaluation survey. These data are critical to maintain funding for REAP. Additionally, evaluators will release de-identified data from these assessments to individual REAP sites to help them focus program improvement efforts;
- The REAP survey will be distributed using the CVENT registration system so please inform students and mentors that their registration with CVENT is crucial for the AEOPs records and to look for further communication from the Academy of Applied Science (AAS) and the AEOP through the CVENT portal:

Youth Participants – Evaluation Questionnaire Invitation

Dear REAP participant,

Evaluators from Virginia Tech are conducting a study to learn about student experiences in the Research and Engineering Apprenticeship Program (REAP). We are asking you to fill out this survey because you participated in REAP. Your feedback will be used to help us improve REAP for students in the future. The sponsor of REAP, the Army Educational Outreach Program (AEOP), is paying for this study. In 2015, more than 100 apprentices and 90 mentors will participate in REAP and evaluators from Virginia Tech want to hear from you and your mentor.

Here's how you can help:

1) *Complete the REAP Student Survey using the hyperlink below. Your parent or guardian has already provided permission for us to ask you to participate in the survey. Now, it is up to you to decide whether you want to participate or not. The survey takes 25-30 minutes to complete on average.*
   REAP Student Survey Link: Unique URL generated by CVENT
2) *Pass this email along to the mentor(s) who supported you as you as you participated in REAP. Ask them to complete the* ***REAP Mentor Survey.*** *The survey will take 25-30 minutes.*

If you have any questions about these surveys or your participation in the evaluation study please contact the AEOP Evaluation team at Virginia Tech: Tanner Bateman – tbateman@vt.edu.

Thank you so much for your participation in the evaluation of REAP!

Mentor Questionnaire Administration Details

- Distribute the survey near or after the conclusion of the mentors' REAP experience;
- Encourage all adults serving as REAP mentors (typically a University Scientist or Engineer), and others who supported students as they participated in REAP, to complete the survey;
- Encourage mentor participation in the evaluation study before, during, and after program activities;
- If other, non-AEOP, survey(s) will be administered to adults please encourage them to prioritize the completion of AEOP's REAP evaluation survey. These data are critical to maintain funding for REAP. Additionally, evaluators will release de-identified data from these assessments to REAP sites to help them focus program improvement efforts;

- The REAP survey will be distributed using the CVENT registration records so please inform students and mentors that their registration is crucial for the AEOPs records and to look for further communication from AAS and the AEOP through the CVENT portal:

Adult Participants – Evaluation Questionnaire Invitation

Dear Colleague:

You are receiving this email because you participated in the 2015 Research and Engineering Apprenticeship Program (REAP) program in support of one or more students' learning experience(s).

Evaluators from Virginia Tech are conducting program evaluation on behalf of the Technology Student Association (AAS) and U.S. Army. The purpose of evaluation is to determine how well the Army Educational Outreach Program (AEOP) is achieving its primary mission – promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). Virginia Tech is surveying adults who participated in REAP in support of students as they participated in the REAP program (REAP Mentors – University Scientists or Engineers). More than 100 students and 90 adults participated in the REAP program this year and Virginia Tech wants to hear from you!

Here's how you can help:

1) *Click on the link below and complete the **REAP Mentor Survey**. The survey will take about 25-30 minutes.*
   ***REAP Mentor Survey Link** provided by the CVENT system*
2) *Pass an email along to those students you supported in REAP and ask them to complete the appropriate survey. Their survey also takes about 25-30 minutes to complete.*

If you have any questions about the evaluation, these surveys, or your participation in the evaluation, please contact the AEOP Evaluation team: Tanner Bateman at tbateman@vt.edu.

Thank you so much for your participation in the evaluation of REAP.
Regards,

Appendix B

FY15 REAP Apprentice Data Summaries

REAP Apprentice 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)		
	Freq.	**%**
9th	9	10%
10th	22	26%
11th	40	44%
12th	17	20%
College freshman	0	0%
College sophomore	0	0%
College junior	0	0%
College senior	0	0%
Graduate program	0	0%
Other, (specify)	0	0%
Choose not to report	0	0%
Total	**98**	**100%**

What is your gender?		
	Freq.	**%**
Male	138	41%
Female	197	58%
Choose not to report	2	1%
Total	**337**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	55	16%
Asian	62	18%
Black or African American	130	39%
Native American or Alaska Native	2	1%
Native Hawaiian or Other Pacific Islander	3	1%
White	61	18%
Other race or ethnicity, (specify):	4	1%
Choose not to report	20	6%

Total	**337**	**100%**

Do you qualify for free or reduced lunches at school?		
	Freq.	**%**
Yes	37	42%
No	35	40%
Choose not to report	16	18%
Total	**88**	**100%**

Which best describes the location of your school?		
	Freq.	**%**
Frontier or tribal school	0	0%
Rural (country)	8	9%
Suburban	49	56%
Urban (city)	31	35%
Total	**88**	**100%**

What kind of school do you attend?		
	Freq.	**%**
Public school	80	91%
Private school	8	9%
Home school	0	0%
Online school	0	0%
Department of Defense school (DoDDS or DoDEA)	0	0%
Total	**88**	**100%**

At which of the following REAP sites did you participate? (Select ONE)						
	Freq.	%			Freq.	%
Alabama State University – Montgomery, AL	4	5%		Michigan Technological University – Houghton, MI	1	1%
University of Alabama – Huntsville, AL	2	3%		Oakland University – Rochester, MI	2	3%
Arizona State University – Tempe, AZ	0	0%		Jackson State University – Jackson, MS	4	5%
University of Arkansas at Pine Bluff – Pine Bluff, AK	2	3%		University of Missouri – Columbia, MO	0	0%
University of California, Berkeley – Berkeley, CA	2	3%		Montana State University – Bozeman, MT	1	1%
Colorado State University – Fort Collins, CO	2	3%		University of New Hampshire – Durham, NH	1	1%
University of Colorado, Boulder – Boulder, CO	0	0%		New Jersey Institute of Technology – Newark, NJ	4	5%
Delaware State University – Dover, DE	3	4%		New Mexico State – Las Cruces, NM	1	1%
Miami Dade University – Miami, FL	4	5%		LeMoyne College – Syracuse, NY	0	0%
University of Central Florida – Orlando, FL	4	5%		North Carolina A&T State University – Greensboro, NC	0	0%
University of South Florida – Tampa, FL	2	3%		North Carolina Central University – Durham, NC	2	3%
Clark Atlanta University – Atlanta, GA	1	1%		University of Puerto Rico – San Juan, PR	1	1%
Georgia State University – Atlanta, GA	0	0%		University of Puerto Rico at Humacao – Humacao, PR	2	3%
Savannah State University - Savannah, GA	2	3%		South Dakota School of Mines – Rapid City, SD	1	1%
Loyola University – Chicago, IL	5	6%		Texas Southern – Houston, TX	2	3%
University of Iowa – Iowa City, IA	2	3%		Texas Tech University – Lubbock, TX	2	3%
Xavier University of Louisiana – New Orleans, LA	2	3%		University of Houston – Houston, TX	6	8%
University of Maryland, Baltimore – Baltimore, MD	4	5%		University of Texas, El Paso – El Paso, TX	2	3%
University of Massachusetts, Lowell – Lowell, MA	2	3%		University of Utah – Salt Lake City, UT	2	3%
				University of Washington – Seattle, WA	2	3%
				Total	79	100%

Note. Other = "Miami Dade College" (n = 5), and "Invasive Plant Research Laboratory".

How did you learn about REAP? (Check all that apply) (n = 392)						
	Freq.	%			Freq.	%
AEOP on Facebook, Twitter, Pinterest, or other social media	5	1%		Past participant of program	29	7%
Army Educational Outreach Program (AEOP) website	63	16%		School or university newsletter, email, or website	52	13%
Choose not to report	3	1%		Someone who works at the school or university I attend	57	15%
Community group or program	10	3%		Someone who works with program	37	9%
Family member	50	13%		Someone who works with the Department of Defense (Army, Navy, Air Force)	12	3%
Friend	31	8%		Other, (specify):	30	8%
Friend or co-worker of a family member	13	3%				

Note. Other = "S.L.E.W.S. Leader", and "Past participant of UNITE".

How motivating were the following factors in your decision to participate in REAP?	
	1
Teacher or professor encouragement	6 (8%)
An academic requirement or school grade	0 (0%)
Desire to learn something new or interesting	45 (59%)
The program mentor(s)	9 (12%)
Building college application or résumé	17 (22%)
Networking opportunities	6 (8%)
Interest in science, technology, engineering, or mathematics (STEM)	59 (78%)
Interest in STEM careers with the Army	2 (3%)
Having fun	3 (4%)
Earning stipend or award while doing STEM	3 (4%)
Opportunity to do something with friends	0 (0%)
Opportunity to use advanced laboratory technology	9 (12%)
Desire to expand laboratory or research skills	26 (34%)
Learning in ways that are not possible in school	12 (16%)
Serving the community or country	1 (1%)
Recommendations of past participants	1 (1%)
Figuring out education or career goals	17 (22%)
Exploring a unique work environment	9 (12%)
Seeing how school learning applies to real life	3 (4%)
Other, (specify)	0 (0%)

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 science, technology, engineering, or mathematics (STEM) topics that are new to you	1 (1%)	3 (3%)	18 (20%)	29 (33%)	36 (41%)	87	4.12	0.93
Apply STEM learning to real-life situations	5 (5%)	4 (4%)	35 (40%)	22 (25%)	21 (24%)	87	3.58	1.09
Learn about new discoveries in STEM	5 (5%)	11 (12%)	38 (44%)	17 (19%)	15 (17%)	86	3.31	1.09
Learn about different careers that use STEM	4 (4%)	6 (6%)	47 (54%)	16 (18%)	14 (16%)	87	3.35	0.99
Interact with scientists or engineers	14 (16%)	19 (21%)	28 (32%)	7 (8%)	19 (21%)	87	3.00	1.35
Communicate with other students about STEM	3 (3%)	8 (9%)	18 (20%)	26 (29%)	32 (36%)	87	3.87	1.13

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 REAP this year?								
	1	2	3	4	5	n	Avg.	SD
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	1 (1%)	5 (5%)	7 (8%)	15 (17%)	58 (67%)	86	4.44	0.95
Apply STEM learning to real-life situations	2 (2%)	4 (4%)	13 (15%)	25 (29%)	42 (48%)	86	4.17	1.01
Learn about new discoveries in STEM	2 (2%)	5 (5%)	17 (20%)	28 (32%)	33 (38%)	85	4.00	1.02
Learn about different careers that use STEM	2 (2%)	6 (7%)	26 (30%)	28 (32%)	24 (27%)	86	3.77	1.01
Interact with scientists or engineers	3 (3%)	5 (5%)	4 (4%)	14 (16%)	60 (69%)	86	4.43	1.06
Communicate with other students about STEM	4 (4%)	2 (2%)	16 (18%)	19 (22%)	45 (52%)	86	4.15	1.10

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
Use laboratory procedures and tools	1 (1%)	11 (12%)	33 (38%)	35 (40%)	6 (7%)	86	3.40	0.84
Participate in hands-on STEM activities	2 (2%)	8 (9%)	37 (43%)	28 (32%)	11 (12%)	86	3.44	0.92
Work as part of a team	0 (0%)	4 (4%)	24 (27%)	37 (43%)	21 (24%)	86	3.87	0.84
Identify questions or problems to investigate	6 (7%)	5 (5%)	27 (31%)	20 (23%)	28 (32%)	86	3.69	1.19
Design an investigation	11 (12%)	18 (20%)	28 (32%)	20 (23%)	9 (10%)	86	2.98	1.18
Carry out an investigation	11 (12%)	15 (17%)	22 (25%)	26 (30%)	11 (12%)	85	3.13	1.23
Analyze data or information	3 (3%)	6 (7%)	24 (27%)	30 (34%)	23 (26%)	86	3.74	1.04
Draw conclusions from an investigation	7 (8%)	7 (8%)	26 (31%)	29 (34%)	15 (17%)	84	3.45	1.13
Come up with creative explanations or solutions	4 (4%)	12 (14%)	23 (26%)	29 (33%)	18 (20%)	86	3.52	1.11
Build or make a computer model	46 (53%)	22 (25%)	9 (10%)	6 (7%)	3 (3%)	86	1.81	1.10

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 REAP this year?								
	1	2	3	4	5	n	Avg.	SD
Use laboratory procedures and tools	8 (9%)	6 (7%)	7 (8%)	17 (19%)	48 (55%)	86	4.06	1.33
Participate in hands-on STEM activities	6 (7%)	2 (2%)	9 (10%)	18 (20%)	51 (59%)	86	4.23	1.18
Work as part of a team	2 (2%)	7 (8%)	6 (7%)	23 (27%)	46 (54%)	84	4.24	1.06
Identify questions or problems to investigate	4 (4%)	2 (2%)	9 (10%)	38 (44%)	33 (38%)	86	4.09	1.00
Design an investigation	10 (11%)	8 (9%)	13 (15%)	23 (26%)	32 (37%)	86	3.69	1.37
Carry out an investigation	5 (5%)	8 (9%)	9 (10%)	25 (29%)	39 (45%)	86	3.99	1.21
Analyze data or information	3 (3%)	4 (4%)	11 (12%)	17 (19%)	51 (59%)	86	4.27	1.08
Draw conclusions from an investigation	7 (8%)	8 (9%)	9 (10%)	27 (31%)	34 (40%)	85	3.86	1.27
Come up with creative explanations or solutions	4 (4%)	9 (10%)	13 (15%)	31 (36%)	29 (33%)	86	3.84	1.15
Build or make a computer model	36 (42%)	16 (18%)	9 (10%)	9 (10%)	15 (17%)	85	2.42	1.55

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

How much did each of the following resources help you learn about Army Educational Outreach Programs (AEOPs)?								
	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science website	36 (42%)	5 (5%)	17 (20%)	14 (16%)	13 (15%)	85	2.56	1.54
Army Educational Outreach Program (AEOP) website	19 (22%)	1 (1%)	19 (22%)	17 (20%)	29 (34%)	85	3.42	1.52
AEOP on Facebook, Twitter, Pinterest or other social media	53 (62%)	10 (11%)	12 (14%)	7 (8%)	3 (3%)	85	1.79	1.18
AEOP brochure	25 (30%)	6 (7%)	10 (12%)	18 (21%)	24 (28%)	83	3.12	1.63
It Starts Here! Magazine	58 (69%)	8 (9%)	10 (11%)	5 (6%)	3 (3%)	84	1.65	1.13
My REAP mentor(s)	14 (16%)	4 (4%)	14 (16%)	16 (19%)	36 (42%)	84	3.67	1.48
Invited speakers or "career" events during REAP	46 (53%)	6 (7%)	10 (11%)	11 (12%)	13 (15%)	86	2.29	1.57
Participation in REAP	11 (12%)	3 (3%)	7 (8%)	8 (9%)	57 (66%)	86	4.13	1.43

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 REAP:								
	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science website	41 (48%)	7 (8%)	14 (16%)	13 (15%)	10 (11%)	85	2.34	1.49
Army Educational Outreach Program (AEOP) website	26 (31%)	7 (8%)	14 (16%)	20 (23%)	17 (20%)	84	2.94	1.55
AEOP on Facebook, Twitter, Pinterest or other social media	59 (69%)	9 (10%)	9 (10%)	3 (3%)	5 (5%)	85	1.66	1.17
AEOP brochure	27 (32%)	9 (10%)	12 (14%)	16 (19%)	20 (23%)	84	2.92	1.60
It Starts Here! Magazine	60 (71%)	9 (10%)	5 (6%)	7 (8%)	3 (3%)	84	1.62	1.14
My REAP mentor(s)	20 (23%)	10 (11%)	16 (18%)	15 (17%)	24 (28%)	85	3.15	1.54
Invited speakers or "career" events during REAP	47 (54%)	8 (9%)	10 (11%)	10 (11%)	11 (12%)	86	2.19	1.51
Participation in REAP	18 (21%)	6 (7%)	17 (20%)	13 (15%)	31 (36%)	85	3.39	1.55

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

How SATISFIED were you with each of the following REAP program features?								
	0	1	2	3	4	n	Avg.	SD
Applying or registering for the program	1 (1%)	0 (0%)	5 (5%)	28 (32%)	51 (60%)	85	4.51	0.72
Communicating with your REAP host site organizers	7 (8%)	1 (1%)	8 (9%)	20 (23%)	49 (57%)	85	4.21	1.20
The physical location(s) of REAP activities	1 (1%)	3 (3%)	2 (2%)	17 (19%)	63 (73%)	86	4.60	0.80
The variety of STEM topics available to you in REAP	1 (1%)	4 (4%)	6 (7%)	18 (21%)	56 (65%)	85	4.46	0.91
Teaching or mentoring provided during REAP activities	1 (1%)	3 (3%)	3 (3%)	11 (13%)	66 (78%)	84	4.64	0.82
Stipends (payment)	2 (2%)	2 (2%)	2 (2%)	11 (13%)	67 (79%)	84	4.65	0.84
Research abstract preparation requirements	2 (2%)	3 (3%)	7 (8%)	21 (25%)	51 (60%)	84	4.38	0.96
Development opportunities beyond conducting research (attending seminars, taking courses, pursuing competitions, or scholarships, presenting or publishing research, etc.)	11 (13%)	3 (3%)	9 (10%)	13 (15%)	48 (57%)	84	4.00	1.42

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

Which of the following statements best reflects the input you had into your project initially?		
	Freq.	%
I did not have a project	3	3%
I was assigned a project by my mentor	38	44%
I worked with my mentor to design a project	14	16%
I had a choice among various projects suggested by my mentor	10	12%
I worked with my mentor and members of a research team to design a project	19	22%
I designed the entire project on my own	2	2%
Total	**86**	**100%**

Which of the following statements best reflects the availability of your mentor?		
	Freq.	**%**
I did not have a mentor	1	1%
The mentor was never available	1	1%
The mentor was available less than half of the time	1	1%
The mentor was available about half of the time of my project	11	13%
The mentor was available more than half of the time	16	19%
The mentor was always available	56	65%
Total	**86**	**100%**

Which of the following statements best reflects your working as part of a group or team?		
	Freq.	**%**
I worked alone (or alone with my research mentor)	12	14%
I worked with others in a shared laboratory or other space, but we work on different projects	25	29%
I worked alone on my project and I met with others regularly for general reporting or discussion	7	8%
I worked alone on a project that was closely connected with projects of others in my group	17	20%
I work with a group who all worked on the same project	25	29%
Total	**86**	**100%**

How SATISFIED were you with each of the following?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
My working relationship with my mentor	1 (1%)	0 (0%)	7 (8%)	11 (12%)	67 (77%)	86	4.66	0.73
My working relationship with the group or team	8 (9%)	1 (1%)	5 (5%)	8 (9%)	64 (74%)	86	4.38	1.25
The amount of time I spent doing meaningful research	1 (1%)	2 (2%)	7 (8%)	10 (11%)	65 (76%)	85	4.60	0.83
The amount of time I spent with my research mentor	1 (1%)	3 (3%)	8 (9%)	15 (17%)	59 (68%)	86	4.49	0.89
The research experience overall	0 (0%)	1 (1%)	2 (2%)	16 (18%)	67 (77%)	86	4.73	0.56

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

Which of the following statements apply to your research experience? (choose all that apply) (n = 73)						
	Freq.	%			Freq.	%
I presented a talk or poster to other students or faculty	43	59%		I will present a talk or poster to other students or faculty	37	51%
I presented a talk or poster at a professional symposium or conference	14	19%		I will present a talk or poster at a professional symposium or conference	15	21%
I attended a symposium or conference	25	34%		I will attend a symposium or conference	14	19%
I wrote or co-wrote a paper that was/will be published in a research journal	8	11%		I will write or co-write a paper that was/will be published in a research journal	7	10%
I wrote or co-wrote a technical paper or patent	7	10%		I will write or co-write a technical paper or patent	9	12%
				I won an award or scholarship based on my research	1	1%

The list below describes 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 for REAP:					
		Yes - my mentor used this strategy with me		No - my mentor did not use this strategy with me	
	n	Freq.	%	Freq.	%
Helped me become aware of the roles STEM play in my everyday life	86	69	80%	17	20%
Helped me understand how STEM can help me improve my community	86	64	74%	22	26%
Used a variety of strategies to help me learn	86	74	86%	12	14%
Gave me extra support when I needed it	86	79	92%	7	8%
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	86	62	72%	24	28%
Allowed me to work on a team project or activity	85	75	88%	10	12%
Helped me learn or practice a variety of STEM skills	86	79	92%	7	8%
Gave me feedback to help me improve in STEM	86	73	85%	13	15%
Talked to me about the education I need for a STEM career	86	66	77%	20	23%
Recommended Army Educational Outreach Programs that match my interests	86	35	41%	51	59%
Discussed STEM careers with the DoD or government	86	34	40%	52	61%

Which category best describes the focus of your REAP experience?		
	Freq.	%
Science	55	64%
Technology	13	15%
Engineering	15	17%
Mathematics	3	4%
Total	86	100%

AS A RESULT OF YOUR REAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
In depth knowledge of a STEM topic(s)	1 (1%)	4 (4%)	18 (20%)	39 (45%)	24 (27%)	86	3.94	0.89
Knowledge of research conducted in a STEM topic or field	1 (1%)	0 (0%)	18 (20%)	29 (33%)	38 (44%)	86	4.20	0.85
Knowledge of research processes, ethics, and rules for conduct in STEM	3 (3%)	1 (1%)	14 (16%)	36 (41%)	32 (37%)	86	4.08	0.95
Knowledge of how scientists and engineers work on real problems in STEM	1 (1%)	2 (2%)	14 (16%)	31 (36%)	37 (43%)	85	4.19	0.88
Knowledge of what everyday research work is like in STEM	1 (1%)	2 (2%)	14 (16%)	26 (30%)	43 (50%)	86	4.26	0.90

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

AS A RESULT OF YOUR REAP 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 scientific experiments	1 (1%)	3 (5%)	14 (25%)	24 (43%)	13 (23%)	55	3.82	0.93
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	2 (3%)	2 (3%)	15 (27%)	25 (45%)	11 (20%)	55	3.75	0.95
Making a model of an object or system showing its parts and how they work	6 (10%)	7 (12%)	16 (29%)	17 (30%)	9 (16%)	55	3.29	1.21
Designing procedures for an experiment that are appropriate for the question to be answered	3 (5%)	8 (14%)	5 (9%)	23 (41%)	16 (29%)	55	3.75	1.19
Identifying the limitations of the methods and tools used for data collection	2 (3%)	0 (0%)	10 (18%)	25 (45%)	18 (32%)	55	4.04	0.92
Carrying out procedures for an experiment and recording data accurately	2 (3%)	1 (1%)	8 (14%)	19 (34%)	25 (45%)	55	4.16	1.00
Using computer models of objects or systems to test cause and effect relationships	11 (20%)	7 (12%)	17 (30%)	10 (18%)	10 (18%)	55	3.02	1.37
Organizing data in charts or graphs to find patterns and relationships	8 (14%)	5 (9%)	8 (14%)	17 (30%)	17 (30%)	55	3.55	1.40
Considering different interpretations of data when deciding how the data answer a question	2 (3%)	4 (7%)	12 (21%)	19 (34%)	18 (32%)	55	3.85	1.08
Supporting an explanation for an observation with data from experiments	2 (3%)	3 (5%)	5 (9%)	22 (40%)	22 (40%)	54	4.09	1.03
Supporting an explanation with relevant scientific, mathematical, and/or engineering	1 (1%)	3 (5%)	12 (21%)	21 (38%)	18 (32%)	55	3.95	0.97
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	3 (5%)	6 (10%)	13 (23%)	18 (32%)	15 (27%)	55	3.65	1.16
Defending an argument that conveys how an explanation best describes an observation	5 (9%)	4 (7%)	22 (40%)	12 (21%)	12 (21%)	55	3.40	1.18
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	4 (7%)	5 (9%)	17 (30%)	18 (32%)	11 (20%)	55	3.49	1.14
Integrating information from technical or scientific texts and other media to support your explanation of an observation	4 (7%)	4 (7%)	14 (25%)	20 (36%)	13 (23%)	55	3.62	1.15
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	1 (1%)	5 (9%)	10 (18%)	17 (30%)	22 (40%)	55	3.98	1.06

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

AS A RESULT OF YOUR REAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	1 (3%)	4 (12%)	8 (25%)	11 (35%)	7 (22%)	31	3.61	1.09
Using knowledge and creativity to propose a testable solution for a problem	1 (3%)	2 (6%)	7 (22%)	14 (45%)	7 (22%)	31	3.77	0.99
Making a model of an object or system to show its parts and how they work	5 (16%)	4 (12%)	8 (25%)	8 (25%)	6 (19%)	31	3.19	1.35
Designing procedures for an experiment that are appropriate for the question to be answered	5 (16%)	1 (3%)	12 (38%)	10 (32%)	3 (9%)	31	3.16	1.19
Identifying the limitations of the methods and tools used for data collection	3 (9%)	4 (12%)	6 (19%)	14 (45%)	4 (12%)	31	3.39	1.17
Carrying out procedures for an experiment and recording data accurately	2 (6%)	3 (9%)	6 (19%)	12 (38%)	8 (25%)	31	3.68	1.17
Using computer models of an object or system to investigate cause and effect relationships	5 (16%)	4 (12%)	8 (25%)	9 (29%)	5 (16%)	31	3.16	1.32
Considering different interpretations of the data when deciding if a solution works as intended	5 (16%)	3 (9%)	7 (22%)	11 (35%)	5 (16%)	31	3.26	1.32
Organizing data in charts or graphs to find patterns and relationships	4 (12%)	7 (22%)	11 (35%)	3 (9%)	6 (19%)	31	3.00	1.29
Supporting a solution for a problem with data from experiments	4 (12%)	4 (12%)	8 (25%)	9 (29%)	6 (19%)	31	3.29	1.30
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	4 (12%)	4 (12%)	3 (9%)	14 (45%)	6 (19%)	31	3.45	1.31
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	4 (13%)	4 (13%)	9 (30%)	8 (26%)	5 (16%)	30	3.20	1.27
Defend an argument that conveys how a solution best meets design criteria	3 (10%)	7 (23%)	8 (26%)	8 (26%)	4 (13%)	30	3.10	1.21
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	3 (9%)	7 (22%)	8 (25%)	8 (25%)	5 (16%)	31	3.16	1.24
Integrating information from technical or scientific texts and other media to support your solution to a problem	3 (9%)	4 (12%)	8 (25%)	12 (38%)	4 (12%)	31	3.32	1.17
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	5 (16%)	1 (3%)	7 (23%)	10 (33%)	7 (23%)	30	3.43	1.36

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

AS A RESULT OF YOUR REAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Learning to work independently	1	2	3	4	5	n	Avg.	SD
Setting goals and reflecting on performance	0 (0%)	0 (0%)	18 (20%)	31 (36%)	37 (43%)	86	4.22	0.77
Sticking with a task until it is finished	0 (0%)	7 (8%)	19 (22%)	32 (37%)	28 (32%)	86	3.94	0.94
Making changes when things do not go as planned	1 (1%)	2 (2%)	14 (16%)	29 (33%)	40 (46%)	86	4.22	0.89
Working well with people from all backgrounds	1 (1%)	2 (2%)	8 (9%)	34 (40%)	40 (47%)	85	4.29	0.83
Including others' perspectives when making decisions	2 (2%)	3 (3%)	7 (8%)	38 (44%)	36 (41%)	86	4.20	0.91
Communicating effectively with others	3 (3%)	3 (3%)	17 (19%)	35 (40%)	28 (32%)	86	3.95	0.99
Viewing failure as an opportunity to learn	1 (1%)	2 (2%)	9 (10%)	37 (43%)	37 (43%)	86	4.24	0.83

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

AS A RESULT OF YOUR REAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Interest in a new STEM topic	2 (2%)	3 (3%)	26 (30%)	25 (29%)	30 (34%)	86	3.91	1.00
Deciding on a path to pursue a STEM career	4 (4%)	6 (7%)	18 (21%)	31 (36%)	26 (30%)	85	3.81	1.10
Sense of accomplishing something in STEM	2 (2%)	4 (4%)	11 (12%)	32 (37%)	37 (43%)	86	4.14	0.97
Feeling prepared for more challenging STEM activities	2 (2%)	3 (3%)	15 (17%)	24 (28%)	41 (48%)	85	4.16	1.00
Confidence to try out new ideas or procedures on my own in a STEM project	3 (3%)	4 (4%)	13 (15%)	25 (29%)	40 (47%)	85	4.12	1.06
Patience for the slow pace of STEM research	3 (3%)	3 (3%)	15 (17%)	31 (36%)	34 (39%)	86	4.05	1.02
Desire to build relationships with mentors who work in STEM	2 (2%)	3 (3%)	7 (8%)	39 (45%)	35 (40%)	86	4.19	0.90
Connecting a STEM topic or field to my personal values	3 (3%)	6 (7%)	11 (12%)	29 (33%)	37 (43%)	86	4.06	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 REAP 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
Watch or read non-fiction STEM	3 (3%)	3 (3%)	35 (40%)	30 (34%)	15 (17%)	86	3.59	0.94
Tinker (play) with a mechanical or electrical device	1 (1%)	2 (2%)	34 (39%)	28 (32%)	21 (24%)	86	3.77	0.89
Work on solving mathematical or scientific puzzles	2 (2%)	1 (1%)	32 (37%)	34 (40%)	16 (18%)	85	3.72	0.87
Use a computer to design or program something	2 (2%)	6 (7%)	34 (40%)	22 (25%)	21 (24%)	85	3.64	1.01
Talk with friends or family about STEM	0 (0%)	0 (0%)	19 (22%)	42 (48%)	25 (29%)	86	4.07	0.72
Mentor or teach other students about STEM	0 (0%)	1 (1%)	16 (18%)	42 (48%)	27 (31%)	86	4.10	0.74
Help with a community service project related to STEM	0 (0%)	1 (1%)	20 (23%)	38 (44%)	27 (31%)	86	4.06	0.77
Participate in a STEM camp, club, or competition	0 (0%)	0 (0%)	16 (18%)	39 (45%)	31 (36%)	86	4.17	0.72
Take an elective (not required) STEM class	1 (1%)	1 (1%)	15 (17%)	33 (38%)	36 (41%)	86	4.19	0.85
Work on a STEM project or experiment in a university or professional setting	0 (0%)	1 (1%)	5 (5%)	30 (34%)	50 (58%)	86	4.50	0.66

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 REAP?		
	Freq.	%
Graduate from high school	1	1%
Go to a trade or vocational school	0	0%
Go to college for a little while	1	1%
Finish college (get a Bachelor's degree)	16	19%
Get more education after college	5	6%
Get a master's degree	18	21%
Get a Ph.D.	13	15%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	18	21%
Get a combined M.D. / Ph.D.	10	12%
Get another professional degree (law, business, etc.)	4	5%
Total	**86**	**100%**

How far did you want to go in school AFTER participating in REAP?		
	Freq.	**%**
Graduate from high school	0	0%
Go to a trade or vocational school	1	1%
Go to college for a little while	1	1%
Finish college (get a Bachelor's degree)	7	8%
Get more education after college	4	5%
Get a master's degree	13	15%
Get a Ph.D.	21	24%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	16	19%
Get a combined M.D. / Ph.D.	16	19%
Get another professional degree (law, business, etc.)	7	8%
Total	**86**	**100%**

BEFORE REAP, 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 REAP)

	Freq.	**%**			**Freq.**	**%**
Undecided	5	6%		**Health (nursing, pharmacy, technician, etc.)**	4	5%
Science (no specific subject)	7	8%		**Social science (psychologist, sociologist, etc.)**	1	1%
Physical science (physics, chemistry, astronomy, materials science)	6	7%		**Teaching, STEM**	1	1%
Biological science	2	2%		**Teaching, non-STEM**	0	0%
Earth, atmospheric or oceanic science	0	0%		**Business**	1	1%
Environmental science	0	0%		**Law**	4	5%
Computer science	1	1%		**Military, police, or security**	1	1%
Technology	0	0%		**Art (writing, dancing, painting, etc.)**	1	1%
Engineering	22	26%		**Skilled trade (carpenter**	0	0%
Mathematics or statistics	0	0%		**Other, (specify):**	4	5%
Medicine (doctor, dentist, veterinarian, etc.)	25	29%				
				Total	**85**	**100%**

Note. Other = "Pro Athlete".

AFTER REAP, 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 REAP)						
	Freq.	%			Freq.	%
Undecided	3	4%		Health (nursing, pharmacy, technician, etc.)	2	2%
Science (no specific subject)	2	2%		Social science (psychologist, sociologist, etc.)	0	0%
Physical science (physics, chemistry, astronomy, materials science)	7	8%		Teaching, STEM	1	1%
Biological science	2	2%		Teaching, non-STEM	0	0%
Earth, atmospheric or oceanic science	1	1%		Business	1	1%
Environmental science	1	1%		Law	1	1%
Computer science	2	2%		Military, police, or security	2	2%
Technology	2	2%		Art (writing, dancing, painting, etc.)	0	0%
Engineering	23	27%		Skilled trade (carpenter	0	0%
Mathematics or statistics	1	1%		Other, (specify):	7	8%
Medicine (doctor, dentist, veterinarian, etc.)	27	32%				
				Total	85	100%

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	0	0%
less than 25% of the time	3	3%
26% to 50% of the time	12	14%
51% to 75% of the time	24	28%
76% to 100% of the time	47	55%
Total	86	100%

How interested are you in participating in the following programs in the future?								
	0	1	2	3	4	n	Avg.	SD
Gains in the Education of Mathematics and Science (GEMS)	37 (43%)	2 (2%)	12 (14%)	15 (17%)	20 (23%)	86	2.76	1.68
UNITE	39 (45%)	3 (3%)	14 (16%)	11 (12%)	18 (21%)	85	2.60	1.65
Junior Science & Humanities Symposium (JSHS)	37 (43%)	5 (5%)	10 (11%)	9 (10%)	24 (28%)	85	2.74	1.73
Science & Engineering Apprenticeship Program (SEAP)	24 (28%)	2 (2%)	5 (6%)	14 (16%)	39 (46%)	84	3.50	1.73
Research & Engineering Apprenticeship Program (REAP)	6 (7%)	1 (1%)	8 (9%)	7 (8%)	64 (74%)	86	4.42	1.16
High School Apprenticeship Program (HSAP)	34 (40%)	5 (6%)	5 (6%)	15 (17%)	25 (29%)	84	2.90	1.75
College Qualified Leaders (CQL)	38 (44%)	1 (1%)	12 (14%)	15 (17%)	20 (23%)	86	2.74	1.69
GEMS Near Peer Mentor Program	40 (47%)	3 (3%)	13 (15%)	12 (14%)	17 (20%)	85	2.56	1.64
Undergraduate Research Apprenticeship Program (URAP)	23 (27%)	1 (1%)	6 (7%)	17 (20%)	37 (44%)	84	3.52	1.68
Science Mathematics, and Research for Transformation (SMART) College	24 (27%)	1 (1%)	9 (10%)	15 (17%)	37 (43%)	86	3.47	1.69
National Defense Science & Engineering Graduate (NDSEG) Fellowship	36 (41%)	2 (2%)	10 (11%)	17 (19%)	21 (24%)	86	2.83	1.70

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

How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during REAP?		
	Freq.	%
None	2	2%
1	6	7%
2	12	14%
3	24	28%
4	10	12%
5 or more	32	37%
Total	86	100%

How many Department of Defense (DoD) STEM jobs/careers did you learn about during REAP?		
	Freq.	%
None	39	45%
1	16	19%
2	11	13%
3	4	5%
4	8	9%

5 or more	8	9%
Total	**86**	**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	1 (1%)	0 (0%)	24 (28%)	31 (36%)	28 (33%)	84	4.01	0.86
DoD researchers develop new, cutting edge technologies	1 (1%)	0 (0%)	21 (25%)	34 (40%)	28 (33%)	84	4.05	0.84
DoD researchers solve real-world problems	1 (1%)	1 (1%)	23 (27%)	32 (38%)	27 (32%)	84	3.99	0.87
DoD research is valuable to society	1 (1%)	1 (1%)	20 (24%)	29 (34%)	32 (38%)	83	4.08	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 REAP?

	1	2	3	4	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	1 (1%)	2 (2%)	53 (61%)	30 (34%)	86	3.30	0.58
I am more interested in participating in STEM activities outside of school requirements	2 (2%)	7 (8%)	51 (59%)	26 (30%)	86	3.17	0.67
I am more aware of other AEOPs	15 (17%)	6 (7%)	32 (37%)	33 (38%)	86	2.97	1.08
I am more interested in participating in other AEOPs	9 (10%)	6 (7%)	44 (51%)	27 (31%)	86	3.03	0.90
I am more interested in taking STEM classes in school	3 (3%)	13 (15%)	51 (59%)	19 (22%)	86	3.00	0.72
I am more interested in earning a STEM degree in college	1 (1%)	13 (15%)	50 (58%)	22 (25%)	86	3.01	0.66
I am more interested in pursuing a STEM career	20 (23%)	7 (8%)	33 (38%)	26 (30%)	86	3.08	0.67
I am more aware of DoD STEM research and careers	17 (19%)	7 (8%)	38 (44%)	24 (27%)	86	2.76	1.13
I have a greater appreciation of DoD STEM research and careers	27 (31%)	7 (8%)	39 (45%)	13 (15%)	86	2.80	1.06
I am more interested in pursuing a STEM career with the DoD	1 (1%)	2 (2%)	53 (61%)	30 (34%)	86	2.44	1.09
I am more confident in my STEM knowledge, skills, and abilities	1 (1%)	2 (2%)	53 (61%)	30 (34%)	86	3.30	0.58

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

Appendix C

FY15 REAP Mentor Data Summaries

REAP Mentor Data Summary

What is your gender?		
	Freq.	**%**
Male	29	67%
Female	14	33%
Choose not to report	0	0%
Total	**43**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	1	2%
Asian	11	26%
Black or African American	9	21%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	18	42%
Other race or ethnicity, (specify):	0	0%
Choose not to report	4	9%
Total	**43**	**100%**

Which of the following BEST describes your current occupation? (select ONE)		
	Freq.	**%**
Teacher	0	0%
Other school staff	1	2%
University educator	31	56%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	17	31%
Scientist, Engineer, or Mathematics professional	3	5%
Other, (specify):	3	5%
Total	**55**	**100%**

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

Which of the following BEST describes your organization? (select ONE)		
	Freq.	%
No organization	1	2%
School or district (K-12)	1	2%
State educational agency	3	5%
Institution of higher education (vocational school, junior college, college, or university)	49	89%
Private Industry	0	0%
Department of Defense or other government agency	0	0%
Non-profit	1	2%
Other, (specify):	0	0%
Total	55	100%

Which of the following best describes your primary area of research?						
	Freq.	%			Freq.	%
Physical science (physics, chemistry, astronomy, materials science, etc.)	14	26%		Technology	1	2%
Biological science	17	32%		Engineering	12	23%
Earth, atmospheric, or oceanic science	0	0%		Mathematics or statistics	3	6%
Environmental science	1	2%		Medical, health, or behavioral science	1	2%
Computer science	1	2%		Social Science (psychology, sociology, anthropology)	1	2%
				Other, (specify):	2	4%
				Total	53	100%

At which of the following REAP sites did you participate? (Select ONE)						
	Freq.	%			Freq.	%
Alabama State University	2	4%		University of Arkansas at Pine Bluff	1	2%
Ball State University	1	2%		University of California-Berkeley	1	2%
Clark Atlanta University	0	0%		University of Central Florida	1	2%
Colorado State University	1	2%		University of Colorado-Colorado Springs	1	2%
Delaware State University	1	2%		University of Houston	0	0%
Georgia State University	0	0%		University of Iowa	3	5%
Jackson State University	2	4%		University of Maryland-Baltimore	2	4%
Loyola University	0	0%		University of Massachusetts-Lowell	0	0%
Miami Dade University	0	0%		University of New Hampshire	0	0%
Michigan Technological University	0	0%		University of Puerto Rico	1	2%
Montana State University	0	0%		University of Puerto Rico-Hu Macao	1	2%
New Jersey Technical Institute	0	0%		University of South Florida	0	0%
New Mexico State	0	0%		University of Texas-El Paso	4	7%
North Carolina A&T State University	0	0%		University of Utah	3	5%
North Carolina Central University	1	2%		University of Washington	2	4%
Oakland University	0	0%		Xavier University of Louisiana	2	4%
South Dakota School of Mines & Technology	0	0%		Other, (specify):	0	0%
Texas Southern University	1	2%		No site selected	22	40%
Texas Tech University	1	2%			0	0%
University of Alabama-Huntsville	0	0%			0	0%
				Total	55	100%

Which of the following BEST describes your role during REAP?		
	Freq.	%
Research Mentor	43	78%
Research Team Member but not a Principal Investigator (PI)	8	15%
Other, (specify)	4	7%
Total	55	100%

Note. Other = "PI", "Administrative Assistant", and "Program Director".

How many REAP students did you work with this year?		
# of Students	**Freq.**	**%**
1	22	40%
2	22	40%
3	4	7%
4	2	5%
5	5	8%
Total	**55**	**100%**

How did you learn about REAP? (Check all that apply) (n = 55)						
	Freq.	**%**			**Freq.**	**%**
Academy of Applied Science website	18	33%		**A colleague**	12	22%
Army Educational Outreach Program (AEOP) website	12	22%		**My supervisor or superior**	16	29%
AEOP on Facebook, Twitter, Pinterest, or other social media	0	0%		**REAP site host/director**	12	22%
A STEM conference or STEM education conference	3	5%		**Workplace communications**	1	2%
An email or newsletter from school, university, or a professional organization	6	11%		**Someone who works at an Army laboratory**	1	2%
Past REAP participant	13	24%		**Other, (specify):**	2	4%
A student	0	0%				

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	30 (60%)	1 (2%)	0 (0%)	0 (0%)	19 (38%)	50	2.54	1.95
eCYBERMISSION	27 (54%)	1 (2%)	0 (0%)	0 (0%)	22 (44%)	50	2.78	1.99
Junior Solar Sprint (JSS)	29 (58%)	0 (0%)	0 (0%)	0 (0%)	21 (42%)	50	2.68	1.99
West Point Bridge Design Contest (WPBDC)	29 (58%)	0 (0%)	0 (0%)	0 (0%)	21 (42%)	50	2.68	1.99
Junior Science & Humanities Symposium (JSHS)	29 (58%)	2 (4%)	1 (2%)	2 (4%)	16 (32%)	50	2.48	1.87
Gains in the Education of Mathematics and Science (GEMS)	31 (63%)	0 (0%)	1 (2%)	0 (0%)	17 (34%)	49	2.43	1.91
GEMS Near Peers	31 (62%)	0 (0%)	0 (0%)	0 (0%)	19 (38%)	50	2.52	1.96
UNITE	27 (50%)	1 (1%)	1 (1%)	5 (9%)	19 (35%)	53	2.77	1.90
Science & Engineering Apprenticeship Program (REAP)	34 (68%)	0 (0%)	0 (0%)	0 (0%)	16 (32%)	50	2.28	1.88
Research & Engineering Apprenticeship Program (REAP)	7 (12%)	11 (20%)	9 (16%)	22 (40%)	6 (10%)	55	3.16	1.24
High School Apprenticeship Program (HSAP)	31 (62%)	2 (4%)	0 (0%)	0 (0%)	17 (34%)	50	2.40	1.90
College Qualified Leaders (CQL)	30 (60%)	0 (0%)	1 (2%)	0 (0%)	19 (38%)	50	2.56	1.95
Undergraduate Research Apprenticeship Program (URAP)	29 (58%)	2 (4%)	0 (0%)	2 (4%)	17 (34%)	50	2.52	1.90
Science Mathematics, and Research for Transformation (SMART) College Scholarship	32 (64%)	2 (4%)	0 (0%)	1 (2%)	15 (30%)	50	2.30	1.84
National Defense Science & Engineering Graduate (NDSEG) Fellowship	35 (71%)	1 (2%)	0 (0%)	1 (2%)	12 (24%)	49	2.06	1.75

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

Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply) (n = 55)						
	Freq.	%			Freq.	%
Applications from Academy of Applied Science (AAS) or the AEOP	28	51%		Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)	5	9%
Personal acquaintance(s) (friend, family, neighbor, etc.)	10	18%		Communication(s) generated by a university or faculty (newsletter, email blast, website)	8	15%
Colleague(s) in my workplace	13	24%		STEM or STEM Education conference(s) or event(s)	8	15%
K-12 school teacher(s) outside of my workplace	24	44%		Organization(s) that serve underserved or underrepresented populations	5	9%
University faculty outside of my workplace	6	11%		The student contacted me (the mentor) about the program	8	15%
Informational materials sent to K-12 schools or Universities outside of my workplace	17	31%		I do not know how student(s) were recruited for REAP	13	24%
				Other, (specify):	3	5%

How SATISFIED were you with each of the following REAP features?								
	0	1	2	3	4	n	Avg.	SD
Application or registration process	14 (26%)	1 (1%)	3 (5%)	14 (26%)	21 (39%)	53	3.51	1.65
Other administrative tasks	15 (28%)	2 (3%)	6 (11%)	10 (18%)	20 (37%)	53	3.34	1.67
Communications from Academy of Applied Science	18 (34%)	1 (1%)	4 (7%)	6 (11%)	24 (45%)	53	3.32	1.81
Communications from [REAP site]	10 (18%)	2 (3%)	1 (1%)	9 (16%)	32 (59%)	54	3.94	1.57
Support for instruction or mentorship during program activities	10 (18%)	1 (1%)	9 (16%)	7 (13%)	27 (50%)	54	3.74	1.54
Stipends (payment)	12 (22%)	1 (1%)	6 (11%)	10 (18%)	24 (45%)	53	3.62	1.61
Research abstract preparation requirements	9 (16%)	0 (0%)	6 (11%)	12 (22%)	27 (50%)	54	3.89	1.46

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

The list below describes 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 REAP.					
		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Become familiar with my student(s) background and interests at the beginning of the REAP experience	54	54	100%	0	0%
Giving students real-life problems to investigate or solve	54	50	93%	4	7%
Selecting readings or activities that relate to students' backgrounds	54	44	82%	10	19%
Encouraging students to suggest new readings, activities, or projects	54	39	72%	15	28%
Helping students become aware of the role(s) that STEM plays in their everyday lives	54	45	83%	9	17%
Helping students understand how STEM can help them improve their own community	54	39	72%	15	28%
Asking students to relate real-life events or activities to topics covered in REAP	54	35	65%	19	35%

The list below describes 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 REAP.					
		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Identify the different learning styles that my student (s) may have at the beginning of the REAP experience	54	38	70%	16	30%
Interact with students and other personnel the same way regardless of their background	53	48	91%	5	9%
Use a variety of teaching and/or mentoring activities to meet the needs of all students	54	49	91%	5	9%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	53	31	59%	22	42%
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	54	49	91%	5	9%
Directing students to other individuals or programs for additional support as needed	53	37	70%	16	30%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	53	30	57%	23	43%

The list below describes 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 REAP.					
		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Having my student(s) tell other people about their backgrounds and interest	53	41	77%	12	23%
Having my student(s) explain difficult ideas to others	53	40	76%	13	25%
Having my student(s) listen to the ideas of others with an open mind	53	47	89%	6	11%
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	53	39	74%	14	26%
Having my student(s) give and receive constructive feedback with others	52	47	90%	5	10%
Having students work on collaborative activities or projects as a member of a team	51	46	90%	5	10%
Allowing my student(s) to resolve conflicts and reach agreement within their team	52	29	56%	23	44%

The list below describes 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 REAP.					
		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Teaching (or assigning readings) about specific STEM subject matter	53	46	87%	7	13%
Having my student(s) search for and review technical research to support their work	53	50	94%	3	6%
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	53	49	93%	4	8%
Supervising my student(s) while they practice STEM research skills	52	49	94%	3	6%
Providing my student(s) with constructive feedback to improve their STEM competencies	53	50	94%	3	6%
Allowing students to work independently to improve their self-management abilities	53	51	96%	2	4%
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	53	48	91%	5	9%
Encouraging students to seek support from other team members	53	50	94%	3	6%
Teaching (or assigning readings) about specific STEM subject matter	53	46	87%	7	13%

The list below describes 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 REAP.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Asking my student(s) about their educational and/or career goals	53	53	100%	0	0%
Recommending extracurricular programs that align with students' goals	53	29	55%	24	45%
Recommending Army Educational Outreach Programs that align with students' goals	52	28	54%	24	46%
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	53	47	89%	6	11%
Discussing STEM career opportunities within the DoD or other government agencies	53	32	60%	21	40%
Discussing STEM career opportunities in private industry or academia	53	43	81%	10	19%
Discussing the economic, political, ethical, and/or social context of a STEM career	53	29	55%	24	45%
Recommending student and professional organizations in STEM to my student(s)	53	31	59%	22	42%
Helping students build a professional network in a STEM field	53	31	59%	22	42%
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	51	22	43%	29	57%

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

	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science website	23 (43%)	1 (1%)	4 (7%)	7 (13%)	18 (34%)	53	2.92	1.82
Army Educational Outreach Program (AEOP) website	16 (29%)	1 (1%)	6 (11%)	11 (20%)	20 (37%)	54	3.33	1.68
AEOP on Facebook, Twitter, Pinterest or other social media	43 (79%)	5 (9%)	1 (1%)	1 (1%)	4 (7%)	54	1.48	1.14
AEOP brochure and/or presentation	22 (41%)	2 (3%)	8 (15%)	8 (15%)	13 (24%)	53	2.77	1.68
It Starts Here! Magazine	41 (77%)	1 (1%)	5 (9%)	1 (1%)	5 (9%)	53	1.64	1.30
REAP Program administrator or site	10 (19%)	0 (0%)	4 (7%)	9 (17%)	29 (55%)	52	3.90	1.55
Invited speakers or "career" events	39 (75%)	3 (5%)	2 (3%)	3 (5%)	5 (9%)	52	1.69	1.35
Participation in REAP	8 (14%)	0 (0%)	1 (1%)	11 (20%)	34 (63%)	54	4.17	1.41

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 REAP?					
		Yes - I discussed this program with my student(s)		No - I did not discuss this program with my student(s)	
	n	Freq.	%	Freq.	%
Gains in the Education of Mathematics and Science (GEMS)	50	8	16%	42	84%
UNITE	47	8	17%	39	83%
Junior Science & Humanities Symposium (JSHS)	49	9	18%	40	82%
Science & Engineering Apprenticeship Program (SEAP)	50	13	26%	37	74%
Research & Engineering Apprenticeship Program (REAP)	53	39	74%	14	26%
High School Apprenticeship Program (HSAP)	51	12	24%	39	77%
College Qualified Leaders (CQL)	49	5	10%	44	90%
GEMS Near Peer Mentor Program	48	5	10%	43	90%
Undergraduate Research Apprenticeship Program (URAP)	51	17	33%	34	67%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	51	12	24%	39	77%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	50	6	12%	44	88%
I discussed AEOP with my student(s) but did not discuss any specific program	48	16	33%	32	67%

How USEFUL were each of the following in your efforts to expose your student(s) to Department of Defense (DoD) STEM careers during REAP?								
	0	1	2	3	4	n	Avg.	SD
Academy of Applied Science website	25 (47%)	0 (0%)	4 (7%)	7 (13%)	17 (32%)	53	2.83	1.83
Army Educational Outreach Program (AEOP) website	19 (35%)	0 (0%)	5 (9%)	9 (17%)	20 (37%)	53	3.21	1.77
AEOP on Facebook, Twitter, Pinterest or other social media	44 (84%)	2 (3%)	2 (3%)	0 (0%)	4 (7%)	52	1.42	1.13
AEOP brochure and/or presentation	22 (41%)	2 (3%)	9 (17%)	7 (13%)	13 (24%)	53	2.75	1.67
It Starts Here! Magazine	42 (80%)	0 (0%)	6 (11%)	0 (0%)	4 (7%)	52	1.54	1.20
REAP Program administrator or site	13 (24%)	0 (0%)	5 (9%)	9 (17%)	26 (49%)	53	3.66	1.65
Invited speakers or “career” events	39 (75%)	1 (1%)	2 (3%)	4 (7%)	6 (11%)	52	1.79	1.46
Participation in REAP	9 (17%)	0 (0%)	2 (3%)	9 (17%)	33 (62%)	53	4.08	1.49

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%)	0 (0%)	2 (3%)	15 (28%)	35 (67%)	52	4.63	0.56
DoD researchers develop new, cutting edge technologies	0 (0%)	0 (0%)	2 (3%)	14 (26%)	36 (69%)	52	4.65	0.56
DoD researchers solve real-world problems	0 (0%)	0 (0%)	3 (5%)	15 (28%)	34 (65%)	52	4.60	0.60
DoD research is valuable to society	0 (0%)	0 (0%)	2 (3%)	15 (28%)	35 (67%)	52	4.63	0.56
DoD researchers advance science and engineering fields	0 (0%)	0 (0%)	2 (3%)	15 (28%)	35 (67%)	52	4.63	0.56

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 do each of the following in REAP?								
	1	2	3	4	5	n	Avg.	SD
Learn new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	2 (3%)	4 (7%)	19 (35%)	28 (52%)	53	4.38	0.79
Apply STEM knowledge to real life situations	0 (0%)	1 (1%)	7 (13%)	27 (50%)	18 (34%)	53	4.17	0.73
Learn about new discoveries in STEM	1 (1%)	2 (3%)	16 (30%)	20 (38%)	13 (25%)	52	3.81	0.93
Learn about different careers that use STEM	0 (0%)	8 (15%)	18 (34%)	18 (34%)	9 (17%)	53	3.53	0.95
Interact with scientists or engineers	0 (0%)	0 (0%)	7 (13%)	14 (26%)	32 (60%)	53	4.47	0.72
Communicate with other students about STEM	0 (0%)	4 (7%)	8 (15%)	15 (28%)	26 (49%)	53	4.19	0.96
Use laboratory or field techniques, procedures, and tools	0 (0%)	0 (0%)	2 (3%)	14 (26%)	37 (69%)	53	4.66	0.55
Participate in hands-on STEM activities	0 (0%)	1 (1%)	3 (5%)	14 (26%)	35 (66%)	53	4.57	0.69
Work as part of a team	1 (1%)	2 (3%)	3 (5%)	13 (24%)	34 (64%)	53	4.45	0.91
Identify questions or problems to investigate	0 (0%)	2 (3%)	12 (22%)	17 (32%)	22 (41%)	53	4.11	0.89
Design an investigation	5 (9%)	4 (7%)	16 (31%)	14 (27%)	12 (23%)	51	3.47	1.22
Carry out an investigation	0 (0%)	4 (7%)	9 (17%)	11 (21%)	28 (53%)	52	4.21	1.00
Analyze data or information	1 (1%)	5 (9%)	8 (15%)	17 (32%)	21 (40%)	52	4.00	1.07
Draw conclusions from an investigation	1 (1%)	7 (13%)	10 (19%)	16 (30%)	18 (34%)	52	3.83	1.12
Come up with creative explanations or solutions	1 (2%)	5 (9%)	12 (23%)	17 (33%)	16 (31%)	51	3.82	1.05
Build or make a computer model	25 (47%)	8 (15%)	10 (18%)	6 (11%)	4 (7%)	53	2.17	1.34

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 student's REAP project?		
	Freq.	**%**
Science	35	65%
Technology	3	6%
Engineering	14	26%
Mathematics	2	4%
Total	**54**	**100%**

AS A RESULT OF THE REAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
In depth knowledge of a STEM topic(s)	0 (0%)	2 (3%)	6 (11%)	29 (55%)	15 (28%)	52	4.10	0.75
Knowledge of research conducted in a STEM topic or field	0 (0%)	1 (1%)	6 (11%)	21 (40%)	24 (46%)	52	4.31	0.76
Knowledge of research processes, ethics, and rules for conduct in STEM	0 (0%)	2 (3%)	9 (17%)	21 (40%)	20 (38%)	52	4.13	0.84
Knowledge of how professionals work on real problems in STEM	0 (0%)	1 (1%)	9 (17%)	22 (42%)	20 (38%)	52	4.17	0.79
Knowledge of what everyday research work is like in STEM	0 (0%)	0 (0%)	5 (9%)	21 (40%)	26 (50%)	52	4.40	0.66

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

AS A RESULT OF THE REAP 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 scientific experiments	0 (0%)	4 (11%)	8 (23%)	18 (52%)	4 (11%)	34	3.65	0.85
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	0 (0%)	7 (20%)	7 (20%)	17 (50%)	3 (8%)	34	3.47	0.93
Making a model of an object or system showing its parts and how they work	10 (29%)	7 (20%)	5 (14%)	10 (29%)	2 (5%)	34	2.62	1.35
Designing procedures for an experiment that are appropriate for the question to be answered	3 (8%)	6 (17%)	8 (23%)	13 (38%)	4 (11%)	34	3.26	1.16
Identifying the limitations of the methods and tools used for data collection	1 (2%)	5 (14%)	11 (32%)	14 (41%)	3 (8%)	34	3.38	0.95
Carrying out procedures for an experiment and recording data accurately	0 (0%)	3 (9%)	4 (12%)	18 (54%)	8 (24%)	33	3.94	0.86
Using computer models of objects or systems to test cause and effect relationships	16 (47%)	6 (17%)	5 (14%)	4 (11%)	3 (8%)	34	2.18	1.38
Organizing data in charts or graphs to find patterns and relationships	3 (9%)	9 (27%)	7 (21%)	11 (33%)	3 (9%)	33	3.06	1.17
Considering different interpretations of data when deciding how the data answer a question	2 (5%)	7 (20%)	9 (26%)	15 (44%)	1 (2%)	34	3.18	1.00
Supporting an explanation for an observation with data from experiments	0 (0%)	4 (11%)	8 (23%)	20 (58%)	2 (5%)	34	3.59	0.78
Supporting an explanation with relevant scientific, mathematical, and/or engineering	2 (5%)	3 (8%)	8 (23%)	17 (50%)	4 (11%)	34	3.53	1.02
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	2 (5%)	11 (32%)	5 (14%)	14 (41%)	2 (5%)	34	3.09	1.11
Defending an argument that conveys how an explanation best describes an observation	7 (20%)	4 (11%)	9 (26%)	14 (41%)	0 (0%)	34	2.88	1.17
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	6 (17%)	4 (11%)	9 (26%)	13 (38%)	2 (5%)	34	3.03	1.22
Integrating information from technical or scientific texts and other media to support your explanation of an observation	1 (2%)	10 (29%)	4 (11%)	14 (41%)	5 (14%)	34	3.35	1.15
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	0 (0%)	4 (11%)	5 (14%)	17 (50%)	8 (23%)	34	3.85	0.93

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

AS A RESULT OF THE REAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	0 (0%)	0 (0%)	7 (41%)	7 (41%)	3 (17%)	17	3.76	0.75
Using knowledge and creativity to propose a testable solution for a problem	0 (0%)	0 (0%)	2 (11%)	11 (64%)	4 (23%)	17	4.12	0.60
Making a model of an object or system to show its parts and how they work	1 (5%)	3 (17%)	3 (17%)	7 (41%)	3 (17%)	17	3.47	1.18
Designing procedures for an experiment that are appropriate for the question to be answered	0 (0%)	1 (5%)	5 (29%)	8 (47%)	3 (17%)	17	3.76	0.83
Identifying the limitations of the methods and tools used for data collection	0 (0%)	1 (5%)	3 (17%)	9 (52%)	4 (23%)	17	3.94	0.83
Carrying out procedures for an experiment and recording data accurately	1 (5%)	0 (0%)	3 (17%)	8 (47%)	5 (29%)	17	3.94	1.03
Using computer models of an object or system to investigate cause and effect relationships	2 (11%)	3 (17%)	4 (23%)	6 (35%)	2 (11%)	17	3.18	1.24
Considering different interpretations of the data when deciding if a solution works as intended	0 (0%)	2 (11%)	4 (23%)	5 (29%)	6 (35%)	17	3.88	1.05
Organizing data in charts or graphs to find patterns and relationships	0 (0%)	1 (5%)	3 (17%)	7 (41%)	6 (35%)	17	4.06	0.90
Supporting a solution for a problem with data from experiments	1 (5%)	1 (5%)	4 (23%)	8 (47%)	3 (17%)	17	3.65	1.06
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	1 (5%)	3 (17%)	11 (64%)	2 (11%)	17	3.82	0.73
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	1 (5%)	1 (5%)	4 (23%)	6 (35%)	5 (29%)	17	3.76	1.15
Defend an argument that conveys how a solution best meets design criteria	1 (5%)	4 (23%)	3 (17%)	7 (41%)	2 (11%)	17	3.29	1.16
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	1 (5%)	1 (5%)	3 (17%)	7 (41%)	5 (29%)	17	3.82	1.13
Integrating information from technical or scientific texts and other media to support your solution to a problem	0 (0%)	2 (11%)	3 (17%)	8 (47%)	4 (23%)	17	3.82	0.95
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or	0 (0%)	2 (11%)	1 (5%)	7 (41%)	7 (41%)	17	4.12	0.99

math equations)								

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

AS A RESULT OF THE REAP EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learning to work independently	0 (0%)	0 (0%)	13 (25%)	22 (43%)	16 (31%)	51	4.06	0.76
Setting goals and reflecting on performance	0 (0%)	3 (6%)	15 (30%)	19 (38%)	13 (26%)	50	3.84	0.89
Sticking with a task until it is completed	0 (0%)	0 (0%)	12 (23%)	21 (41%)	18 (35%)	51	4.12	0.77
Making changes when things do not go as planned	0 (0%)	2 (3%)	15 (29%)	23 (45%)	11 (21%)	51	3.84	0.81
Including others' perspectives when making decisions	1 (2%)	4 (7%)	8 (15%)	23 (45%)	15 (29%)	51	3.92	0.98
Communicating effectively with others	0 (0%)	3 (6%)	7 (14%)	25 (50%)	15 (30%)	50	4.04	0.83
Confidence with new ideas or procedures in a STEM project	0 (0%)	3 (5%)	10 (19%)	26 (51%)	12 (23%)	51	3.92	0.82
Patience for the slow pace of research	1 (2%)	3 (5%)	15 (29%)	22 (43%)	10 (19%)	51	3.73	0.92
Desire to build relationships with	1 (2%)	4 (7%)	15 (29%)	19 (37%)	12 (23%)	51	3.73	0.98
Connecting a topic or field and their personal values	2 (3%)	11 (21%)	10 (19%)	20 (39%)	8 (15%)	51	3.41	1.12

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 the REAP program?							
	1	**2**	**3**	**4**	**n**	**Avg.**	**SD**
More confident in STEM knowledge, skills, and abilities	0 (0%)	0 (0%)	38 (73%)	14 (26%)	52	3.27	0.45
More interested in participating in STEM activities outside of school requirements	0 (0%)	3 (5%)	32 (61%)	17 (32%)	52	3.27	0.56
More aware of other AEOPs	5 (10%)	2 (4%)	23 (48%)	17 (36%)	47	3.11	0.91
More interested in participating in other AEOPs	7 (14%)	0 (0%)	26 (54%)	15 (31%)	48	3.02	0.96
More interested in taking STEM classes in school	0 (0%)	3 (6%)	34 (68%)	13 (26%)	50	3.20	0.53
More interested in earning a STEM degree in college	0 (0%)	4 (7%)	36 (70%)	11 (21%)	51	3.14	0.53
More interested in pursuing a career in STEM	0 (0%)	3 (5%)	36 (70%)	12 (23%)	51	3.18	0.52
More aware of Department of Defense (DoD) STEM research and careers	6 (12%)	3 (6%)	21 (43%)	18 (37%)	48	3.06	0.98
Greater appreciation of DoD STEM research and careers	6 (12%)	2 (4%)	22 (46%)	17 (36%)	47	3.06	0.96
More interested in pursuing a STEM career with the DoD	9 (18%)	3 (6%)	21 (43%)	15 (31%)	48	2.88	1.06

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

Appendix D

FY15 REAP Apprentice and Mentor Interview Protocol

2015 Research and Engineering Apprenticeship Program (REAP) Evaluation Study
Apprentice Phone Interview Participant Characteristics

Please tell us about yourself by answering the following questions. You may choose not to respond to any or all of these questions, but we hope that you will—this information is very important to the Army, one of the sponsors of the REAP program.

1. **What is your gender?**
   - Male
   - Female

2. **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 (specify), _____

3. **What is grade level will you start this fall? (select one)**
   - 8th
   - 9th
   - 10th
   - 11th
   - 12th
   - College
   - Other (specify), _____

4. **How many years have you participated in REAP <u>in addition to this year</u>?**
   - One year
   - Two years
   - Three years
   - Four years
   - Five years or more

5. **Have you participated in any of the following AEOP programs? (check all that apply)**
   - Camp Invention
   - eCYBERMISSION
   - Junior Solar Sprint (JSS)
   - Gains in the Education of Mathematics & Science (GEMS)
   - GEMS Near Peers
   - Junior Science & Humanities Symposium (JSHS)
   - Science & Engineering Apprenticeship program (SEAP)
   - UNITE
   - High School Apprenticeship Program (HSAP)

2015 Army Educational Outreach Program
REAP Apprentice Interview

Facilitator: "Thank you for talking with me today so that we can learn more about your experiences in [X] program. What is shared on this phone call cannot be traced back to individuals. 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 recording 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.

2015 Research and Engineering Apprenticeship Program (REAP) Evaluation Study
ADULT Phone Interview Participant Characteristics

1. **What is your gender?**
   - Male
   - Female

2. **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 (specify), _____

3. **Which of the following BEST describes your occupation? (select one)**
   - Teacher
   - Other school staff
   - University educator or employee (faculty member, researcher, etc.)
   - Scientist, Engineer, or Mathematician in training (undergraduate student, graduate student, etc.)
   - Department of Defense STEM professional
   - Industry STEM professional
   - Other (specify), _____

4. **Which of the following BEST describes your role in REAP?**
   - Research Mentor
   - Research Team Member but not a Principal Investigator (PI)
   - Other (specify), ___Director_____

5. **How many years have you participated in REAP <u>in addition to this year</u>?**
   - One year
   - Two years
   - Three years
   - Four years
   - Five years or more

6. **Have you participated in any of the following AEOP programs? (check all that apply)**
   - Camp Invention
   - eCYBERMISSION
   - Junior Solar Sprint (JSS)
   - Gains in the Education of Mathematics & Science (GEMS)
   - GEMS Near Peers
   - Junior Science & Humanities Symposium (JSHS)
   - Science & Engineering Apprenticeship Program (SEAP)
   - UNITE
   - 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

2015 Army Educational Outreach Program

Adult Interview

Facilitator: "Thank you for talking with me today so that we can learn more about your experiences in [X] program. What is shared on this phone call cannot be traced back to individuals. 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 recording 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 benefitted?
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 question:

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

Appendix E

FY15 REAP Apprentice Survey Instrument

2015 Research and Engineering Apprenticeship Program (REAP): REAP Participant Survey

Virginia Tech conducts program evaluation on behalf of the Academy of Applied Science (AAS) and U.S. Army to determine how well the Army Educational Outreach Programs (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 the Research and Engineering Apprenticeship Program (REAP). The survey will collect information about you, your experiences in school, and your experiences in REAP.

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.

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 the AEOP program you just completed or will soon complete.

Contact Information		
Please verify the following information:		
*First Name:		
*Last Name:		
*Email Address:		
All fields with an asterisk (*) are required.		

*1. Do you agree to participate in this survey? (required)(*Required)		
Select one.		
○	Yes, I agree to participate in this survey	(Go to question number 2.)
○	No, I do not wish to participate in this survey	Go to end of chapter

8. At which of the following REAP sites did you participate? (Select ONE)

Select one

○	Alabama State University – Montgomery, AL
○	University of Alabama – Huntsville, AL
○	Arizona State University – Tempe, AZ
○	University of Arkansas at Pine Bluff – Pine Bluff, AK
○	University of California, Berkeley – Berkeley, CA
○	Colorado State University – Fort Collins, CO
○	University of Colorado, Boulder – Boulder, CO
○	Delaware State University – Dover, DE
○	Miami Dade University – Miami, FL
○	University of Central Florida – Orlando, FL
○	University of South Florida – Tampa, FL
○	Clark Atlanta University – Atlanta, GA
○	Georgia State University – Atlanta, GA
○	Savannah State University - Savannah, GA
○	Loyola University – Chicago, IL
○	University of Iowa – Iowa City, IA
○	Xavier University of Louisiana – New Orleans, LA
○	University of Maryland, Baltimore – Baltimore, MD
○	University of Massachusetts, Lowell – Lowell, MA
○	Michigan Technological University – Houghton, MI
○	Oakland University – Rochester, MI
○	Jackson State University – Jackson, MS
○	University of Missouri – Columbia, MO
○	Montana State University – Bozeman, MT
○	University of New Hampshire – Durham, NH
○	New Jersey Institute of Technology – Newark, NJ
○	New Mexico State – Las Cruces, NM
○	LeMoyne College – Syracuse, NY

○	North Carolina A&T State University – Greensboro, NC
○	North Carolina Central University – Durham, NC
○	University of Puerto Rico – San Juan, PR
○	University of Puerto Rico at Humacao – Humacao, PR
○	South Dakota School of Mines – Rapid City, SD
○	Texas Southern – Houston, TX
○	Texas Tech University – Lubbock, TX
○	University of Houston – Houston, TX
○	University of Texas, El Paso – El Paso, TX
○	University of Utah – Salt Lake City, UT
○	University of Washington – Seattle, WA

9. How often did you do each of the following in STEM classes at school?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	○	○	○	○	○
Apply STEM learning to real-life situations	○	○	○	○	○
Learn about new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○

10. How often did you do each of the following in REAP this year?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	○	○	○	○	○
Apply STEM learning to real-life situations	○	○	○	○	○
Learn about new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○

11. How often did you do each of the following in STEM classes at school?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Use laboratory procedures and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

12. How often did you do each of the following in REAP this year?

Select one per row.

	Not at all	*At least once*	*A few times*	*Most days*	*Every day*
Use laboratory procedures and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

13. How much did each of the following resources help you learn about Army Educational Outreach Programs (AEOPs)?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Academy of Applied Science (ASS) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My REAP mentor(s)	○	○	○	○	○
Invited speakers or “career” events during REAP	○	○	○	○	○
Participation in REAP	○	○	○	○	○

14. How much did each of the following resources help you learn about STEM careers in the Army or Department of Defense (DoD)?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Academy of Applied Science (AAS) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My REAP mentor(s)	○	○	○	○	○
Invited speakers or “career” events during REAP	○	○	○	○	○
Participation in REAP	○	○	○	○	○

15. How SATISFIED were you with the following REAP features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Applying or registering for the program	○	○	○	○	○
Communicating with your REAP host site organizers	○	○	○	○	○
The physical location(s) of REAP activities	○	○	○	○	○
The variety of STEM topics available to you in REAP	○	○	○	○	○
Teaching or mentoring provided during REAP activities	○	○	○	○	○
Stipends (payment)	○	○	○	○	○
Research abstract preparation requirements	○	○	○	○	○
Development opportunities beyond conducting research (attending seminars, taking courses, pursuing competitions, or scholarships, presenting or publishing research, etc.)	○	○	○	○	○

16. How much input did you have in selecting your REAP research project?

Select one.

○	I did not have a project
○	I was assigned a project by my mentor
○	I worked with my mentor to design a project
○	I had a choice among various projects suggested by my mentor
○	I worked with my mentor and members of a research team to design a project
○	I designed the entire project on my own

17. How often was your mentor available to you during REAP?

Select one.

○	I did not have a mentor
○	The mentor was never available
○	The mentor was available less than half of the time
○	The mentor was available about half of the time of my project
○	The mentor was available more than half of the time
○	The mentor was always available

18. To what extent did you work as part of a group or team during REAP?

Select one.

○	I worked alone (or alone with my research mentor)
○	I worked with others in a shared laboratory or other space, but we work on different projects
○	I worked alone on my project and I met with others regularly for general reporting or discussion
○	I worked alone on a project that was closely connected with projects of others in my group
○	I work with a group who all worked on the same project

19. How SATISFIED were you with each of the following:

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
My working relationship with my mentor	○	○	○	○	○
My working relationship with the group or team	○	○	○	○	○
The amount of time I spent doing meaningful research	○	○	○	○	○
The amount of time I spent with my research mentor	○	○	○	○	○
The research experience overall	○	○	○	○	○

20. The list below includes effective teaching and mentoring strategies. From the list, please indicate which strategies that your mentor(s) used when working with you in REAP:

Select one per row.

	Yes - my mentor used this strategy with me	*No - my mentor did not use this strategy with me*
Helped me become aware of STEM in my everyday life	○	○
Helped me understand how I can use STEM to improve my community	○	○
Used a variety of strategies to help me learn	○	○
Gave me extra support when I needed it	○	○
Encouraged me to share ideas with others who have different backgrounds or viewpoints than I do	○	○
Allowed me to work on a team project or activity	○	○
Helped me learn or practice a variety of STEM skills	○	○
Gave me feedback to help me improve in STEM	○	○
Talked to me about the education I need for a STEM career	○	○
Recommended Army Educational Outreach Programs that match my interests	○	○
Discussed STEM careers with the DoD or government	○	○

21. Which of the following statements apply to your research experience in REAP? (Choose ALL that apply)

Select all that apply.

☐	I presented a talk or poster to other students or faculty
☐	I presented a talk or poster at a professional symposium or conference
☐	I attended a symposium or conference
☐	I wrote or co-wrote a paper that was/will be published in a research journal
☐	I wrote or co-wrote a technical paper or patent
☐	I will present a talk or poster to other students or faculty
☐	I will present a talk or poster at a professional symposium or conference
☐	I will attend a symposium or conference
☐	I will write or co-write a paper that was/will be published in a research journal
☐	I will write or co-write a technical paper or patent
☐	I won an award or scholarship based on my research

22. As a result of your REAP experience, how much did you GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
In depth knowledge of a STEM topic(s)	○	○	○	○	○
Knowledge of research conducted in a STEM topic or field	○	○	○	○	○
Knowledge of research processes, ethics, and rules for conduct in STEM	○	○	○	○	○
Knowledge of how scientists and engineers work on real problems in STEM	○	○	○	○	○
Knowledge of what everyday research work is like in STEM	○	○	○	○	○

23. Which category best describes the focus of your student(s) REAP activities?		
Select one.		
○	Science	(Go to question number 24.)
○	Technology	(Go to question number 25.)
○	Engineering	(Go to question number 25.)
○	Mathematics	(Go to question number 25.)

24. As a result of your REAP experience, how much did you GAIN in your ability to do each of the following?

Select one per row.

If answered, go to question number 26.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Asking a question that can be answered with one or more scientific experiments	○	○	○	○	○
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	○	○	○	○	○
Making a model of an object or system showing its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of objects or systems to test cause and effect relationships	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Considering different interpretations of data when deciding how the data answer a question	○	○	○	○	○
Supporting an explanation for an observation with data from experiments	○	○	○	○	○
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	○	○	○	○	○
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	○	○	○	○	○
Defending an argument that conveys how an explanation	○	○	○	○	○

best describes an observation					
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your explanation of an observation	○	○	○	○	○
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	○	○	○	○	○

25. As a result of your REAP experience, how much did you GAIN in your ability to do each of the following?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Defining a problem that can be solved by developing a new or improved object, process, or system	○	○	○	○	○
Using knowledge and creativity to propose a testable solution for a problem	○	○	○	○	○
Making a model of an object or system to show its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of an object or system to investigate cause and effect relationships	○	○	○	○	○
Considering different interpretations of the data when deciding if a solution works as intended	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Supporting a solution for a problem with data from experiments	○	○	○	○	○
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	○	○	○	○	○
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	○	○	○	○	○
Defend an argument that conveys how a solution best meets design criteria	○	○	○	○	○

Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your solution to a problem	○	○	○	○	○
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	○	○	○	○	○

26. As a result of your REAP experience, how much did you GAIN in each of the skills/abilities listed below?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Learning to work independently	○	○	○	○	○
Setting goals and reflecting on performance	○	○	○	○	○
Sticking with a task until it is finished	○	○	○	○	○
Making changes when things do not go as planned	○	○	○	○	○
Working well with people from all backgrounds	○	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○	○
Communicating effectively with others	○	○	○	○	○
Viewing failure as an opportunity to learn	○	○	○	○	○

27. As a result of your REAP experience, how much did you GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Interest in a new STEM topic	○	○	○	○	○
Deciding on a path to pursue a STEM career	○	○	○	○	○
Sense of accomplishing something in STEM	○	○	○	○	○
Feeling prepared for more challenging STEM activities	○	○	○	○	○
Confidence to try out new ideas or procedures on my own in a STEM project	○	○	○	○	○
Patience for the slow pace of STEM research	○	○	○	○	○
Desire to build relationships with mentors who work in STEM	○	○	○	○	○
Connecting a STEM topic or field to my personal values	○	○	○	○	○

28. AS A RESULT OF YOUR REAP experience, are you MORE or LESS likely to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?

Select one per row.

	Much less likely	*Less likely*	*About the same before and after*	*More likely*	*Much more likely*
Watch or read non-fiction STEM	○	○	○	○	○
Tinker (play) with a mechanical or electrical device	○	○	○	○	○
Work on solving mathematical or scientific puzzles	○	○	○	○	○
Use a computer to design or program something	○	○	○	○	○
Talk with friends or family about STEM	○	○	○	○	○
Mentor or teach other students about STEM	○	○	○	○	○
Help with a community service project related to STEM	○	○	○	○	○
Participate in a STEM camp, club, or competition	○	○	○	○	○
Take an elective (not required) STEM class	○	○	○	○	○
Work on a STEM project or experiment in a university or professional setting	○	○	○	○	○

29. Before you participated in REAP, how far did you want to go in school?

Select one.

○	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
○	Get a master's degree
○	Get a Ph.D.
○	Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
○	Get a combined M.D. / Ph.D.
○	Get another professional degree (law, business, etc.)

30. After you have participated in REAP, how far do you want to go in school?

Select one.

○	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
○	Get a master's degree
○	Get a Ph.D.
○	Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
○	Get a combined M.D. / Ph.D.
○	Get another professional degree (law, business, etc.)

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

Select one.

○	not at all
○	up to 25% of the time
○	up to 50% of the time
○	up to 75% of the time
○	up to 100% of the time

32. Before you participated in REAP, what kind of work did you want to do when you are 30? (select one)

Select one.

○	Undecided
○	Science (no specific subject)
○	Physical science (physics, chemistry, astronomy, materials science)
○	Biological science
○	Earth, atmospheric or oceanic science
○	Environmental science
○	Computer science
○	Technology
○	Engineering
○	Mathematics or statistics
○	Medicine (doctor, dentist, veterinarian, etc.)
○	Health (nursing, pharmacy, technician, etc.)
○	Social science (psychologist, sociologist, etc.)
○	Teaching, STEM
○	Teaching, non-STEM
○	Business
○	Law
○	Military, police, or security
○	Art (writing, dancing, painting, etc.)
○	Skilled trade (carpenter
○	Other, (specify)::

33. After you participated in REAP, what kind of work do you want to do when you are 30? (select one)

Select one.

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

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

Select one per row.

	I've never heard of this program	*Not at all*	*A little*	*Somewhat*	*Very much*
Gains in the Education of Mathematics and Science (GEMS)	○	○	○	○	○
UNITE	○	○	○	○	○
Junior Science & Humanities Symposium (JSHS)	○	○	○	○	○
Science & Engineering Apprenticeship Program (SEAP)	○	○	○	○	○
Research & Engineering Apprenticeship Program (REAP)	○	○	○	○	○
High School Apprenticeship Program (HSAP)	○	○	○	○	○
College Qualified Leaders (CQL)	○	○	○	○	○
GEMS Near Peer Mentor Program	○	○	○	○	○
Undergraduate Research Apprenticeship Program (URAP)	○	○	○	○	○
Science Mathematics, and Research for Transformation (SMART) College Scholarship	○	○	○	○	○
National Defense Science & Engineering Graduate (NDSEG) Fellowship	○	○	○	○	○

35. How many jobs/careers in STEM did you learn about during REAP?

Select one.

○	None
○	1
○	2
○	3
○	4
○	5 or more

36. How many Army or Department of Defense (DoD) STEM jobs/careers did you learn about during REAP?

Select one.

○	None
○	1
○	2
○	3
○	4
○	5 or more

37. How much do you agree or disagree with the following statements about Department of Defense (DoD) researchers and research:

Select one per row.

	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 solve real-world problems	○	○	○	○	○
DoD research is valuable to society	○	○	○	○	○

38. Which of the following statements describe you after participating in the REAP program?

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of REAP*	*Agree - REAP contributed*	*Agree - REAP 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 earning a STEM degree	○	○	○	○
I am more interested in pursuing a career in STEM	○	○	○	○
I am more aware of Army or DoD STEM research and careers	○	○	○	○
I have a greater appreciation of Army or DoD STEM research	○	○	○	○
I am more interested in pursuing a STEM career with the Army or DoD	○	○	○	○

39. What are the three most important ways that REAP has helped you?	
Benefit #1:	
Benefit #2:	
Benefit #3:	

40. What are the three ways that REAP should be improved for future participants?	
Improvement #1:	
Improvement #2:	
Improvement #3:	

41. Please tell us about your overall satisfaction with your REAP experience.

Appendix F

FY15 REAP Mentor Survey Instrument

2014 Research and Engineering Apprenticeship Program (REAP): REAP 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

Contact Information		
Please verify the following information:		
*First Name:		
*Last Name:		
*Email Address:		
All fields with an asterisk (*) are required.		

*1. Do you agree to participate in this survey? (required)(*Required)
Select one.

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

6. Which of the following BEST describes the organization you work for? (select ONE)
Select one.

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

7. Which of the following BEST describes your current occupation (select ONE)		
Select one.		
○	Teacher	(Go to question number 8.)
○	Other school staff	(Go to question number 8.)
○	University educator	(Go to question number 13.)
○	Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	(Go to question number 13.)
○	Scientist, Engineer, or Mathematics professional	(Go to question number 13.)
○	Other, (specify)::	(Go to question number 13.)

8. What grade level(s) do you teach (select all that apply)?	
Select all that apply.	
☐	Upper elementary
☐	Middle school
☐	High school

9. Which best describes the location of your school?	
Select one.	
○	Frontier or tribal school
○	Rural (country)
○	Suburban
○	Urban (city)

10. At what kind of school did you teach while participating in REAP?	
Select one.	
○	Public school
○	Private school
○	Home school
○	Online school
○	Department of Defense school (DoDDS, DoDEA)

12. Which of the following subjects do you teach? (select ALL that apply)	
Select all that apply.	
If answered, go to question number 14.	
☐	Upper elementary
☐	Physical science (physics, chemistry, astronomy, materials science, etc.)
☐	Biological science
☐	Earth, atmospheric, or oceanic science
☐	Environmental science
☐	Computer science
☐	Technology
☐	Engineering
☐	Mathematics or statistics
☐	Medical, health, or behavioral science
☐	Social Science (psychology, sociology, anthropology)
☐	Other, (specify)::

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

Select one.

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

15. Which of the following BEST describes your role during REAP?

Select one.

○	Research Mentor
○	Research Team Member but not a Principal Investigator (PI)
○	Other, (specify)::

16. How many REAP students did you work with this year?

_____ students.

17. How did you learn about REAP? (Check all that apply)

Select all that apply.

☐	Academy of Applied Science (AAS)
☐	Army Educational Outreach Program (AEOP) website
☐	AEOP on Facebook, Twitter, Pinterest, or other social media
☐	A STEM conference or STEM education conference
☐	An email or newsletter from school, university, or a professional organization
☐	Past REAP participant
☐	A student
☐	A colleague
☐	My supervisor or superior
☐	A REAP site host or director
☐	Workplace communications
☐	Someone who works with the Department of Defense (Army, Navy, Air Force)
☐	Other, (specify)::

18. 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."

Select one per row.

	Never	*Once*	*Twice*	*Three or more times*	*I've never heard of this program*
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	○	○	○	○	○

19. Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply)

Select all that apply.

☐	Applications from Academy of Applied Science (AAS) or the AEOP
☐	Personal acquaintance(s) (friend, family, neighbor, etc.)
☐	Colleague(s) in my workplace
☐	K-12 school teacher(s) outside of my workplace
☐	University faculty outside of my workplace
☐	Informational materials sent to K-12 schools or Universities outside of my workplace
☐	Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)
☐	Communication(s) generated by a university or faculty (newsletter, email blast, website)
☐	STEM or STEM Education conference(s) or event(s)
☐	Organization(s) that serve underserved or underrepresented populations
☐	The student contacted me (the mentor) about the program
☐	I do not know how student(s) were recruited for REAP
☐	Other, (specify)::

20. How SATISFIED were you with the following REAP features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Application or registration process	○	○	○	○	○
Other administrative tasks (in-processing, network access, etc.)	○	○	○	○	○
Communicating with Academy of Applied Science (AAS)	○	○	○	○	○
Communicating with REAP organizers	○	○	○	○	○
Support for instruction or mentorship during program activities	○	○	○	○	○
Stipends (payment)	○	○	○	○	○
Research abstract preparation requirements	○	○	○	○	○

21. The list below describes 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 REAP.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Become familiar with my student(s) background and interests at the beginning of the REAP experience	○	○
Giving students real-life problems to investigate or solve	○	○
Selecting readings or activities that relate to students' backgrounds	○	○
Encouraging students to suggest new readings, activities, or projects	○	○
Helping students become aware of the role(s) that STEM plays in their everyday lives	○	○
Helping students understand how STEM can help them improve their own community	○	○
Asking students to relate real-life events or activities to topics covered in REAP	○	○

22. The list below describes 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 REAP.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Identify the different learning styles that my student (s) may have at the beginning of the REAP experience	○	○
Interact with students and other personnel the same way regardless of their background	○	○
Use a variety of teaching and/or mentoring activities to meet the needs of all students	○	○
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	○	○
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	○	○
Directing students to other individuals or programs for additional support as needed	○	○
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	○	○

23. The list below describes 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 REAP.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Having my student(s) tell other people about their backgrounds and interests	○	○
Having my student(s) explain difficult ideas to others	○	○
Having my student(s) listen to the ideas of others with an open mind	○	○
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	○	○
Having my student(s) give and receive constructive feedback with others	○	○
Having students work on collaborative activities or projects as a member of a team	○	○
Allowing my student(s) to resolve conflicts and reach agreement within their team	○	○

24. The list below describes 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 REAP.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Teaching (or assigning readings) about specific STEM subject matter	○	○
Having my student(s) search for and review technical research to support their work	○	○
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	○	○
Supervising my student(s) while they practice STEM research skills	○	○
Providing my student(s) with constructive feedback to improve their STEM competencies	○	○
Allowing students to work independently to improve their self-management abilities	○	○
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	○	○
Encouraging students to seek support from other team members	○	○

25. This list describes 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 this list, please indicate which strategies you used when working with your student(s) in REAP.

Select one per row.

	Yes - I used this strategy	*No - I did not use this strategy*
Asking my student(s) about their educational and/or career goals	○	○
Recommending extracurricular programs that align with students' goals	○	○
Recommending Army Educational Outreach Programs that align with students' goals	○	○
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	○	○
Discussing STEM career opportunities within the DoD or other government agencies	○	○
Discussing STEM career opportunities in private industry or academia	○	○
Discussing the economic, political, ethical, and/or social context of a STEM career	○	○
Recommending student and professional organizations in STEM to my student(s)	○	○
Helping students build a professional network in a STEM field	○	○
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	○	○

26. How useful were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during REAP?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Academy of Applied Science (AAS) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
REAP Program administrator or site coordinator	○	○	○	○	○
Invited speakers or “career” events	○	○	○	○	○
Participation in REAP	○	○	○	○	○

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

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Academy of Applied Science (AAS) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
REAP Program administrator or site coordinator	○	○	○	○	○
Invited speakers or “career” events	○	○	○	○	○
Participation in REAP	○	○	○	○	○

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

Select one per row.

	Yes - I discussed this program with my student(s)	*No - I did not discuss this program with my student(s)*
Gains in the Education of Mathematics and Science (GEMS)	○	○
UNITE	○	○
Junior Science & Humanities Symposium (JSHS)	○	○
Science & Engineering Apprenticeship Program (SEAP)	○	○
Research & Engineering Apprenticeship Program (REAP)	○	○
High School Apprenticeship Program (HSAP)	○	○
College Qualified Leaders (CQL)	○	○
GEMS Near Peer Mentor Program	○	○
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	○	○

29. How much do you agree or disagree with the following statements about Department of Defense (DoD) researchers and research:

Select one per row.

	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 solve real-world problems	○	○	○	○	○
DoD research is valuable to society	○	○	○	○	○

30. How often did YOUR STUDENT(S) have opportunities to do each of the following in REAP?

Select one per row.

	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 new discoveries in STEM	○	○	○	○	○
Learn about different careers that use STEM	○	○	○	○	○
Interact with scientists or engineers	○	○	○	○	○
Communicate with other students about STEM	○	○	○	○	○
Use laboratory or field techniques, procedures, and tools	○	○	○	○	○
Participate in hands-on STEM activities	○	○	○	○	○
Work as part of a team	○	○	○	○	○
Identify questions or problems to investigate	○	○	○	○	○
Design an investigation	○	○	○	○	○
Carry out an investigation	○	○	○	○	○
Analyze data or information	○	○	○	○	○
Draw conclusions from an investigation	○	○	○	○	○
Come up with creative explanations or solutions	○	○	○	○	○
Build or make a computer model	○	○	○	○	○

31. As a result of their REAP experience, how much did your student(s) GAIN in the following areas?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
In depth knowledge of a STEM topic(s)	○	○	○	○	○
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	○	○	○	○	○

32. Which category best describes the focus of your student(s) REAP activities?

Select one.

○	Science	(Go to question number 33.)
○	Technology	(Go to question number 34.)
○	Engineering	(Go to question number 34.)
○	Mathematics	(Go to question number 34.)

33. AS A RESULT OF THEIR REAP EXPERIENCE, how much did your student(s) GAIN in their abilities to do each of the following?

Select one per row.

If answered, go to question number 35.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Asking a question that can be answered with one or more scientific experiments	○	○	○	○	○
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	○	○	○	○	○
Making a model of an object or system showing its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of objects or systems to test cause and effect relationships	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Considering different interpretations of data when deciding how the data answer a question	○	○	○	○	○
Supporting an explanation for an observation with data from experiments	○	○	○	○	○
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	○	○	○	○	○
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	○	○	○	○	○

Defending an argument that conveys how an explanation best describes an observation	○	○	○	○	○
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your explanation of an observation	○	○	○	○	○
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	○	○	○	○	○

34. **AS A RESULT OF THEIR REAP EXPERIENCE, how much did your student(s) GAIN in their ability to do each of the following?**

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Defining a problem that can be solved by developing a new or improved object, process, or system	○	○	○	○	○
Using knowledge and creativity to propose a testable solution for a problem	○	○	○	○	○
Making a model of an object or system to show its parts and how they work	○	○	○	○	○
Designing procedures for an experiment that are appropriate for the question to be answered	○	○	○	○	○
Identifying the limitations of the methods and tools used for data collection	○	○	○	○	○
Carrying out procedures for an experiment and recording data accurately	○	○	○	○	○
Using computer models of an object or system to investigate cause and effect relationships	○	○	○	○	○
Considering different interpretations of the data when deciding if a solution works as intended	○	○	○	○	○
Organizing data in charts or graphs to find patterns and relationships	○	○	○	○	○
Supporting a solution for a problem with data from experiments	○	○	○	○	○
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	○	○	○	○	○
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	○	○	○	○	○
Defend an argument that conveys how a solution best	○	○	○	○	○

meets design criteria					
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	○	○	○	○	○
Integrating information from technical or scientific texts and other media to support your solution to a problem	○	○	○	○	○
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	○	○	○	○	○

35. AS A RESULT OF THE REAP EXPERIENCE, how much did your student(s) GAIN (on average) in the skills/abilities listed below?

Select one per row.

	No gain	*A little gain*	*Some gain*	*Large gain*	*Extreme gain*
Learning to work independently	○	○	○	○	○
Setting goals and reflecting on performance	○	○	○	○	○
Sticking with a task until it is finished	○	○	○	○	○
Making changes when things do not go as planned	○	○	○	○	○
Including others' perspectives when making decisions	○	○	○	○	○
Communicating effectively with others	○	○	○	○	○
Confidence with new ideas or procedures in a STEM project	○	○	○	○	○
Patience for the slow pace of research	○	○	○	○	○
Desire to build relationships with professionals in a field	○	○	○	○	○
Connecting a topic or field with their personal values	○	○	○	○	○

36. Which of the following statements describe YOUR STUDENT(S) after participating in the REAP program?

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of REAP*	*Agree - REAP contributed*	*Agree - REAP 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 earning a STEM degree	○	○	○	○
More interested in pursuing a career in STEM	○	○	○	○
More aware of DoD STEM research and careers	○	○	○	○
Greater appreciation of DoD STEM research	○	○	○	○
More interested in pursuing a STEM career with the DoD	○	○	○	○

37. What are the three most important strengths of REAP?

Strength #1:	
Strength #2:	
Strength #3:	

38. What are the three ways REAP should be improved for future participants?

Improvement #1:	
Improvement #2:	
Improvement #3:	

39. Please tell us about your overall satisfaction with your REAP experience.

Appendix G

Academy of Applied Science (AAS)
FY15 Evaluation Report Response

The Academy of Applied Science was provided with an opportunity to review the FY15 REAP Evaluation Report and shared the following two items of concern in regards to the REAP program areas: mentor diversity and promotion of DOD and Army careers. Below is text from the email response provided from AAS (O'Mara).

Two items of concern to me are: the continuous comments of the REAP mentors not matching the ethnicity of the apprentices. We have one mentor (of varied ethnicity) and two students, the make up of which can be one female (white) and one male (African American). I've been wrapping my head around this and have not come up with a solution. We do, however, recommend to the directors/mentors to invite professors from different departments and ethnicities to visit their labs and speak with the students about their experiences.

The other concern I have is the difficulty in obtaining US.Army career materials (brochures, video clips, flyers, etc.). The only item we were able to get were web links to ARMY, NAVY and, AIR FORCE research sites.