Army Educational Outreach Program

Undergraduate Research Apprentice Program

2015 Annual Program Evaluation Report

URAP_03_05112016

U.S. Army Contacts

Jagadeesh Pamulapati, Ph.D.
Director for Integration and Laboratory Management Policy
Office of the Assistant Secretary of the Army
Acquisition, Logistics, and Technology
(703) 617-0309
jagadeesh.pamulapati.civ@mail.mil

Andrea Simmons-Worthen
Army Educational Outreach Program Director on
behalf of the Office of the Deputy
Secretary of the Army for Research and Technology
(703) 617-0202
andrea.e.simmons.ctr@mail.mil

AEOP Cooperative Agreement Manager

Louie Lopez
AEOP Cooperative Agreement Manager
U.S. Army Research, Development, and
Engineering Command (RDECOM)
(410) 278-9858
louie.r.lopez.civ@mail.mil

Battelle Memorial Institute – Lead Organization

David Burns
Project Director, AEOP CA
Director of STEM Innovation Networks
(859) 322-7431
burnsd@battelle.org

URAP Program Administrators

Michael Caccuitto
Chief, Technology Integration and Outreach Division
U.S. Army Research Office
(919) 549-4339
michael.j.caccuitto.civ@mail.mil

Reshockie Smith
URAP Program Administrator
U.S. Army Research Office
(919) 459-4339
reshockie.smith.ctr@us.army.mil

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Evaluation Team Contacts

Carla C. Johnson, Ed.D.
Evaluation Director, AEOP CA
Purdue University
(765) 494-0019
carlacjohnson@purdue.edu

Toni A. Sondergeld, Ph.D.
Asst. Evaluation Director, AEOP CA
Metriks Amerique
(419) 902-6898
tonisondergeld@metriks.com

Erin Peters Burton, Ph.D.
Asst. Evaluation Director, AEOP CA
Metriks Amerique
(419) 902-6898
erin.peters1@gmail.com

Contents

Executive Summary

The Undergraduate Research Apprenticeship Program (URAP), managed by the U.S. Army Research Office (ARO), is an Army Educational Outreach Program (AEOP) commuter program for undergraduate students who demonstrate an interest in science, technology, engineering, or mathematics (STEM) to gain research experience as an apprentice in an Army-funded university or college research laboratory. URAP is designed so that students (herein called apprentices) can apprentice in fields of their choice with experienced Army-funded scientists and engineers (S&Es, herein called mentors) full-time during the summer or part-time during the school year.
Apprentices receive an educational stipend equivalent to $10 per hour and are allowed to work up to 300 hours total. The apprentices contribute to the research of the laboratory while learning research techniques in the process. This "hands-on" experience gives students a broader view of their fields of interest and shows students what kind of work awaits them in their future career. At the end of the program, the apprentices prepare abstracts for submission to the US Army Research Office Youth Science programs office.

This report, prepared by the consortium evaluation team with based in part on data from the U.S. Army Research Office, documents the administration of 2015 URAP. The intent is to provide key data points from 2015 URAP as well as a contextualized understanding of administration decisions and program achievements.

In 2015, URAP provided outreach to 48 apprentices and 40 mentors at 36 Army-sponsored university/college laboratory sites. Participant enrollment in URAP decreased 18.5% in FY15. However, there was a 29% increase in mentors (31) from FY14. There were nine more Army-sponsored university/college laboratory sites in FY15 than in FY14. This report documents the evaluation of the 2015 URAP program. The evaluation addressed questions related to program strengths and challenges, benefits to participants, and overall effectiveness in meeting AEOP and program objectives. The assessment strategy for URAP included: in-person interviews with apprentices and mentors conducted online or over the telephone and online post-program questionnaires distributed to all apprentices and mentors.

2015 URAP Fast Facts	
Description	STEM Apprenticeship Program – Summer, in Army-funded labs at colleges/universities nationwide, with college/university S&E mentors
Participant Population	College undergraduate students
No. of Applicants	104
No. of Students (Apprentices)	48
Placement Rate	46%
No. of Adults (Mentors)	40
No. of Army-Funded College/University Laboratories	36
No. of HBCU/MSIs	7

Total Cost	$173,909.50
Admin/Overhead Costs (Host Sites)	$27,373.50
Total Stipends	$146,536.00
Cost Per Student Participant	$3,700.20

Summary of Findings

The 2015 evaluation of URAP collected data about participants; participants' perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in the following table.

2015 URAP Evaluation Findings	
Participant Profiles	
URAP continues to be a popular and selective program	Over 100 applications were received for the URAP program (an increase of 13% from FY14). Of the 104 applications for apprenticeships, only 48 students were selected, yielding an acceptance rate of 46%, which is competitive. The placement rate for FY15 decreased 20% from FY14. 22 URAP sites were also sites for the HSAP program.
Although URAP has increased numbers of Hispanic or Latino/a apprentices, outreach efforts are not motivating other historically underrepresented populations to apply.	More female and Hispanic or Latino/a apprentices participated in 2015 than in 2014. In 2014 there were 28% females and 3% Latino/a apprentices, and in 2015 this increased to 35% females and 11% Latino/a apprentices.
	Black or African American apprentice attendance was similar to 2014 at 13%, and URAP has low proportions of apprentices identify as Native American or Alaskan Native (0%), and Native Hawaiian (0%). Twenty-one percent of the apprentices identify as Asian.
URAP has had some success in recruiting diverse STEM mentors.	The number of overall mentors increased 22% in FY15. Although white mentors increase from 38% in 2014 to 54% in 2015, URAP gained 7% more Black or African American mentors.
Actionable Program Evaluation	
URAP apprentices and mentors marketed almost exclusively by the universities or colleges that host URAP	ARO continued to market and recruit URAP mentors from university or college laboratories that conduct Army-sponsored research. Subsequently, university or college researchers marketed and recruited URAP apprentices using university or college channels.
	There are a variety of ways that apprentices learned about URAP including: through local connections (university personnel, advertisements, classes), or other acquaintances associated with URAP site. Several apprentices reported previous connections with their mentor prior to URAP. One of the primary objectives for the URAP program is to expose new students to research opportunities. However, mentors benefit from having some continuity with apprentices as returning apprentices are able to contribute more to the lab's work. Thus, since this recommendation was also made in FY14, the program should continue to try to

	find the right balance between recruiting new participants and retaining existing students while affirming that each selected apprentice is an appropriate candidate overall.
The 2015 URAP apprentices had few prior experiences with URAP or any other AEOP program.	In 2013 and 2014, many apprentices and mentors had existing associations prior to URAP. Only a few 2015 URAP apprentices had prior experiences with AEOP programs. This could suggest an opportunity to continue this relationship through subsequent years and make the current URAP apprentices aware of the opportunity to reapply. URAP should investigate the application/selection process to ensure it is meeting the goal of involving new students in URAP.
URAP further engages apprentices who come to the experience with high interest in STEM through hands-on activities that are meaningful.	Apprentices reported that they were motivated to participate in URAP by their interests in STEM (47%) and the desire to expand laboratory or research skills (47%).
	Most apprentices (90%) had opportunities to engage in a variety of STEM practices during their URAP experience such as interacting with scientists and engineers and communicating with other students about STEM.
	Most apprentices (70-93%) report participating in hands-on activities, using laboratory procedures and tools, analyzing data, working as a team, and coming up with creative solutions on most days or every day of their URAP experience.
	Apprentices reported increased opportunities to learn about STEM and higher engagement in STEM practices during their URAP experience than compared with their daily school activities.
	Mentors reported making learning activities relevant to apprentices, supporting the needs of diverse learners, developing apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
URAP can improve the communication of STEM careers to the apprentices and marketing of other AEOP opportunities.	Although approximately 90% of apprentices reported engaging in a variety of STEM practices, only 41% reported learning about different careers that use STEM. Many apprentices (63%) reported that they had not learned about any DoD STEM jobs/careers during the program, although 11% indicated that they learned about 5 or more DoD STEM jobs/careers during URAP. These data are similar to the data reported in 2014.
	The majority of mentors had no awareness of or past participation in an AEOP initiative beyond URAP and had not heard of other AEOPs. Mentors were aware of the existence of other AEOP programs but were unable to name any of them in interviews. No strategies for addressing this were discussed in the FY15 URAP Annual Report.
URAP offers meaningful experiences to both apprentices and mentors.	100% of apprentices reported satisfaction with their URAP experience. Among the most appreciated experiences were: opportunities to learn about STEM fields and careers, and opportunities for engaging in STEM learning outside of the classroom.
	Most responding mentors reported a positive and meaningful experience as well and expressed interest in working with URAP again.

Outcomes Evaluation	
URAP positively impacted apprentices' STEM knowledge and competencies, and 21st Century Skills.	Positive impacts on STEM knowledge, competencies, and 21st century skills were reported by participants including: large or extreme gains in 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 ubiquitous across all apprentice groups.
	Apprentices also reported impacts on their abilities to do STEM, including such things as applying knowledge, logic, and creativity to propose solutions that can be tested; making a model that represents the key features or functions of a solution to a problem; communicating information about their design processes and/or solutions in different formats; supporting a proposed explanation with data from investigations; and using mathematics to analyze numeric data.
	Apprentices reported large or extreme gains in their ability to have patience for the slow pace of research, sticking with a task until it is complete, making changes when things do not go as planned, learning to work independently, setting goals and reflecting on performance, building relationships with professionals in a field, and having a sense of being part of a learning community.
URAP helped apprentices' create a stronger STEM identify and gain confidence in learning and doing STEM.	Apprentices reported a large or extreme gain in feeling responsible for a STEM project or activity, confidence to do well in future STEM courses, ability to build academic or professional credentials in STEM, preparedness for more challenging STEM activities, feeling like a STEM professional, feeling like part of a STEM community, and trying out new ideas or procedures on their own in a STEM project.
	Apprentices reported a high likelihood that they would engage in additional STEM activities outside of school. A majority of apprentices indicated that as a result of URAP, they were more likely to work on a STEM project or experiment in a university or professional setting, to talk with friends or family about STEM, and to help with a community service project related to STEM.
URAP raised apprentices' education aspirations, and shifted their career aspirations toward a variety of STEM careers.	Apprentices indicated being more likely to go further in their schooling than they would have before URAP, with the greatest change being in the proportion of apprentices who expected to continue their education to a Ph.D. (30% before URAP, 48% after).
	Apprentices were asked to indicate what kind of work they expected to be doing at age 30. Although many of the students wanted to participate in STEM careers before URAP, some of the apprentices shifted their interest away from medicine to computer science.
URAP apprentices and mentors are largely unaware of AEOP initiatives, and mentors often do not explicitly discuss other AEOPs with apprentices.	Only two of the mentors indicated that they explicitly discussed any specific AEOP programs with the apprentices. The interviews confirmed the survey data, and mentors explained that they were aware of other programs but were not aware of the specifics. URAP should work to communicate information about AEOP opportunities (e.g. webinars, packets, etc.)

Recommendations

Evaluation finding indicate that FY15 was a successful year for the URAP program. URAP had a very competitive 48% acceptance rate of the apprentice applicants, which indicates there is great interest in this program. From the high quality applicants (mentors and apprentices), there were 40 mentors and 48 apprentices selected. URAP has experienced success in recruiting diverse STEM mentors and have had increased numbers of women and Hispanic and Latino/a apprentices in FY15. Mentors overwhelmingly reported their satisfaction with the apprentices and apprentices reported their satisfaction with their mentor and with the URAP experience. Mentors indicated they use innovative and research-based strategies to engage apprentices in STEM activities, and the apprentices similarly report increased ability to engage in STEM activities and have STEM habits of mind, due to the URAP experience. Apprentice educational aspirations were reportedly increased due to the URAP experience, most notably in an 18% increase of apprentices wanting to pursue a Ph.D. after the URAP experience. Additionally, engaging in more hands-on STEM experiences motivated the apprentices, which was delivered by their URAP experience. The URAP program succeeded in increasing STEM knowledge and habits of mind of apprentices, increasing mentor and apprentice diversity, and providing an authentic hands-on experience for apprentices that was a professional development experience for mentors.

While the successes for URAP detailed above 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. AEOP objectives include expanding participation of historically underrepresented and underserved populations. URAP has made some progress in this area, as it was noted as an area for improvement in the FY14 evaluation report. Between 2014 and 2015, URAP has engaged more female and more Hispanic or Latino/a mentors, which is a positive trend. Future marketing efforts could focus on the need for a more diverse pool of STEM professionals, and take the opportunity to showcase the diversity of mentors in electronic and printed materials.

2. A second area that was noted for improvement in FY14 was the need to focus more on recruiting students from underrepresented populations. Similar to past years, in URAP, recruitment of apprentices is largely accomplished with personal interactions, either by knowing a professor or peer who attended URAP previously, using professional or academic connections, or mechanisms available to the university or college site. As a result, the ability of URAP to recruit underserved or underrepresented populations of students depends upon the diversity of the universities or colleges in which recruitment takes place. Additionally, the Army and ARO may need to consider practical solutions to the challenge posed by URAP locations, as the student population of some universities and colleges is likely to advantage some groups of students more than others, particularly in STEM fields. Thus, the program may want to emphasize recruiting a more diverse pool of mentors and apprentices, perhaps specifically targeting Historically Black Colleges and Universities and other Minority Serving Institutions. A focused and strategic plan to engage a more diverse pool of mentors could ultimately engage a more diverse pool of apprentices.

3. URAP is very effective in giving apprentices authentic opportunities to engage in STEM professional activities, and for mentors to build the next generation of STEM professionals. Given the goal of exposing apprentices to Army/DoD STEM research and careers, the program may want to build in systematic opportunities to provide this information to their apprentices. More than half of apprentices who completed the survey reported that they did not learn about any DoD STEM jobs/careers during URAP. Perhaps more importantly, only a few mentors were aware of specific Army/DoD STEM research and careers and even fewer mentors explicitly discussed this with their apprentices. This was an area noted by the FY14 evaluation report as a need for additional focus that has not improved much in FY15. In an effort to increase and standardize the information provided to apprentices, it would be beneficial to create a resource that profiles Army STEM interests and the education, on-the-job training, and related research activities of Army careers. Such a resource could not only start the conversation about Army STEM careers and motivate further exploration beyond the resource itself, but could be used to train the mentors to learn more about specific Army/DoD STEM research and careers. The application to be a URAP site or a mentor could ask for their plan to explicitly discuss these resources (e.g., Army and directorate STEM career webpages, online magazines, federal application guidelines), thus developing a network of ongoing opportunities for the apprentices.

4. Perhaps more importantly, as in FY14 evaluation findings, only a few mentors were aware of specific AEOP programs and even fewer mentors explicitly discussed other AEOP opportunities with their apprentices. This lack of awareness is a barrier in communicating about other AEOP opportunities. In an effort to increase and standardize the information provided to apprentices, it would be beneficial to create a resource that profiles AEOP opportunities and the relationship they have to ongoing education, on-the-job training, and related research activities of Army careers. Such a resource could not only start the conversation about AEOP programs and motivate further exploration beyond the resource itself, but could be used to train the mentors to learn more about specific AEOP opportunities. The application to be a URAP site or a mentor could ask for their plan to explicitly discuss these resources thus expanding the network of ongoing opportunities for the apprentices.

AEOP Priority: Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army

1. Efforts should be undertaken to improve participation in evaluation activities, as the low response rates for both the apprentice and mentor questionnaires raise questions about the representativeness of the results. Low response rates were also a concern during the 2013, 2014 and 2015 questionnaire administration. Improved communication with the individual program sites about expectations for the URAP evaluation study may help. In addition, the evaluation instruments may need to be streamlined as the questionnaires are quite lengthy

(estimated response time 45 minutes[1]) and response burden can affect participation. It is recommended that program sites provide time on-site for participants to complete the AEOP evaluation survey.

[1] Berry, S. (2013). How to estimate questionnaire administration time before pretesting: An interactive spreadsheet approach. *Survey Practice, 2*(3). Retrieved from http://www.surveypractice.org/index.php/SurveyPractice/article/view/166. Date accessed: 13 Mar. 2015.

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 of one of the AEOP elements, the Undergraduate Research Apprentice Program (URAP). URAP is managed by the U.S. Army Research Office (ARO). 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

The Undergraduate Research Apprentice Program (URAP), managed by the U.S. Army Research Office (ARO), is an Army Educational Outreach Program (AEOP) commuter program for undergraduate students who demonstrate an interest in science, technology, engineering, or mathematics (STEM) to work as an apprentice in an Army-funded university or college research laboratory. URAP is designed so that students (herein called apprentices) can apprentice in fields of their choice with experienced Army-funded scientists and engineers (S&Es, herein called mentors) full-time during the summer or part-time during the school year.

Apprentices receive an educational stipend equivalent to $10 per hour, and are allowed to work up to 300 hours total. The apprentices contribute to the research of the laboratory while learning research techniques in the process. This "hands-on" experience gives apprentices a broader view of their fields of interest and shows apprentices what kind of work awaits them in their future career. At the end of the program, the apprentices prepare final reports for submission to the U.S. Army Research Office's Youth Science Programs office.

In 2015, URAP was guided by the following priorities:

1. Provide hands-on science and engineering research experience to undergraduates in science or engineering majors;
2. Educate apprentices about the Army's interest and investment in science and engineering research and the associated educational and career opportunities available to apprentices through the Army and the Department of Defense;
3. Provide students with experience in developing and presenting scientific research;
4. Provide apprentices with experience to develop an independent research program in preparation for research fellowships;
5. Develop apprentices' research skills with the intent of preparing them for graduate school and careers in science and engineering research; and,
6. Benefit from the expertise of a scientist or engineer as a mentor.

Apprenticeships were completed at 36 Army-funded university and college research laboratories in 23 U.S states and territories, summarized in Table 1; 7 of the 36 institutions have Historically Black College and University (HBCU) or Minority-serving Institution (MSI) status (denoted with an asterisk below). In 2015, URAP provided outreach to 48 apprentices and their mentors at these 36 universities and college research laboratory sites (herein called URAP sites).

Table 1. 2015 URAP Sites

University/College	City	State	University/College	City	State
Alabama State University*	Montgomery	AL	University of California, Irvine	Irvine	CA
Arizona State University	Tempe	AZ	University of California, Riverside*	Riverside	CA
Brown University	Providence	RI	University of California, Santa Barbara	Santa Barbara	CA
City University of New York	New York	NY	University of Alabama	Tuscaloosa	AL
Columbia	New York	NY	University of Arizona	Tucson	AZ
Cornell	Ithaca	NY	University of Chicago	Chicago	IL
*Hampton University**	*Hampton*	*VA*	University of Delaware	Newark	DE
Louisiana State University	Baton Rouge	LA	University of Florida	Gainesville	FL
Marshall	Huntington	VA	University of Houston, Victoria*	Victoria	TX
Michigan State University	East Lansing	MI	University of Illinois	Champaign	IL
North Carolina A&T*	Greensboro	NC	University of Maryland, College Park	College Park	MD
Rutgers	New Brunswick	NJ	University of Michigan	Ann Arbor	MI
Oklahoma State University	Stillwater	OK	University of New Hampshire	Durham	NH
Ohio State University	Columbus	OH	University of Notre Dame	Notre Dame	IN
Pennsylvania State University	State College	PA	University of Puerto Rico*	Rio Piedras	PR

Purdue	West Lafayette	IN	University of Rochester	Rochester	NY
San Diego State University*	San Diego	CA	University of the Incarnate Word*	San Antonio	TX
University of California, Berkeley	Berkeley	CA	University of Utah	Salt Lake City	UT
			Washington University	St. Louis	MO
			Total Universities	**36**	

The total cost of 2015 URAP was approximately $173,909 including $146,536 for participant stipends. Funding was provided half by AEOP and half by ARO program manager funds. The average cost per 2015 URAP participant taken across all URAP sites was $3,700. Table 3 summarizes these and other 2015 URAP program costs.

Table 2. 2015 URAP Program Costs	
2015 URAP - Cost Per Student Participant	
Total Student Participants (Apprentices)	48
Total Cost	$173,909.50
Total Stipends	$146,536.00
Cost Per Student Participant	$3,700.20

Evidence-Based Program Change

The AEOP funds programs that are tasked with achieving three broad priorities: (1) STEM Literate Citizenry – *Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base.;* (2) STEM Savvy Educators – *Support and empower educators with unique Army research and technology resources*; and (3) Sustainable Infrastructure – *Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army.* ARO initiated the following program changes/additions to the FY14 administration of the URAP program in light of the AEOP priorities, the FY14 URAP evaluation study, and one site visit conducted by ARO:

I. **STEM Literate Citizenry – *Broaden, deepen, and diversify the pool of STEM talent in support of our Defense Industry Base.***
   a. Recruitment of university sites was facilitated by ARO's assistance with proposal submission, systematic review and selection, resulting in seven HBCU/MSIs and 48 apprentices in 41 distinctive Army-funded laboratories over the summer.
   b. At the end of each apprenticeship, there was an "exit letter" provided highlights of the AEOP pipeline of NDSEG/SMART programs (informing 48 students), and at the end of the application encouraged the applicants to examine the AEOP website. The AEOP website was shared with the 56 students who applied for the URAP program but were not selected.

II. **STEM Savvy Educators – *Support and empower educators with unique Army research and technology resources*.**

a. PI's were only approved if they could identify quality educational merit intent for the student apprentice within the proposal. Site applications facilitated mentors explicitly connecting their intent with Army research and technology resources.
b. Any additional mentors at the university site were required to turn in a resume for review in order to determine alignment with the resources and document additional expertise of scientists and mentors.

III. Sustainable Infrastructure – ***Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army*.**

a. The URAP program required apprentices to create an abstract in order to receive their completion certificate and conducted local site visits were students verbally presented their scientific research.
b. Forty-eight undergraduates were provided scientific research experience, which exposed them to STEM subject matter and STEM laboratory practices. The training resulted in apprentices' ability to develop an independent research program in preparation for future research fellowships.

FY15 Evaluation At-A-Glance

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

Inputs	Activities	Outputs	Outcomes (Short term)	Impact (Long Term)
• ARO and AEOP co-sponsorship • ARO providing administration of program • Operations conducted by 27 Army-funded university/ college labs • 59 apprentices participating in URAP apprenticeships • 31 university/college S&Es serving as URAP mentors • Apprenticeship funds administered to university/college research labs to support apprentice participation • Centralized branding and comprehensive marketing • Centralized evaluation	• Apprentices engage in authentic STEM research experiences through hands-on summer apprenticeships at Army-funded university/college labs • University/college S&Es supervise and mentor apprentices' research • Program activities that expose students to AEOP programs and/or STEM careers in the Army or DoD	• Number and diversity of apprentice participants engaged in URAP • Number and diversity of university / college S&Es engaged in URAP • Apprentices, university / college S&Es, and ARO contributing to evaluation	• Increased apprentice STEM competencies (confidence, knowledge, skills, and/or abilities to do STEM) • Increased apprentice interest in future STEM engagement • Increased apprentice awareness of and interest in other AEOP opportunities • Increased apprentice awareness of and interest in STEM research and careers • Increased apprentice awareness of and interest in Army/DoD STEM research and careers • Implementation of evidence-based recommendations to improve URAP programs	• Increased apprentice participation in other AEOP opportunities and Army/DoD-sponsored scholarship/ fellowship programs • 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 URAP

The URAP evaluation gathered information from multiple participant groups about URAP 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 URAP program objectives.

Key Evaluation Questions

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

The assessment strategy for URAP included apprentice and mentor questionnaires as well as 3 individual interviews with apprentices and 4 with mentors. Tables 3-7 outline the information collected in apprentice and mentor questionnaires and interviews.

Table 3. 2015 Apprentice Questionnaires

Category	Description
Profile	**Demographics:** Participant gender, age, grade level, race/ethnicity, and socioeconomic status indicators
	Education Intentions: Degree level, confidence to achieve educational goals, field sought
AEOP Goal 1	**Capturing the Student Experience:** In-school vs. In-program experience
	STEM Competencies: Gains in Knowledge of STEM, Science & Engineering Practices; contribution of AEOP
	Transferrable Competencies: Gains in 21st Century Skills
	STEM Identity: Gains in STEM identity, intentions to participate in STEM, and STEM-oriented education and career aspirations; contribution of AEOP
	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 (students respond to a subset)
	Comprehensive Marketing Strategy: 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 URAP, satisfaction with and suggestions for improving URAP programs, benefits to participants
AEOP Goal 1	**Capturing the Student 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 students to AEOPs, impact of AEOP resources on efforts; contribution of AEOP in changing student AEOP metrics
	Army/DoD STEM: attitudes toward Army/DoD STEM research and careers, efforts to expose students to Army/DoD STEM research/careers, impact of AEOP resources on efforts; contribution of AEOP in changing student Army/DoD career metrics
AEOP Goal 2 and 3	**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
Satisfaction & Suggestions	Benefits to participants, suggestions for improving programs, overall satisfaction

Table 5. 2015 Apprentice Focus Groups	
Category	**Description**
Profile	Gender, race/ethnicity, grade level, past participation in URAP, past participation in other AEOP programs
Satisfaction & Suggestions	Awareness of URAP, motivating factors for participation, awareness of implications of research topics, satisfaction with and suggestions for improving URAP 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 URAP, past participation in URAP, past participation in other AEOP programs
Satisfaction & Suggestions	Perceived value of URAP, benefits to participants suggestions for improving URAP 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 URAP

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 (apprentice) and Appendix C (mentor). Focus group protocols are provided in Appendices D (apprentice) and E (mentor). Major trends in data and analyses are reported herein.

Study Sample

The FY15 URAP Apprentice Survey did not include an item collecting data regarding the location of the site that each apprentice was assigned at. Therefore, site level participation in the survey is not provided in the FY15 URAP Evaluation report. However, Table 7 reports the actual URAP program participation by site as a reference.

Table 7. 2015 URAP Site			
	No. of Apprentice Applicants	No. of Apprentice Participants	No. of Mentor Participants
Alabama State University*	1	1	1
Arizona State University	4	2	1
Brown University	1	1	1
City University of New York	2	1	1
Columbia University	2	1	1
Cornell University	5	2	1
Hampton University*	0	0	0
Louisiana State University	2	2	1
Marshall University	1	1	1
Michigan State University	1	1	1
North Carolina A&T*	11	2	2
Rutgers University	2	1	1
Oklahoma State University	2	2	1
Ohio State University	1	1	1
Pennsylvania State University	1	1	1
Purdue University	3	1	1
San Diego State University*	6	1	1
University of California, Berkeley	2	1	1
University of California, Irvine	6	1	1
University of California, Riverside*	5	3	3
University of California, Santa Barbara	7	4	2
University of Alabama	1	1	1
University of Arizona	3	1	1
University of Chicago	1	1	1
University of Delaware	1	1	1
University of Florida	5	1	1
University of Houston, Victoria*	2	1	1
University of Illinois	2	1	1
University of Maryland, College Park	7	1	1
University of Michigan	3	1	1

University of New Hampshire	2	1	1
University of Notre Dame	2	2	1
University of Puerto Rico*	1	1	1
University of Rochester	1	1	1
University of the Incarnate Word*	4	2	1
University of Utah	2	1	1
Washington University	1	1	1
Total	**104**	**48**	**40**

**A Student is NOT ARO/AEOP funded*

Table 8 provides an analysis of apprentice and mentor participation in the URAP questionnaires, the response rates, 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 apprentice response rate is lower than in 2014 (which had a response rate of 61%) and in 2013 (which had a response rate of 77%). The mentor questionnaire response rate was the same for 2013 but was lower than in 2014 (which was 52%).

Table 8. 2015 URAP Questionnaire Participation

Participant Group	Respondents (Sample)	Total Participants (Population)	Participation Rate	Margin of Error @ 95% Confidence[2]
Apprentices	27	48	56%	±10.9%
Mentors	16	40	40%	±10.1%

Three apprentice interviews were conducted (1 male, 2 females) who were either undergraduate juniors or seniors. Four mentor interviews were also conducted (2 males, 1 female) from 4 sites. Mentors included four university educators. Interviews were not intended to yield generalizable findings; rather they were intended to provide additional evidence of, explanation for, or illustrations of apprentice questionnaire data. They add to the overall narrative of URAP's efforts and impact, and highlight areas for future exploration in programming and evaluation.

Respondent Profiles

Apprentice Demographics

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

Demographic information collected from URAP questionnaire respondents is summarized in Table 9.[3] More males (56%) than females (33%) completed the questionnaire, although 11% preferred not to indicate their gender on the survey. More responding apprentices identified with the race/ethnicity category of White (56%) than any other single race/ethnicity category. The majority of URAP apprentices are advanced undergraduate students (3rd year or older), just graduated, or will be entering graduate school in the fall (89%). The survey respondent demographics aligned with those of the overall population of participating students with respect to gender (56% male, 33% female), and race/ethnicity (56% White, 22% Asian, 0% Black or African American, and 7% Hispanic or Latino).

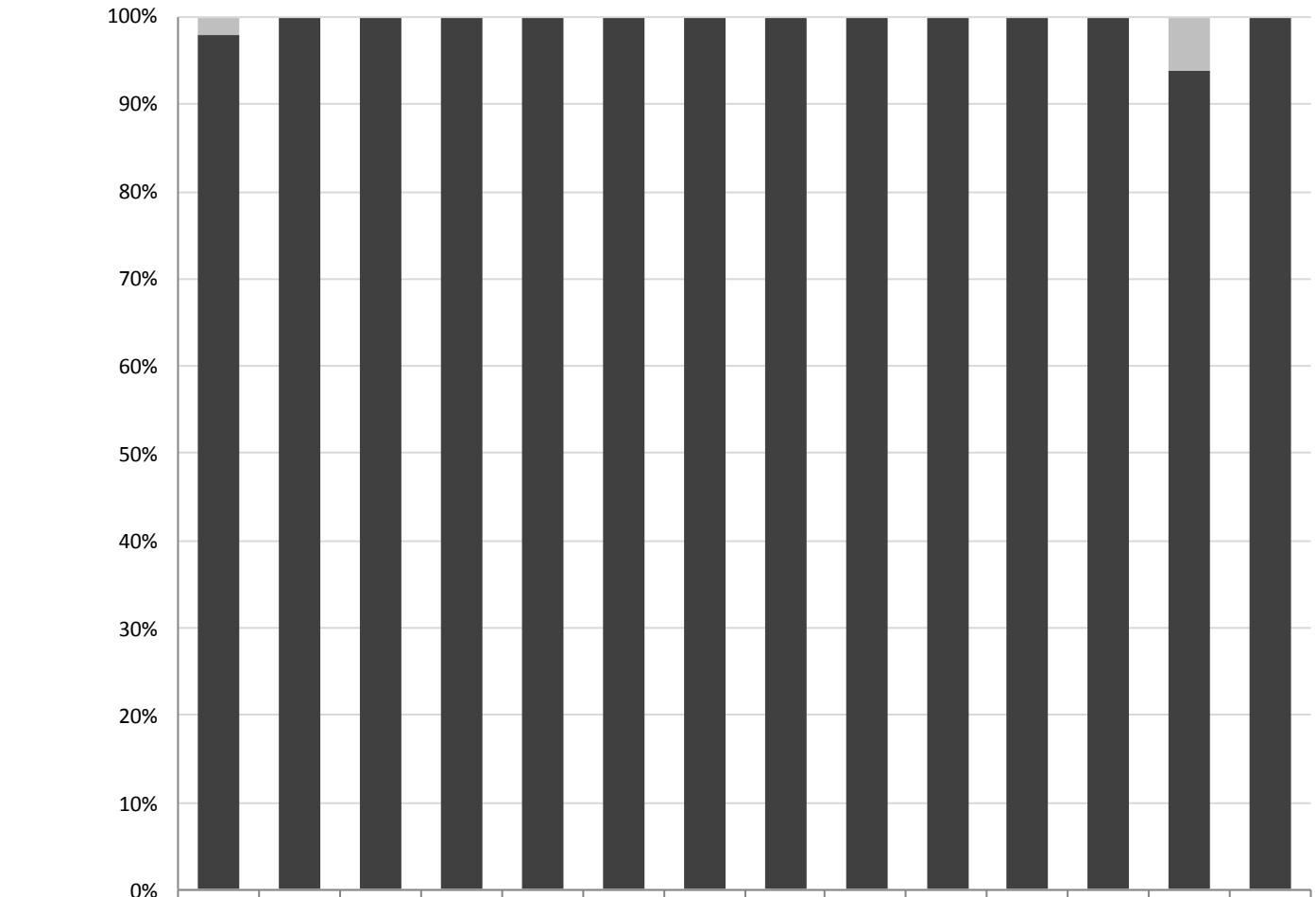
One objective of all AEOPs is to involve a larger percentage of students from previously underrepresented and underserved segments of our population, such as women, American Indians, African Americans, and Hispanics, in pursuing science and engineering careers through participation in Army-sponsored programs. The 2015 questionnaire data suggests that URAP engaged a smaller proportion of female students—a population that is historically underrepresented in certain STEM fields—than male students. The same data suggest that URAP had limited success providing outreach to students from historically underrepresented and underserved minority race/ethnicity groups as well. It is notable that there were no Black or African American respondents, and only 2 Latino/a or Hispanic respondents.

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

Table 9. 2015 URAP Apprentice Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 27)		
Female	9	33%
Male	15	56%
No Response	3	11%
Respondent Race/Ethnicity (n = 27)		
Asian	6	22%
Black or African American	0	0%
Hispanic or Latino	2	7%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	15	56%
Other race or ethnicity, (specify):[†]	0	0%
Choose not to report	4	15%
Respondent Grade Level (n = 27)		
12th grade	0	0%
First-Year college student (13)	5	19%
College sophomore (14)	4	15%
College junior (15)	5	19%
College senior (16)	10	36%
Graduate program (17)	0	0%
Choose not to report	3	11%

In addition, apprentices were asked how many times they participated in each of the AEOP programs. As can be seen in Chart 1, only 6% of responding apprentices reported participating in URAP at least once. This is a large difference from 2014, when 95% of the responding apprentices reported participating in URAP at least once. A small number of participants indicated participating at Camp Invention, which is also much different form the 2014 data. In 2014, respondents reported that they participated most often in the Science Mathematics, and Research for Transformation (SMART) College Scholarship, the High School Apprenticeship Program (HSAP), or the Research & Engineering Apprenticeship Program (REAP). The year 2014 may have been an unusual year because in the 2013 implementation of the program, only 3% of apprentices reported having participated in URAP previously, which is more aligned to the 2015 data. Prior participation in other AEOPs was also uncommon in 2013, aligning with 2015 data, with CQL having 18%, and JSS, JSHS, UNITE, and eCYBERMISSION each having 3%. Most of the apprentices had not participated in other AEOP programs.

Chart 1: Student Participation in AEOP Programs (n = 47)



	Camp Invention	eCybermission	JSS	WPBDC	GEMS	UNITE	JSHS	SEAP	REAP	HSAP	GEMS Near Peer Mentors	CQL	URAP	SMART College Scholarship
Three or more times	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Twice	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Once	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%	0%
Never	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	100%

Mentor Demographics

The 2015 Mentor Questionnaire collected extensive demographic information on the mentors, which is summarized in Table 10. More responding mentors were female than male (56% vs. 31%). In contrast to responding apprentices, 19% of the responding mentors identified themselves as Asian (which is down from 56% in 2014). There were more reported Hispanic or Latino/a mentors in 2015 than in 2014. Mentors primarily identified as university educators for their occupation (82%). In the URAP program, the large majority of responding mentors served as research mentors (88%).

Table 10. 2015 URAP Mentor Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 16)		
Female	5	31%
Male	9	56%
No Response	2	13%
Respondent Race/Ethnicity (n = 16)		
Asian	3	19%
Black or African American	0	0%
Hispanic or Latino	1	5%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	10	63%
No Response	2	13%
Respondent Occupation (n = 16)		
University educator	13	82%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate apprentice, etc.)	1	6%
Scientist, Engineer, or Mathematics professional	1	6%
Other, (specify):	1	6%
Respondent Role in URAP (n = 16)		
Research Mentor	14	88%
Research Team Member but not a Principal Investigator	1	6%
Other, (specify)	1	6%

Actionable Program Evaluation

Actionable Program Evaluation is intended to provide assessment and evaluation of program processes, resources, and activities for the purpose of recommending improvements as the program moves forward. This section highlights information outlined in the Satisfaction & Suggestions sections of Tables 3-6.

A focus of the Actionable Program Evaluation is efforts toward the long-term goal of URAP 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. URAP sites are primarily responsible for local marketing of the program—including any outreach that is done with the specific intention of recruiting apprentices from traditionally underrepresented and underserved populations. Thus, it is important to consider how URAP is marketed and ultimately recruits apprentice participants, the factors that motivate

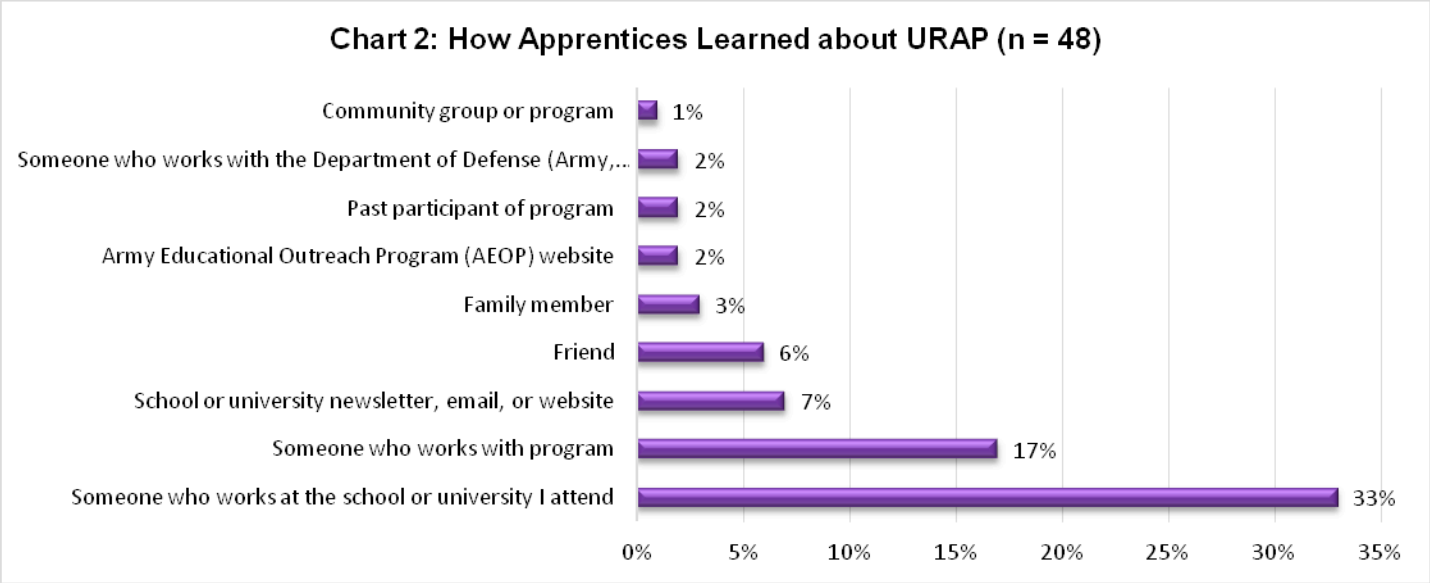
apprentices to participate in URAP, participants' perceptions of and satisfaction with activities, what value participants place on program activities, and what recommendations participants have for program improvement. The following sections report perceptions of apprentices and mentors that pertain to current programmatic efforts and recommend evidence-based improvements to help URAP achieve outcomes related to AEOP programs and objectives. Specifically, this information is intended to help URAP continue to expand participation from and support STEM education for students from underrepresented and underserved groups.

Marketing and Recruiting Underrepresented and Underserved Populations

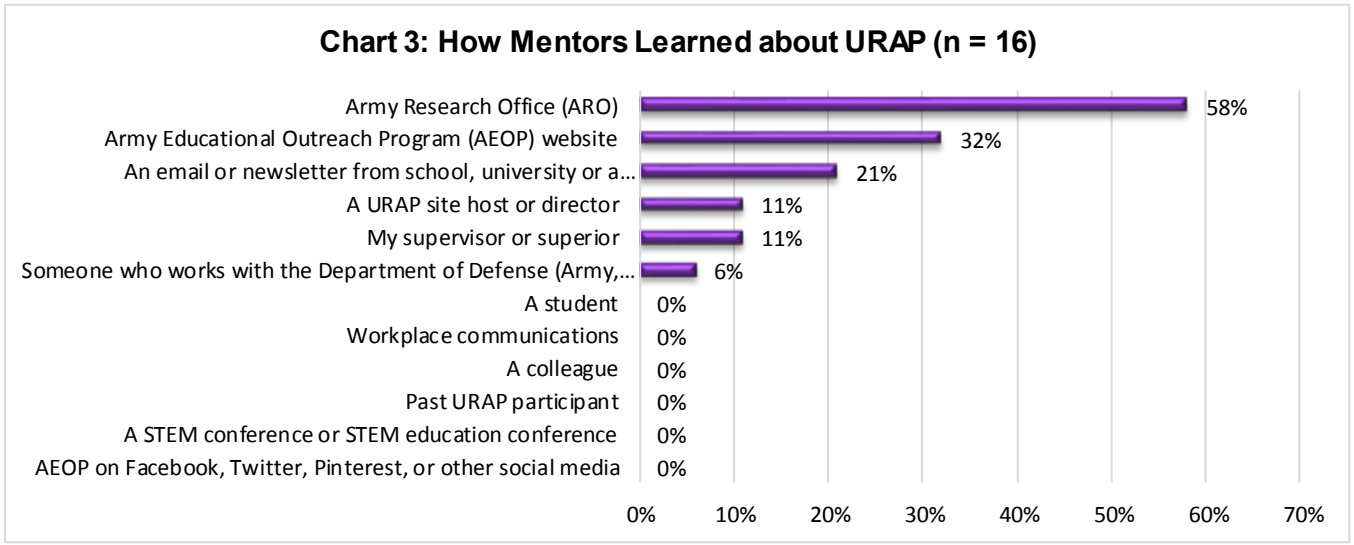
In URAP, recruitment of apprentices is largely a bottom-up phenomenon that occurs at the site-level using connections or mechanisms available to the university or college site. As a result, the ability of URAP to recruit underserved or under-represented populations of students depends upon the diversity of the universities or colleges in which recruitment takes place. ARO, the URAP manager, identified and targeted schools that had traditionally underserved and under-represented populations in STEM and directly sent emails advertising the URAP program. Additionally, all 104 apprentice applicants were given information about the AEOP website to inform them of other programs for which they may be eligible. URAP apprentices who successfully completed the program received an "exit letter" stating pathways to other programs in the AEOP portfolio that were relevant.

ARO requested that all PIs familiarize themselves with the AEOP website in the beginning of the student application process. Also, ARO provided each PI a small number of AEOP brochures and distributed all student participant marketing materials through the PIs (this included an AEOP brochure, lab coat, notebook, and pencil for each student). And lastly, ARO additionally referenced the AEOP website and pipeline opportunities in its final wrap-up email thanking the PIs for their participation. ARO also installed a web-cam on the administrator's computer, with hopes to eventually host webinars that could be useful in working with sites to address this issue.

The evaluation posed questions on the program registration/application to all apprentices related to which recruitment methods were most effective. Chart 2 summarizes the responses of apprentices when asked how they learned about URAP. The most frequently mentioned source of information was someone who works at the school or university I attend (33%). Other sources mentioned relatively frequently were someone who works with the program (17%), a school or university newsletter, email, or website (7%), and a friend (6%).



A post-program questionnaire was given to mentors that asked how they learned about URAP and Chart 3 details their responses. The two most common ways that mentors indicated learning about the program were through The Army Research Office (ARO) (58%) and from the Army Educational Outreach Program (AEOP) website (32%). Additionally, several mentors reported learning about URAP from an email or newsletter (21%), from a URAP site director (11%) or from their supervisor (11%).



Factors Motivating Apprentice Participation

Apprentices were asked during registration and application to URAP about their motivation to participate. They were given the choices detailed in Table 11 and could choose multiple sources of motivation. As can be seen in Table 11, approximately half of the students indicated that a desire to expand laboratory or research skills (47%) (a decrease from 97% in 2014), and an interest in STEM (down from 97% in 2014). Apprentices also indicated that they were interested in learning something new (36%), and being encouraged by a teacher or a professor (23%). Interest in STEM careers with the Army (15%), seeing how school learning applies to real life (15%), learning in ways that are not possible in school (15%), and earning a stipend (13%) were considered by relatively few students to be very motivating.

Table 11. Factors Which Were Very Motivating for Apprentices to Participate in URAP (n = 47)

Item	Questionnaire Respondents
Interest in science, technology, engineering, or mathematics (STEM)	47%
Desire to expand laboratory or research skills	47%
Desire to learn something new or interesting	36%
Teacher or professor encouragement	32%
Building college application or resume	23%
Figuring out education or career goals	17%
Interest in STEM careers with the Army	15%
Learning in ways that are not possible in school	15%
Seeing how school learning applies to real life	15%
Earning stipends or awards for doing STEM	13%
The mentor(s)	9%
Networking opportunities	9%
Opportunity to use advanced laboratory technology	9%
Exploring a unique work environment	4%
Serving the community or country	2%
An academic requirement or school grade	2%
Other	0%

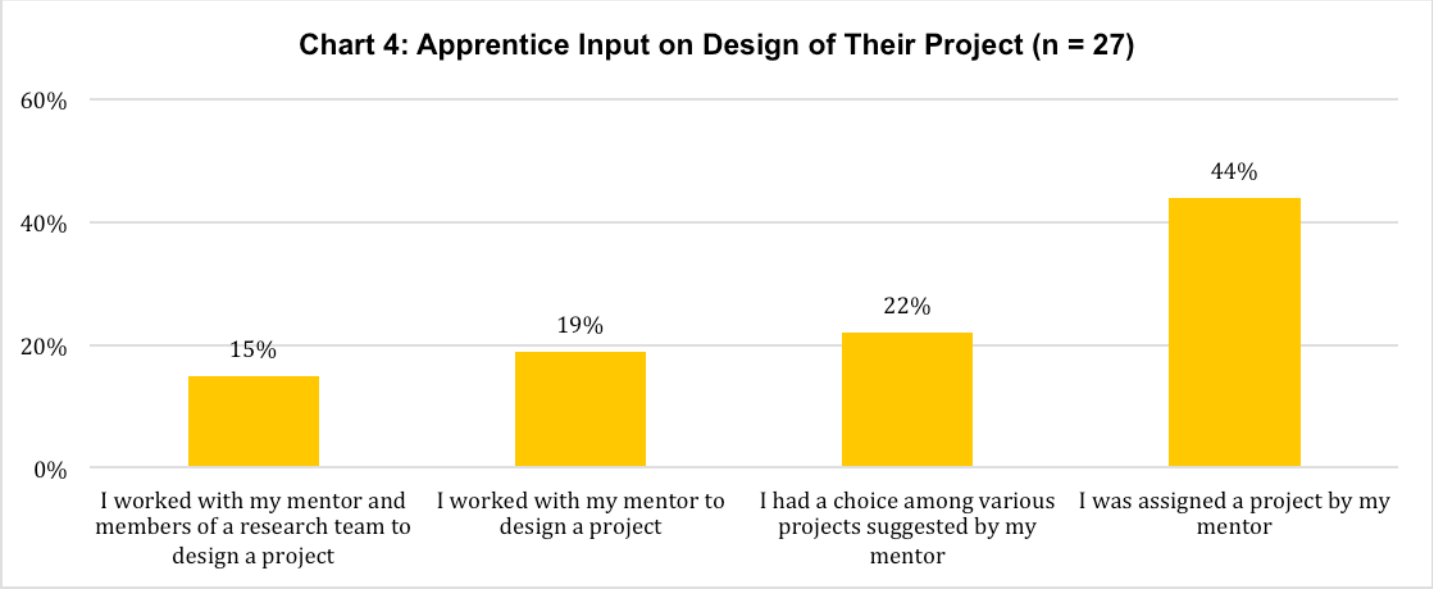
Interviews were conducted to gather more detailed information about motivations of the apprentices to participate in URAP. During these interviews, URAP participants expressed that they were seeking authentic experiences in STEM. Below are the quotes of two of the URAP apprentices regarding their motivations for attending the program.

> *I wanted to have some experience in the field because I going to my third year now. I haven't done anything like related to my major or anything. My mentor, he was also my lab teacher and he told us about URAP program. I thought it was interesting to do something different for the summer. I thought I would learn a lot in the program, so I decided to do it*. (URAP Apprentice)

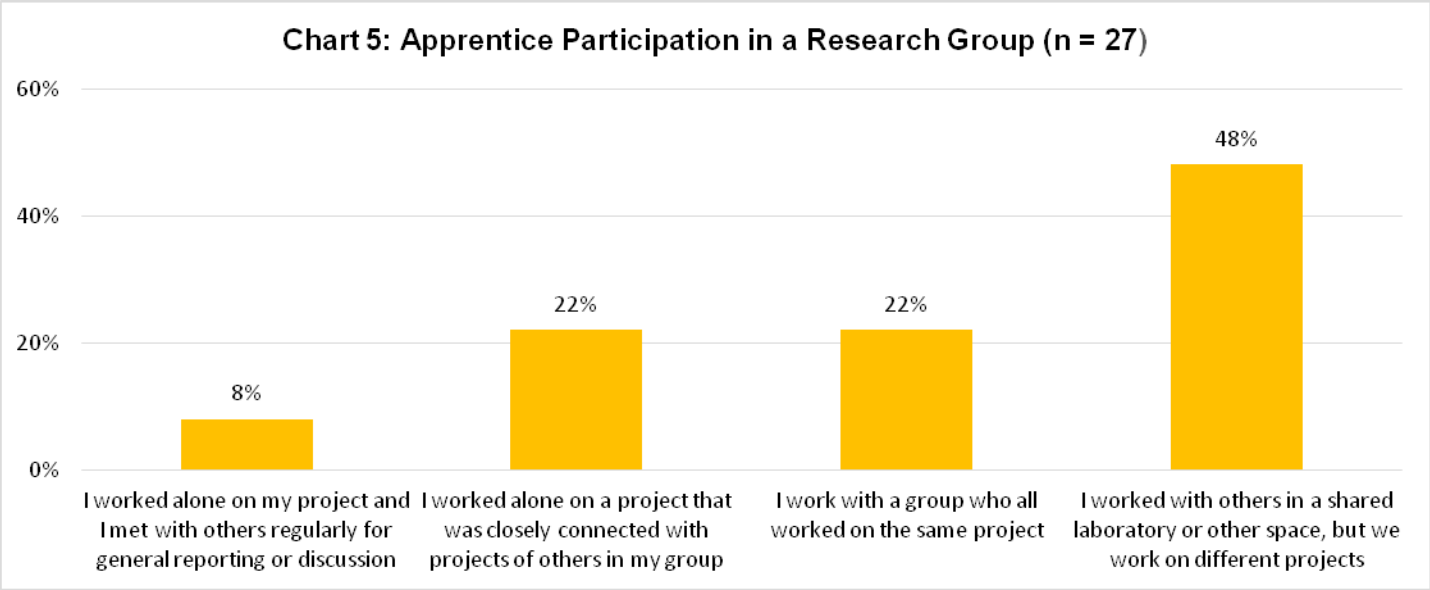
I needed some lab experience prior to applying for graduate school. My professors told me about this program, and it sounded perfect for getting some new experience and some exposure. (URAP Apprentice)

The URAP Experience

In addition to gathering data about demographics and motivation in the application and registration forms, a post-program questionnaire was distributed to all apprentices. Of the 48 apprentices, 27 apprentices completed the questionnaire. The apprentice questionnaire included several items asking about the nature of apprentices' experience in URAP, and how that experience compared to their STEM learning opportunities in school. When asked what field their URAP experience focused on, 56% of responding apprentices selected science, 26% engineering, 15% technology, and 4% mathematics. As can be seen in Chart 4, apprentices indicated that they were assigned a project for the experience by their mentor (44%), had a choice among various projects (22%), or worked with their mentor to design a project (19%). The remaining apprentices reported that they worked with their mentor and a research team to design a project (11%).



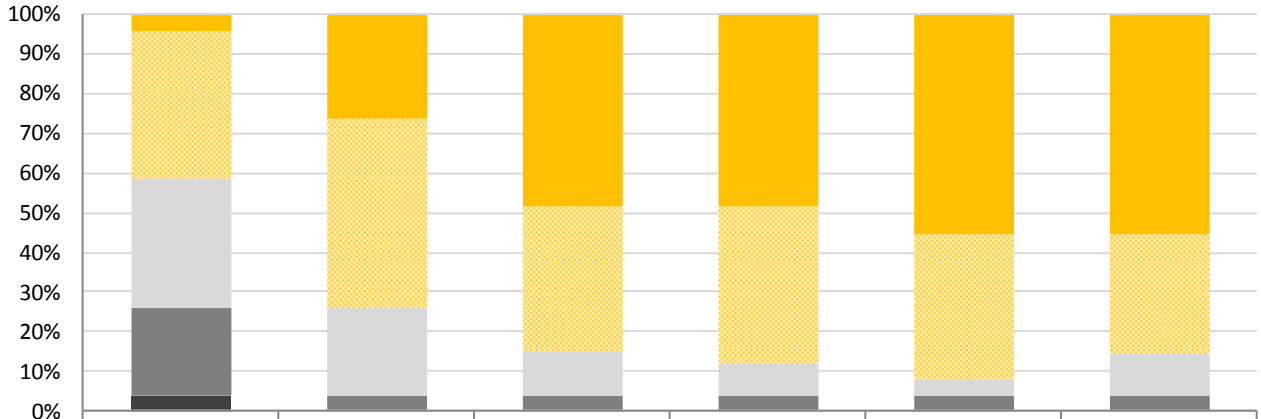
The majority of apprentices who responded to the questionnaire reported that they worked in a shared laboratory space with others on different projects or that they worked in a group, as indicated in Chart 5. The collaborative work reported by apprentices is different from 2014 when most of the apprentices reported working independently. Additionally in 2015, 22% of the apprentices reported working in a shared laboratory/space with others, but on different projects, 22% indicated working alone on a project that was closely connected with others in the group. Only 8% indicated working alone on a project closely connected to other projects in their group.



The questionnaire asked apprentices to share the types of activities they engaged in during their experience. Chart 6 below explains their responses. The majority of respondents indicated communicating with other students about STEM, and interacting with scientists or engineers. About half of the respondents indicated they were learning about new STEM topics, and applying STEM knowledge to real-life situations on most or every day of the experience during URAP. Roughly a quarter of the apprentices reported learning about new discoveries in STEM. Only a few apprentices indicated they learned about different careers that use STEM, and many students indicating that these activities were done only a few times. Mentors were asked similar questions about the nature of their students' experiences. The mentors responded in a similar way to the apprentices (see Appendix C), indicating that the experiences were consistent from each perspective of URAP participants.[4]

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

Chart 6: Nature of Apprentice Activities in URAP (n = 27)



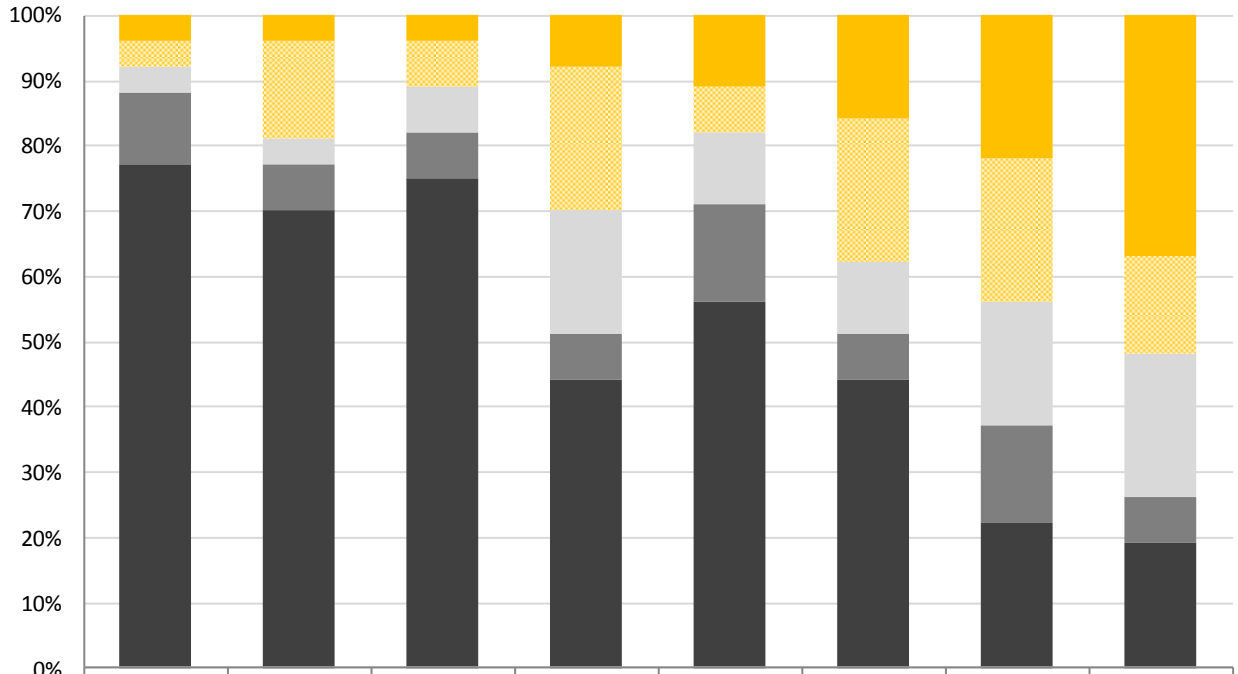
	Learn about different careers that use STEM	Learn about new discoveries in STEM	Apply STEM learning to real-life situations	Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	Interact with scientists or engineers	Communicate with other students about STEM
Every day	4%	26%	48%	48%	56%	56%
Most days	37%	48%	37%	40%	37%	30%
A few times	33%	22%	11%	8%	4%	11%
At least once	22%	4%	4%	4%	4%	4%
Not at all	4%	0%	0%	0%	0%	0%

The questionnaire given to the apprentices post-program asked how many jobs/careers in STEM in general, since URAP and AEOP are interested in increasing the number and diversity of apprentices who pursue STEM careers is one goal of the URAP program. Additionally, the URAP post-program questionnaire asked the apprentices about STEM jobs/careers in the DoD more specifically, and the ways that apprentices learned about during these careers during their experience. As can be seen in Table 12, 89% of the apprentices learned about at least one STEM job/career. However, 63% of apprentices reported that they had not learned about any DoD STEM jobs/careers during the program, although 11% indicated that they learned about 5 or more DoD STEM jobs/careers during URAP. These data are similar to the data reported in 2014.

Table 12. Number of STEM Jobs/Careers Apprentices Learned about During URAP (n = 27)		
	STEM Jobs/Careers	DoD STEM Jobs/Careers
None	11%	63%
1	15%	11%
2	22%	15%
3	26%	0%
4	7%	0%
5 or more	19%	11%

In the post-program questionnaire, apprentices were asked which resources assisted their awareness of DoD STEM careers. Apprentices reported participation in URAP (44%) and their mentors (52%) as being somewhat or very much responsible for impacting their awareness of DoD STEM careers (see Chart 7). However, more than three-quarters of apprentices indicated that they did not learn about any DoD STEM careers. Data from the mentor questionnaire (shown in Appendix C) are generally aligned with data from the apprentice questionnaire with regard to AEOP resources, though mentors considered participation in URAP to be more useful than did apprentices in development of DoD STEM career awareness.

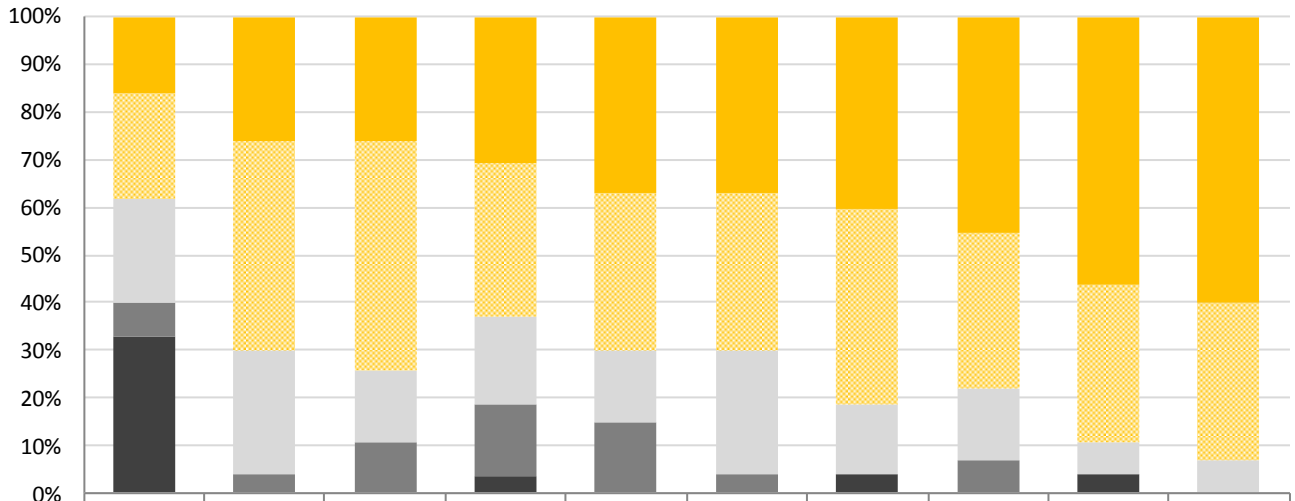
Chart 7: Impact of Resources on Apprentice Awareness of DoD STEM Careers (n = 27)



	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP brochure	It Starts Here! Magazine	Army Research Office (ARO) website	Invited speakers or "career" events during URAP	Army Educational Outreach Program (AEOP) website	Participation in URAP	My URAP mentor(s)
Very Much	4%	4%	4%	8%	11%	16%	22%	37%
Somewhat	4%	15%	7%	22%	7%	22%	22%	15%
A little	4%	4%	7%	19%	11%	11%	19%	22%
Not at all	11%	7%	7%	7%	15%	7%	15%	7%
Did not experience	77%	70%	75%	44%	56%	44%	22%	19%

Apprentices were asked on the questionnaire how often they engaged in various STEM practices during URAP. They reported that they were very actively engaged in doing STEM activities during the program (please see Chart 8). For example, 93% of responding apprentices indicated practicing hands-on STEM activities on most days or every day; 89% reported using laboratory procedures and tools; 78% noted analyzing data or information; and 81% reported working as part of a team. In addition, apprentices indicated being integrally involved the work of STEM on most days or every day, including drawing conclusions from an investigation (70%), carrying out investigations (70%), designing investigations (64%), coming up with creative explanations or solutions (74%), and identifying questions or problems to investigate (70%). Fewer apprentices indicated that they build or make a computer model on most days or every day. Data from the URAP mentor questionnaire generally aligned with data from the apprentice questionnaire.

Chart 8: Apprentice Engagement in STEM Practices in URAP (n = 27)



	Build or make a computer model	Identify questions or problems to investigate	Come up with creative explanations or solutions	Design an investigation	Carry out an investigation	Draw conclusions from an investigation	Work as part of a team	Analyze data or information	Use laboratory procedures and tools	Participate in hands-on STEM activities
Every day	16%	26%	26%	31%	37%	37%	40%	45%	56%	60%
Most days	22%	44%	48%	33%	33%	33%	41%	33%	33%	33%
A few times	22%	26%	15%	19%	15%	26%	15%	15%	7%	7%
At least once	7%	4%	11%	15%	15%	4%	0%	7%	0%	0%
Not at all	33%	0%	0%	4%	0%	0%	4%	0%	4%	0%

A composite score[5] was calculated for each of these two sets of items, the first titled "Learning about STEM in URAP,"[6] and the second "Engaging in STEM Practices in URAP."[7] 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 determine whether there were differences in apprentice experiences by gender and race/ethnic group (minority vs. non-minority apprentices). There were no significant differences by gender or race/ethnicity.

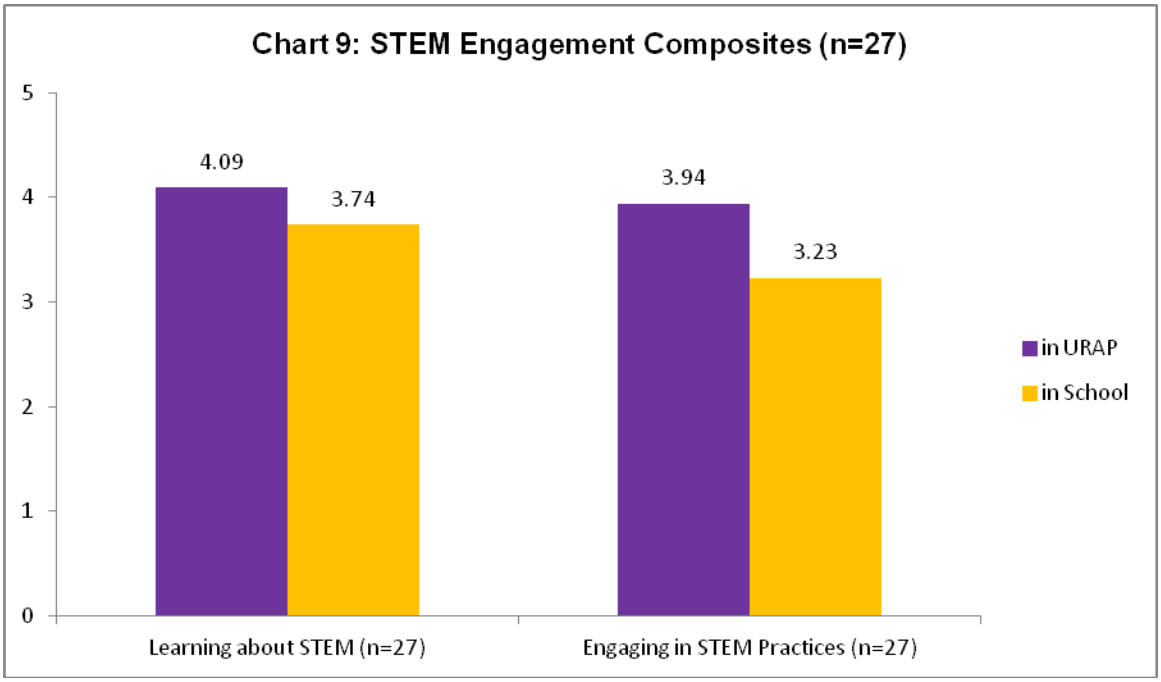
It is important to understand how the URAP experience is the same or different than their typical school experience. In order to collect data in this area, apprentices were asked how often they engaged in the same activities in school (please

[5] 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.

[6] The Cronbach's alpha reliability for these 6 items was 0.671.

[7] The Cronbach's alpha reliability for these 10 items was 0.807.

see Appendix B for frequency tables). The responses were combined into two composite variables: "Learning about STEM in School,"[8] and "Engaging in STEM Practices in School"[9] that are parallel to the ones asking about URAP. As can be seen in Chart 9, scores were significantly higher on the "in URAP" versions of both composites than on the in school versions (large effects[10] of d = 1.07 standard deviations and d = 1.61 standard deviations).[11] These data indicate that URAP provides apprentices with more intensive STEM learning experiences than they would typically receive in school.



The Role of Mentors

Mentors contribute a great deal to the URAP experience. The mentoring provided during URAP defines the experience and is a critical factor in maximizing apprentice participation in these opportunities. Mentoring also plays a key role in inspiring and sustaining apprentice interest in future STEM work. Both the apprentice questionnaire and the mentor questionnaire ask about activities of the mentor and the effectiveness of the mentor-apprentice relationship. In 2015,

[8] The Cronbach's alpha reliability for these 6 items was 0.732.

[9] The Cronbach's alpha reliability for these 10 items was 0.911.

[10] Effect sizes are used to facilitate comparison of the magnitude of differences across different outcomes and/or studies by putting differences on a standardized metric. For difference between means, effect size is calculated as Cohen's d: the difference in means of the two groups divided by the pooled standard deviation. For Cohen's d, effect sizes of about 0.20 are typically considered small, 0.50 medium, and 0.80 large. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

[11] Two-tailed dependent samples t-tests: Learning about STEM, $t(26) = 2.73$, $p < 0.01$; Engaging in STEM Practices, $t(26) = 4.11$, $p < 0.001$

there were more mentors working with individual apprentices. According to the survey, 92% of mentors responding to the questionnaire indicated working with one apprentice and 8% reported working with two or three apprentices.

Mentors were asked whether or not they used a number of strategies when working with apprentices.[12] These strategies comprised five main areas of effective mentoring: [13]

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.

Mentors reported that they used effective strategies to engage apprentices on several different levels (see Table 13). Almost all of the mentors reported that they gave students real-life problems to investigate or solve (94%), more than three-quarters of mentors reported they became familiar with the student's background and interests at the beginning of the URAP experience (88%), selected readings or activities that related to the apprentice's background (81%), and encouraged apprentices to suggests new readings, activities or projects (75%). Over half of the mentors helped students become aware of the role(s) that STEM plays in their everyday lives (63%). The least frequently used strategies of mentors relevant to learning activities were asking students to relate real-life events to topics covered in URAP (31%), and helping students understand how STEM can improve their own community (19%).

[12] The mentor questionnaire used the term "students"; consequently, the data in this section are reported using that term as well.

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

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

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

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

Table 13. Mentors Using Strategies to Establish Relevance of Learning Activities (n = 16)	
Item	**Questionnaire Respondents**
Giving students real-life problems to investigate or solve	94%
Become familiar with my student(s) background and interests at the beginning of the URAP experience	88%
Selecting readings or activities that relate to students' backgrounds	81%
Encouraging students to suggest new readings, activities, or projects	75%
Helping students become aware of the role(s) that STEM plays in their everyday lives	63%
Asking students to relate real-life events or activities to topics covered in URAP	31%
Helping students understand how STEM can help them improve their own community	19%

Mentors were asked about the types of strategies that have been found to be effective in to support the diverse needs of students as learners. Table 14 shows the results of the number of mentors that used the strategies and the majority of mentors used most of the strategies. One hundred percent of the mentors reported using a variety of teaching and/or mentoring activities to meet the needs of all students, 81% provided extra reading or activities to support students who lack essential background knowledge or skills, 63% identify the different learning styles of the students, 56% of mentors reported each of treating all students the same way, regardless of gender or race/ethnicity; integrating ideas from education literature to teach/mentor; and directing students to other individuals or programs for more support. Few mentors highlighted underrepresentation of women and racial and ethnic minority population in STEM (38%).

Table 14. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 16)	
Item	**Questionnaire Respondents**
Use a variety of teaching and/or mentoring activities to meet the needs of all students	100%
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	81%
Identify the different learning styles that my student (s) may have at the beginning of the URAP experience	63%
Interact with students and other personnel the same way regardless of their background	56%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	56%
Directing students to other individuals or programs for additional support as needed	56%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	38%

During URAP, apprentices need to develop collaboration and interpersonal skills. The questionnaire asked mentors to report the strategies to support apprentices' development of collaboration and interpersonal skills (see Table 15) and the mentors reported that they used a variety of strategies. Eighty-eight percent of mentors responding to the questionnaire indicated they used strategies to have their students listen to others with an open mind. The majority of mentors also had students tell other people about their backgrounds and interests (81%), explain difficult ideas to others (81%), give and receive constructive feedback with others (81%), and work on collaborative activities or projects as a member of a team (75%). About half of the mentors had their students resolve conflicts and reach agreement within their team (56%) and exchange ideas with others whose backgrounds or viewpoints are different from their own (50%).

Table 15. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 16)

Item	Questionnaire Respondents
Having my student(s) listen to the ideas of others with an open mind	88%
Having my student(s) tell other people about their backgrounds and interests	81%
Having my student(s) explain difficult ideas to others	81%
Having my student(s) give and receive constructive feedback with others	81%
Having students work on collaborative activities or projects as a member of a team	75%
Allowing my student(s) to resolve conflicts and reach agreement within their team	56%
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	50%

Table 16 shows the percentages of mentors who used strategies used to support apprentice engagement in authentic STEM activities, and the majority of URAP mentors noted using of each of these approaches. In the survey, 94% of the responding mentors reported having 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; allowing students to work independently to improve their self-management abilities. Other widely used strategies were teaching (or assigning readings) about specific STEM subject matter (88%), providing student(s) with constructive feedback to improve their STEM competencies (88%), encouraging students to seek support from other team members (88%), and Encouraging students to learn collaboratively (81%). At least 81% of mentors used all of the strategies listed.

Table 16. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 16)	
Item	**Questionnaire Respondents**
Having my student(s) search for and review technical research to support their work	94%
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	94%
Supervising my student(s) while they practice STEM research skills	94%
Allowing students to work independently to improve their self-management abilities	94%
Teaching (or assigning readings) about specific STEM subject matter	88%
Providing my student(s) with constructive feedback to improve their STEM competencies	88%
Encouraging students to seek support from other team members	88%
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	81%

Additionally, mentors were asked about their support for apprentice future STEM educational and career pathways. These data are listed in Table 17.[14] All of the responding mentors reported asking students about their educational and career interests. Many also indicated providing guidance to students about educational pathways that would prepare them for a STEM career (81%); and discussing STEM career opportunities in private industry or academia (56%). Half of the mentors reported that they recommend student and professional organizations in STEM to their students (50%)

It is somewhat surprising that less than half of the responding mentors reported discussing STEM careers within the DOD or government with apprentices (38%), or helping apprentices build effective STEM networks (43%) since that is a crucial part of developing STEM careers. Additionally, given the interest in having apprentices graduate into other AEOP opportunities, it is also surprising that only 25% of mentors recommended other AEOP programs to apprentices. The amount of mentors recommending the AEOP programs is lower than in 2014, when less than half of mentor interviewees reported passing out AEOP brochures to their apprentices during the program.

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

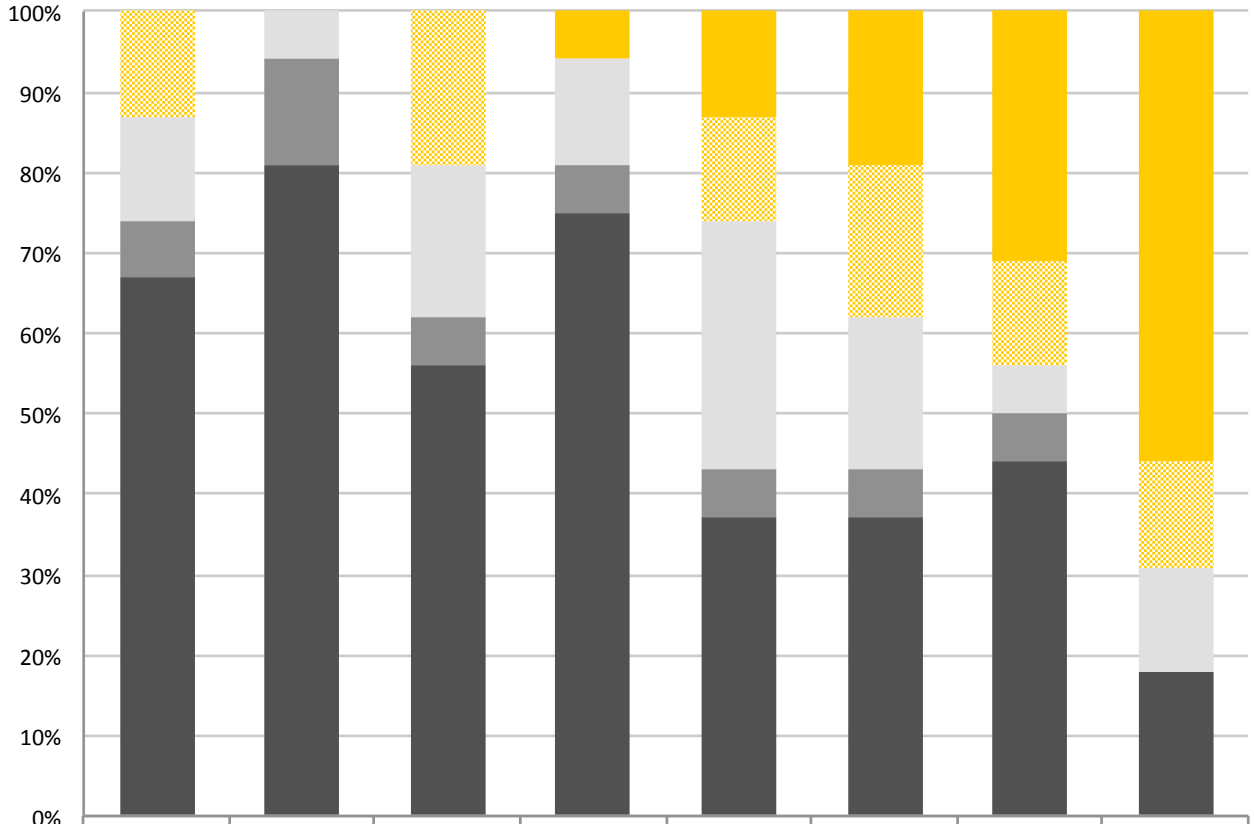
Table 17. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 15-16)	
Item	**Questionnaire Respondents**
Asking my student(s) about their educational and/or career goals	100.0%
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	81%
Discussing STEM career opportunities in private industry or academia	56%
Recommending student and professional organizations in STEM to my student(s)	50%
Recommending extracurricular programs that align with students' goals	44%
Helping students build a professional network in a STEM field	44%
Discussing STEM career opportunities within the DoD or other government agencies	38%
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	38%
Discussing the economic, political, ethical, and/or social context of a STEM career	27%
Recommending Army Educational Outreach Programs that align with students' goals	25%

Mentors were further asked which of the AEOP programs they explicitly discussed with their apprentices during URAP. Surprisingly, the most frequent response was that the mentors discussed AEOP with the apprentices, but did not discuss any specific program (44%), as can be seen in Table 18. Of the programs, which were explicitly discussed, the most commonly mentioned were NDSEG (27%) (a decrease from 36% in 2014) and SMART (20%) (a decrease from 43% in 2014).

Table 18. Mentors Explicitly Discussing AEOPs with Apprentices (n = 15-16)	
Item	**Questionnaire Respondents**
I discussed AEOP with my student(s) but did not discuss any specific program	44%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	27%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	20%
GEMS Near Peer Mentor Program	13%
College Qualified Leaders (CQL)	7%

The questionnaire asked mentors to report about the usefulness of various resources in efforts to expose apprentices to the different AEOPs. Chart 10 demonstrates that mentors reported participation in URAP (69%) was the only resource, which more than half of responding mentors rated as "very much" useful. Beyond participation in URAP, respondents indicated finding little use for most of the resources included on the questionnaire. More than half of respondents reported that they did not experience the AEOP brochure, It Starts Here! Magazine, AEOP social media, or invited speakers or career events.

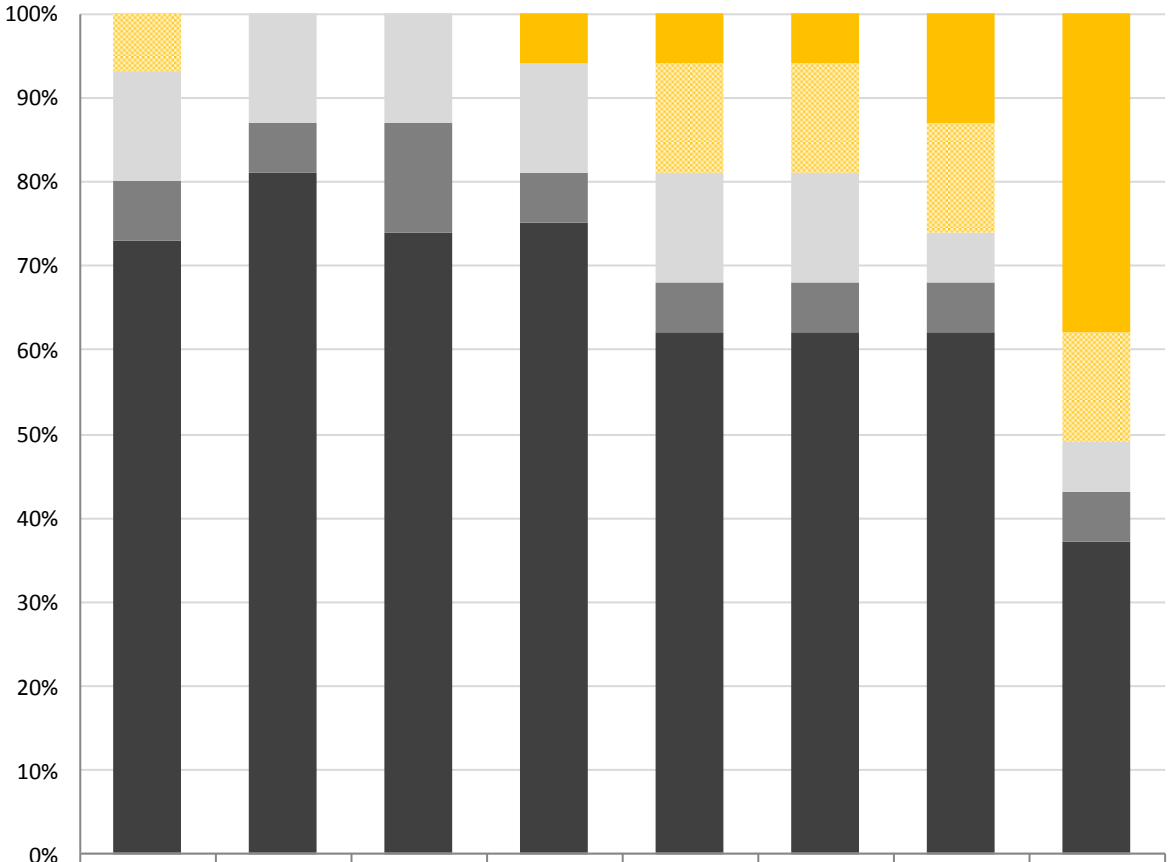
Chart 10: Usefulness of Resources for Exposing Apprentices to AEOPs (n = 14-15)



	AEOP brochure	It Starts Here! Magazine	Invited speakers or "career" events	AEOP on Facebook, Twitter, Pinterest or other social media	Army Research Office (ARO) website	Army Educational Outreach Program (AEOP) website	URAP Program administrator or site coordinator	Participation in URAP
Very Much	0%	0%	0%	6%	13%	19%	31%	56%
Somewhat	13%	0%	19%	0%	13%	19%	13%	13%
A little	13%	6%	19%	13%	31%	19%	6%	13%
Not at all	7%	13%	6%	6%	6%	6%	6%	0%
Did not experience	67%	81%	56%	75%	37%	37%	44%	18%

Chart 11 explains how useful mentors felt the different resources were for exposing apprentices to specific DoD STEM careers. As with the item previously discussed, mentors were most likely to rate participation in URAP as useful, with 38% selecting "very much." Again, as with exposing students to AEOPs, less than a quarter of mentors considered any resource other than participation in URAP as "very much" useful. AEOP resources (website, instructional supplies, brochure, and social media) were not experienced by 62-81% of responding mentors.

Chart 11: Usefulness of Resources for Exposing Apprentices to DoD STEM Careers (n = 15-16)



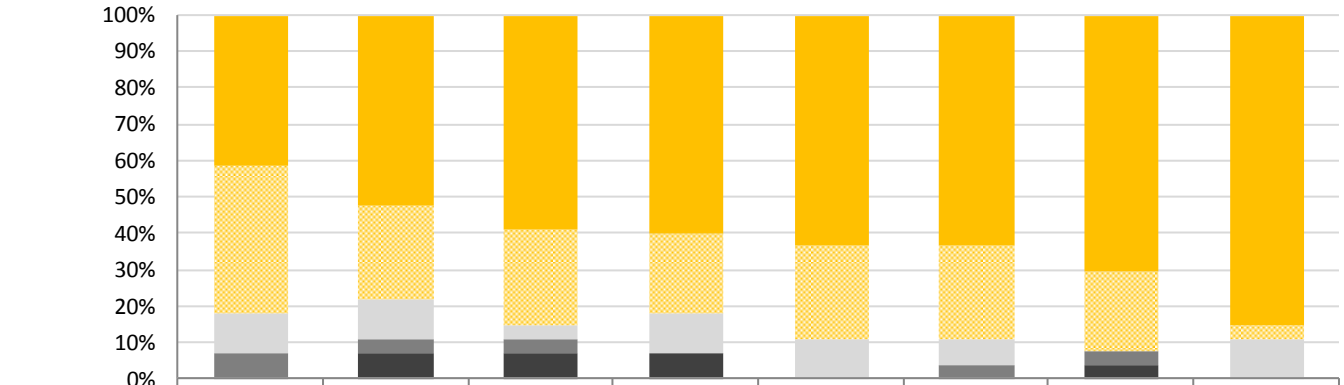
	AEOP brochure	It Starts Here! Magazine	Invited speakers or "career" events	AEOP on Facebook, Twitter, Pinterest or other social media	Army Research Office (ARO) website	URAP Program administrator or site coordinator	Army Educational Outreach Program (AEOP) website	Participation in URAP
Very Much	0%	0%	0%	6%	6%	6%	13%	38%
Somewhat	7%	0%	0%	0%	13%	13%	13%	13%
A little	13%	13%	13%	13%	13%	13%	6%	6%
Not at all	7%	6%	13%	6%	6%	6%	6%	6%
Did not experience	73%	81%	74%	75%	62%	62%	62%	37%

Satisfaction with URAP

Perceived satisfaction with the URAP program can influence the number and quality of future apprentices and mentors, which is central to the success of the program. To glean insight into satisfaction, apprentices were asked how satisfied they were with a number of features of the URAP program. Chart 12 displays the responses of the apprentices, which

show the vast majority of responding apprentices were somewhat or very much satisfied with each of the listed program features. For example, more than two-thirds of the responding participants reported being somewhat or very much satisfied with all of the categories of this question including the physical location of URAP activities (89%), instruction or mentorship during program activities (92%), participant stipends (89%), the application or registration process (89%), the availability of interesting program topics or fields (82%), communication with URAP host site organizers (85%), other administrative tasks (78%), and research abstract preparation requirements (82%).

Chart 12: Apprentice Satisfaction with URAP Program Features (n = 27)



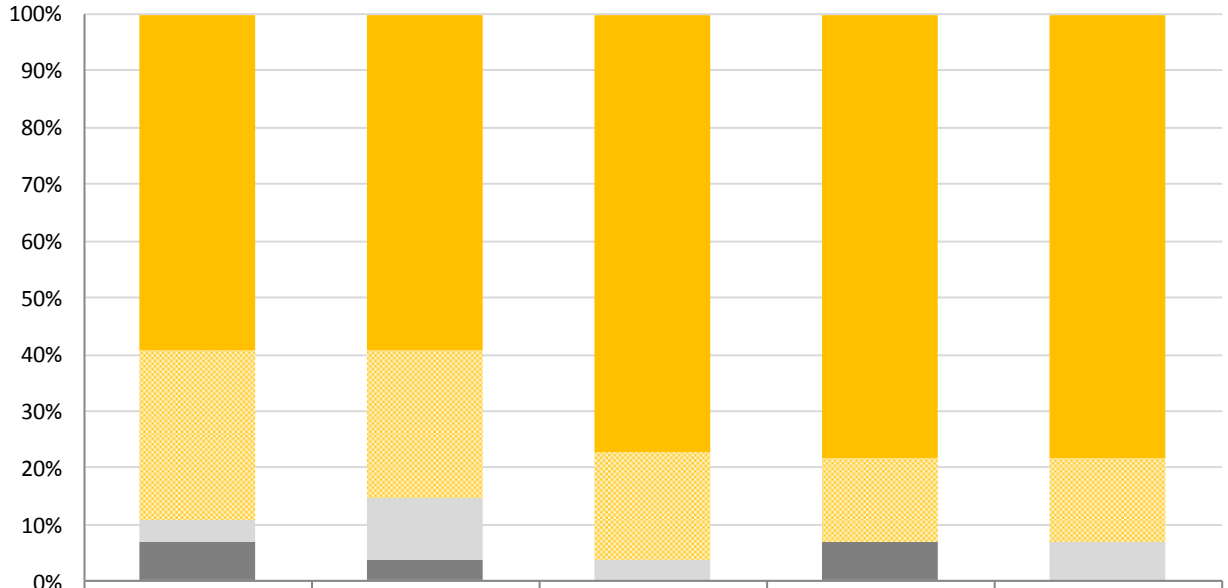
	Research abstract preparation requirements	Other administrative tasks (in-processing, network access, etc.)	Communicating with your URAP host site organizers	The variety of STEM topics available to you in URAP	Applying or registering for the program	Stipends (payment)	Teaching or mentoring provided during URAP activities	The physical location(s) of URAP activities
Very Much	41%	52%	59%	60%	63%	63%	70%	85%
Somewhat	41%	26%	26%	22%	26%	26%	22%	4%
A little	11%	11%	4%	11%	11%	7%	0%	11%
Not at all	7%	4%	4%	0%	0%	4%	4%	0%
Did not experience	0%	7%	7%	7%	0%	0%	4%	0%

Frequent access to a mentor is crucial in developing an effective mentoring relationship. Since this is an important feature of URAP, apprentices were asked about their satisfaction with access to their mentor on the post-program questionnaire. Table 19 shows that 44% of responding apprentices indicated their mentor were always available, and 48% 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 19. Apprentice Reports of Availability of Mentors (n = 27)	
Item	**Questionnaire Respondents**
The mentor was available more than half of the time	48%
The mentor was always available	44%
The mentor was available less than half of the time	4%
The mentor was never available	4%
The mentor was available about half of the time of my project	0%

In addition to the frequency of availability of a mentor, apprentices were asked to rate their satisfaction with their mentors and the research experience. Chart 13 shows that 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, 89% of apprentices selected "very much" when asked about satisfaction with their relationship with their mentor, with another 9% indicating "somewhat." Similarly, 89% were very much satisfied with their relationship with the group or team and 86% with the research experience overall; 86% reported being very much satisfied with the time they spent with their mentor; and 71% with the time spent doing meaningful research.

Chart 13: Apprentice Satisfaction with Their Experience (n = 27)



	The amount of time I spent doing meaningful research	The amount of time I spent with my research mentor	The research experience overall	My working relationship with my mentor	My working relationship with the group or team
Very Much	59%	59%	77%	78%	78%
Somewhat	30%	26%	19%	15%	15%
A little	4%	11%	4%	0%	7%
Not at all	7%	4%	0%	7%	0%
Did not experience	0%	0%	0%	0%	0%

The last few questions on the post-program questionnaire were open ended to allow apprentices to use their own words to explain the program. When asked about their overall experience with the URAP program, the responses were extremely positive. Of the 25 apprentices who answered this question, all but one commented on only positive aspects of the program. The one suggestion for improvement was to have better direct contact with other students in AEOP programs. These responses were sometimes as simple as, "It was an enjoyable experience that I would partake in again, if given the opportunity." Other times, apprentices provided more detail about what they enjoyed about the program, as in the following examples:

> *I really enjoyed doing URAP this summer. My mentor helped me get a better understanding and outlook on STEM. I was also able to meet and talk to other STEM majors and converse about their field of study. Definitely an experience worth having.* (URAP apprentice)

> *I truly appreciate the chance that URAP provided to me. I enjoyed doing research, even though the progress was slow, I encountered with a lot of troubles and the result after the short research period was not as expected. But*

this is an experience that I can't get from classes, especially for a student like me who comes from a small liberal arts college. My lab technique definitely improved greatly. I became more aware of safety and environment issues. My interest of becoming a lab TA increases and I am planning to apply to become a lab TA at my college. The group meeting every week forced me to learn about new STEM topics. I rarely read scientific paper except for school work before. But now I am more willing to read paper just to broaden my view. One thing that I am concerning about is that since this is my first actual research experience, I felt lost occasionally. I hope I communicated more often with my mentor and had a better plan for every step. (URAP apprentice)

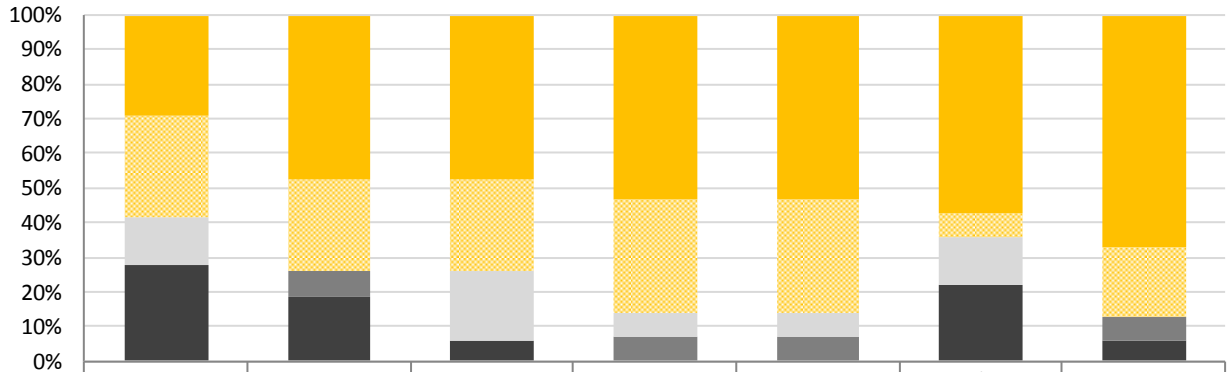
This experience was great. Communication with my mentor was awesome leading up to and during the program. My mentor was able to answer all my questions and teach me everything I needed to be successful in the program. I gained a lot of knowledge in chemistry that will help me become more well rounded as genetic engineer. The research I participated in is not in the curriculum for my degree program so I feel that I obtained a lot of extra knowledge that will give me a professional edge in the future. I gained a lot of experience working in the lab with other scientists and got a feel for how working full time in a lab will be once I graduate. My mentor also shared his experience in choosing a path for his education that helped me in thinking about my direction after obtaining my bachelor's degree. (URAP apprentice)

The apprentices were asked in an open-ended question how the URAP program could be improved. Fourteen apprentices answered. One apprentice indicated that no improvements were necessary and the other 13 indicated some ideas for improvement of the program. The most common theme in the responses was described by 8 apprentices (57%) related to more rigor or more requirements of the apprenticeship. Apprentices embellished this with their rationale for more rigor would give them capital to have more time with the mentor. Several respondents mentioned simply wanting "better communication," while others specified areas such as wanting more guidance and examples for the abstract. Other suggestions included increasing opportunities for research dissemination such as a conference (30%), allowing for more access to and information about the Army and other AEOPs (14%), and utilizing more and diversified methods for advertising and marketing to future participants (7%). In contrast, improvements suggested by apprentices in 2014 were focused on increasing the mentor-apprentice interactions. To compare apprentice experience with mentor experience, mentors were asked how satisfied they were with the program components they experienced. Chart 14 shows that 86% were at least somewhat satisfied with each of the research abstract preparation requirements,

"I really enjoyed doing URAP this summer. My mentor helped me get a better understanding and outlook on STEM. I was also able to meet and talk to other STEM majors and converse about their field of study. Definitely an experience worth having." -- URAP Apprentice

and the application or registration process. Additionally, approximately three-quarters of respondents were somewhat or very much satisfied with communicating with ARO (87%), communicating with URAP organizers (74%) and participation stipends (74%). With the exception of other administrative tasks (64%), at least 7 in 10 responding mentors indicated being at least somewhat satisfied with all other program features.

Chart 14: Mentor Satisfaction with URAP Program Features (n = 14-15)



	Support for instruction or mentorship during program activities	Communicating with URAP organizers	Stipends (payment)	Application or registration process	Research abstract preparation requirements	Other administrative tasks (in-processing, network access, etc.)	Communicating with Army Research Office (ARO)
Very Much	29%	47%	47%	53%	53%	57%	67%
Somewhat	29%	27%	27%	33%	33%	7%	20%
A little	14%	0%	20%	7%	7%	14%	0%
Not at all	0%	7%	0%	7%	7%	0%	7%
Did not experience	28%	19%	6%	0%	0%	22%	6%

The mentor questionnaire included open-ended items asking for opinions about the program, parallel to the apprentice questionnaire. Mentors were asked to identify the three most important strengths of URAP, and 100% of the mentors responded to this question. The most frequently described was providing students the opportunity to engage in hands-on research (10 mentors, or 63%), characterized by responses such as "giving a chance for someone to do research in this environment that would not have otherwise" and "hands-on participation in academic research." This sentiment was echoed in the mentor focus group. As one mentor said:

> *This summer program encourages both high schools and undergraduates to adventure into scientific research. I think from that point of view we are putting an early seed into this one* [getting the students involved in research]. (URAP mentor)

The mentors also independently wrote that strengths of the program included URAP apprentice stipends (32%); student opportunities for learning (56%); and the capacity to network with graduate students, professors, and STEM professionals (38%).

> *"The program could not be better, it affords me the opportunity to recruit the best students possible, and they have challenging projects provided for them."*
> -- URAP Mentor

The questionnaire asked mentors to note three ways in which URAP should be improved for future participants. Thirteen mentors responded to this question, and their comments were evenly split across several areas. Several mentors recommended that the program include a provision for students to do more than an abstract at the end of the project (33%). Others suggested increasing funding (to include more students and to provide students with greater stipends) (33%), providing a forum for students to share their research findings with others (46%), and increasing opportunities for undergraduate networking (18%).

Mentors reported on the questionnaire their overall satisfaction with their URAP experience. Fourteen mentors responded to this question, and the responses were positive. Some mentors noted being "very satisfied" or having "enjoyed the experience" without additional elaboration. Others offered more detail about their experience; one mentor wrote:

> *It was great to have a HS student join my group and participate in our projects.* [The apprentice] *worked hard, and learned quite a lot over the summer. Unfortunately, we had some equipment issues that prevented him from seeing the project to completion, but this is very common in our area and he got to learn just how difficult cutting edge research can be. This experience will benefit him as he attends UCLA as a Physics major in the Fall, and will also help as he becomes involved with research in graduate school.* (URAP mentor)

It is clear from the Actionable Program Evaluation portion of the questionnaire that URAP provides a program that actively engages apprentices in authentic STEM experiences and influences apprentice aspirations for STEM education in the future. Although apprentices obtain hands-on experiences with STEM, and gain authentic experiences in laboratories, DoD STEM jobs/careers have not been emphasized equally across program sites, nor has recruitment be implemented beyond local connections.

Apprentices and mentors are satisfied or very satisfied with the experiences they obtain with the URAP program, particularly how apprentices actively engage in learning about STEM and in STEM practices. Apprentices indicate that they learn about more STEM knowledge in URAP than they would typically experience in school. In part, the success of URAP is due to large proportions of mentors employing strategies to help make the learning activities relevant to apprentices, support the diverse needs of apprentices as learners, support apprentices' development of collaboration and interpersonal skills, and support student engagement in authentic STEM activities.

Outcomes Evaluation

The evaluation of URAP included measurement of several outcomes related 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 knowledge of and interest in participating in additional AEOP opportunities.[15] STEM competencies are necessary for a STEM-literate citizenry. STEM competencies include foundational knowledge, skills, and abilities in STEM, as well as the confidence to apply them appropriately. STEM competencies are important for those engaging in STEM enterprises, but also 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 URAP 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

As a result of the URAP program, the majority of apprentices reported large or extreme gains in their STEM knowledge in each area (see Chart 15). For example, large or extreme gains were reported by 78% of apprentices in their knowledge of what everyday research work is like in STEM, and by 85% in their knowledge of research conducted in a STEM topic or field. Similarly, most apprentices reported impacts on knowledge of how professionals work on real problems in STEM (74%); knowledge of a STEM topic or field in depth (81%); and knowledge of research processes, ethics, and rules for conduct in STEM (70%). There were no apprentices who indicated that they had no or little gain in any of the areas on the survey. Mentors reported similar impacts on their apprentices' STEM knowledge (see Appendix C).

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

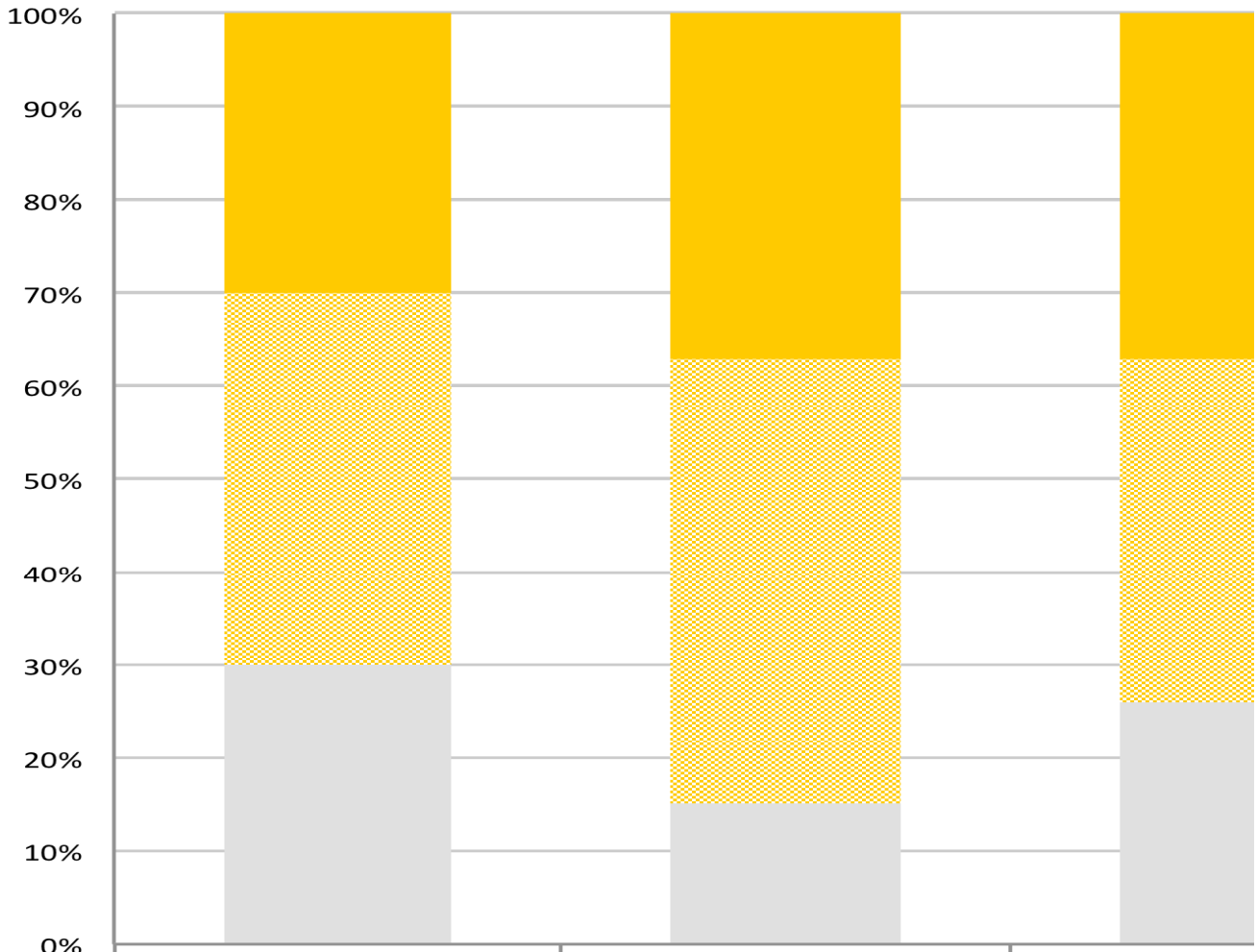
Committee on STEM Education. (2013*). Federal Science, Technology, Engineering, and Mathematics (STEM) education 5-year strategic plan: A report from the Committee on STEM Education, National Science and Technology Council.* Washington, DC: The White House, Office of Science and Technology Policy.

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

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

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

Chart 15: Apprentice Report of Impacts or



	Knowledge of research processes, ethics, and rules for conduct in STEM	Knowledge of research conducted in a STEM topic or field	Knowledge of how engineers work on in STE
Extreme gain	30%	37%	37%
Large gain	40%	48%	37%
Some gain	30%	15%	26%
A little gain	0%	0%	0%
No gain	0%	0%	0%

The apprentice questionnaire also asked about perceived impacts on STEM skills, i.e., apprentices' abilities to use STEM practices. Apprentices were presented with different sets of items depending on the focus of their URAP experience (science vs. technology, engineering, or mathematics). Table 20 shows the percentage of responding apprentices reporting large or extreme gains in science-related practices. More than half of apprentices indicated large or greater

gains in 12 of the 16 competencies, with the exception of identifying the strengths and limitations of data interpretations, or arguments presented in technical or scientific texts (47%), defending an argument that conveys how an explanation best describes an observation (40%), using computer models of objects or systems to test cause and effect relationships (33%), and making a model of an object or system showing its parts and how they work (27%). Most apprentices reported large or extreme gains in their ability to communicate about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics) (80%), using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation (73%), carrying out procedures for an experiment and recording data accurately (73%), and designing procedures for an experiment that are appropriate for the question to be answered (71%). The apprentice questionnaire items were combined into a composite variable[16] to test for differential impacts across subgroups of apprentices. There were no significant differences between males and females, or between minority and non-minority apprentices.

Table 20. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Science Practices (n = 14-15)

Item	Questionnaire Respondents
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	80%
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	73%
Carrying out procedures for an experiment and recording data accurately	73%
Designing procedures for an experiment that are appropriate for the question to be answered	71%
Asking a question that can be answered with one or more scientific experiments	67%
Identifying the limitations of the methods and tools used for data collection	67%
Integrating information from technical or scientific texts and other media to support your explanation of an observation	60%
Organizing data in charts or graphs to find patterns and relationships	53%
Considering different interpretations of data when deciding how the data answer a question	53%
Supporting an explanation for an observation with data from experiments	53%
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	53%
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	53%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	47%
Defending an argument that conveys how an explanation best describes an observation	40%
Using computer models of objects or systems to test cause and effect relationships	33%
Making a model of an object or system showing its parts and how they work	27%

[16] The Cronbach's alpha reliability for these 5 items was 0.880.

Table 21 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 gains for this group of apprentices were similar to those reporting on science-related practices. Again, half or more than half of respondents indicated large or extreme gains in all competencies except 2 of the 16, designing procedures for an experiment that are appropriate for the question to be answered (42%), and making a model of an object or system to show its parts and how they work (33%). When asked about apprentices' gains in science and engineering practices, mentors reported similar results.

Composite scores were calculated for each set of practices items[17] on the student questionnaire to examine whether the URAP program had differential impacts on subgroups of apprentices. There were no significant differences between genders or racial/ethnic groups on either composite.

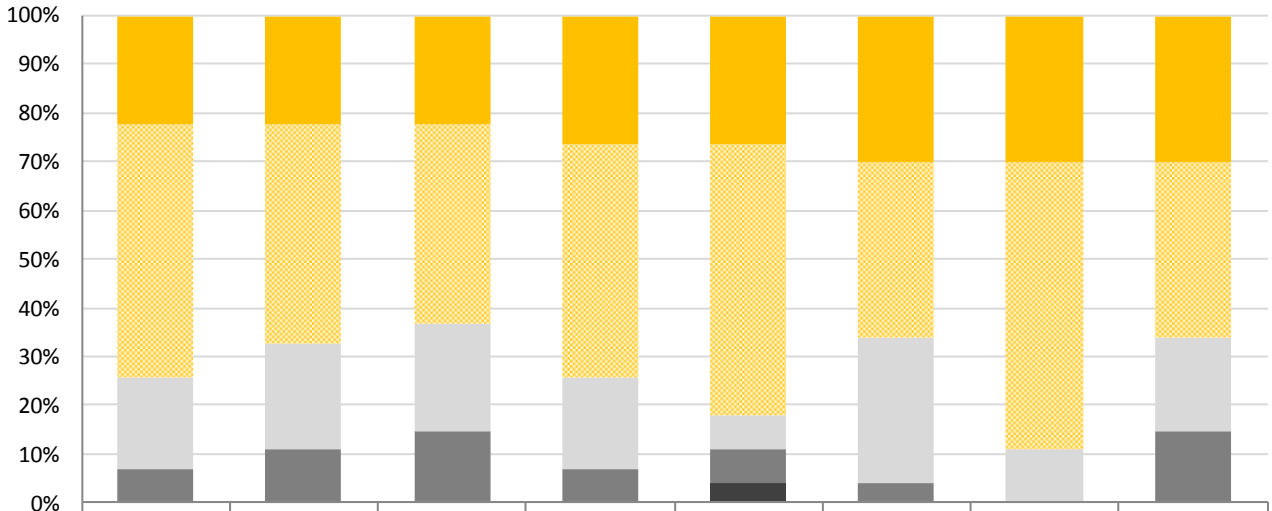
Table 21. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Engineering Practices (n = 12)

Item	Questionnaire Respondents
Using knowledge and creativity to propose a testable solution for a problem	92%
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	92%
Defining a problem that can be solved by developing a new or improved object, process, or system	75%
Carrying out procedures for an experiment and recording data accurately	67%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	67%
Defend an argument that conveys how a solution best meets design criteria	67%
Integrating information from technical or scientific texts and other media to support your solution to a problem	67%
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	67%
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	58%
Identifying the limitations of the methods and tools used for data collection	58%
Considering different interpretations of the data when deciding if a solution works as intended	58%
Organizing data in charts or graphs to find patterns and relationships	58%
Using computer models of an object or system to investigate cause and effect relationships	50%
Supporting a solution for a problem with data from experiments	50%
Designing procedures for an experiment that are appropriate for the question to be answered	42%
Making a model of an object or system to show its parts and how they work	33%

[17] The science practices composite has a Cronbach's alpha reliability of 0.962; the engineering practices composite has a Cronbach's alpha reliability of 0.971.

The apprentice questionnaire also asked participants to share information about the impact of URAP on their "21st Century Skills" that are necessary across a wide variety of fields. As can be seen in Chart 16, approximately three-fourths of responding apprentices reported large or extreme gains for four of these skills, making changes when things do not go as planned (89%), viewing failure as an opportunity to learn (82%), communicating effectively with others (74%), and learning to work independently (74%). Apprentices reported similar gains regardless of gender or race/ethnicity. In addition, mentor reports of apprentice gains in this area are generally similar to those of the apprentices.

Chart 16: Apprentice Report of Impacts on 21st Century Skills (n = 27)



	Learning to work independently	Setting goals and reflecting on performance	Working well with people from all backgrounds	Communicating effectively with others	Viewing failure as an opportunity to learn	Sticking with a task until it is finished	Making changes when things do not go as planned	Including others' perspectives when making decisions
Extreme gain	22%	22%	22%	26%	26%	30%	30%	30%
Large gain	52%	45%	41%	48%	56%	36%	59%	36%
Some gain	19%	22%	22%	19%	7%	30%	11%	19%
A little gain	7%	11%	15%	7%	7%	4%	0%	15%
No gain	0%	0%	0%	0%	4%	0%	0%	0%

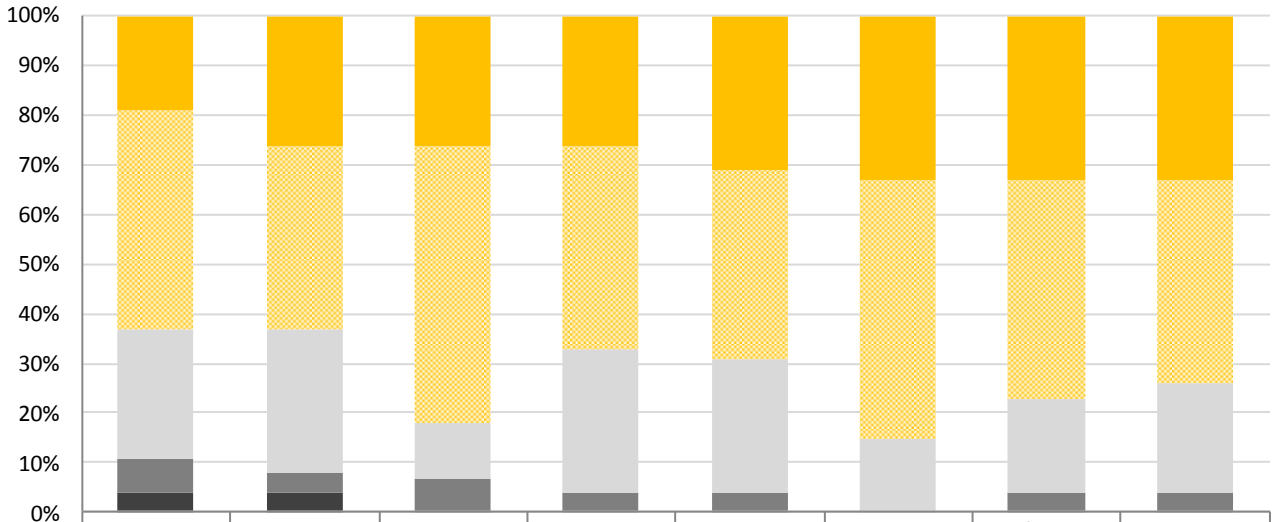
STEM Identity and Confidence

Deepening apprentices' STEM knowledge and skills is 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.[18] Consequently, the apprentice questionnaire included a series of items intended to measure

[18] 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.

the impact of URAP on apprentices' STEM identity. These data are shown in Chart 17 and strongly suggest that the program has had a positive impact in this area. For example, 85% of responding apprentices reported a large or extreme gain in feeling prepared for more challenging STEM activities and 82% reported gains in sense of accomplishing something in STEM. Similarly, substantial proportions of apprentices reported large or extreme gains in their confidence to try out new STEM ideas (77%), patience for the slow pace of STEM research (74%), desire to build relationships with mentors in STEM (69%), and connecting a STEM topic or field to their personal values (67%). Comparing results on the composite created from these items,[19] there were no differences in impact based on gender or race/ethnicity.

Chart 17: Apprentice Report of Impacts on STEM Identity (n = 27)



	Interest in a new STEM topic	Deciding on a path to pursue a STEM career	Sense of accomplishing something in STEM	Connecting a STEM topic or field to my personal values	Desire to build relationships with mentors who work 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
Extreme gain	19%	26%	26%	26%	31%	33%	33%	33%
Large gain	44%	37%	56%	41%	38%	52%	44%	41%
Some gain	26%	29%	11%	29%	27%	15%	19%	22%
A little gain	7%	4%	7%	4%	4%	0%	4%	4%
No gain	4%	4%	0%	0%	0%	0%	0%	0%

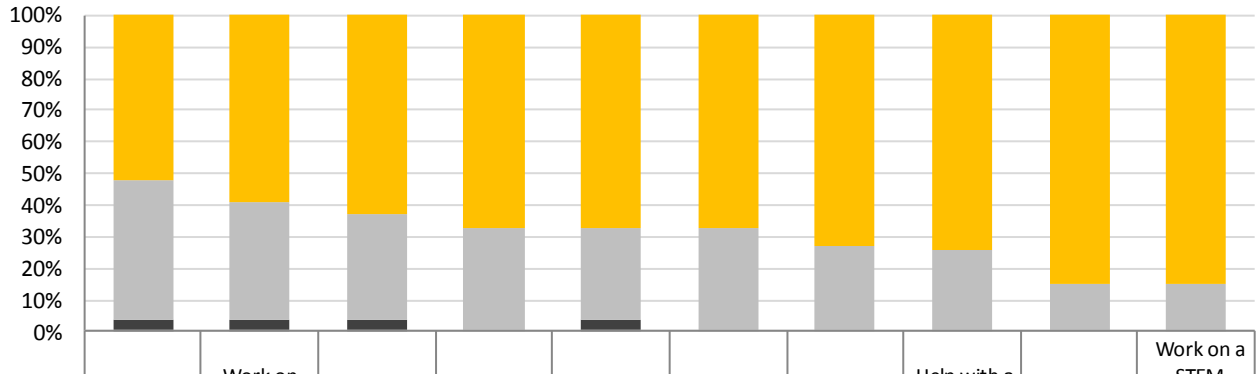
[19] The Cronbach's alpha reliability for these 8 items was 0.856.

Interest and Future Engagement in STEM

A composite score was created from these items,[20] and composite scores were compared across subgroups of apprentices. There were no statistically significant differences for these composites by race/ethnicity. However, females were significantly more likely to endorse these items than males; $t(22)=3.24$, $p<.01$, large effect size (Cohen's $d = 1.38$).

A key goal of the AEOP program is to develop a STEM-literate citizenry. To do so, apprentices need to be engaged in and out of school with high quality STEM activities. In order to examine the impact of URAP on apprentices' interest in future engagement in STEM, the questionnaire asked them to reflect on whether the likelihood of their engaging in STEM activities outside of school and their interest level in participating in future AEOP programs changed as a result of their experience. As can be seen in Chart 18, apprentices indicated they were more likely to engage in many of these activities as a result of URAP. For example, 85% reported being more likely to work on a STEM project or experiment in a university or professional setting, 85% reported being more likely to mentor or teach other students about STEM, 74% to help with a community service project related to STEM, and 73% to talk with friends or family about STEM.

Chart 18: Change in Likelihood Apprentices Will Engage in STEM Activities Outside of School (n = 27)

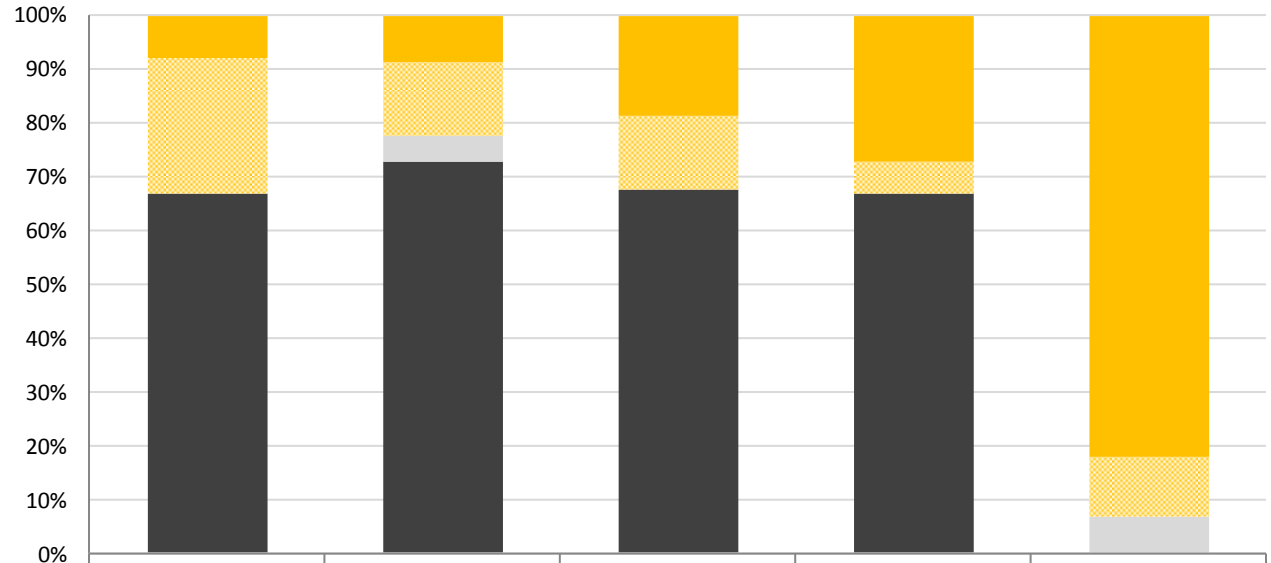


	Use a computer to design or program something	Work on solving mathematical or scientific puzzles	Watch or read non-fiction STEM	Tinker (play) with a mechanical or electrical device	Participate in a STEM camp, club, or competition	Take an elective (not required) STEM class	Talk with friends or family about STEM	Help with a community service project related to STEM	Mentor or teach other students about STEM	Work on a STEM project or experiment in a university or professional setting
More likely	52%	59%	63%	67%	67%	67%	73%	74%	85%	85%
About the same	44%	37%	33%	33%	29%	33%	27%	26%	15%	15%
Less likely	4%	4%	4%	0%	4%	0%	0%	0%	0%	0%

[20] These 10 items had a Cronbach's alpha reliability of 0.875.

When asked how interested they are in participating in future AEOP programs, a large majority (93%) indicated being at least somewhat interested in participating in URAP again, in NDSEG (26%), and in SMART (23%) (see Chart 19). Interest in participating in the other programs may be reported as low because the apprentices also reported that they were not aware of specific AEOP programs. URAP participants are ineligible for many of the other available AEOPs based on their level of education.

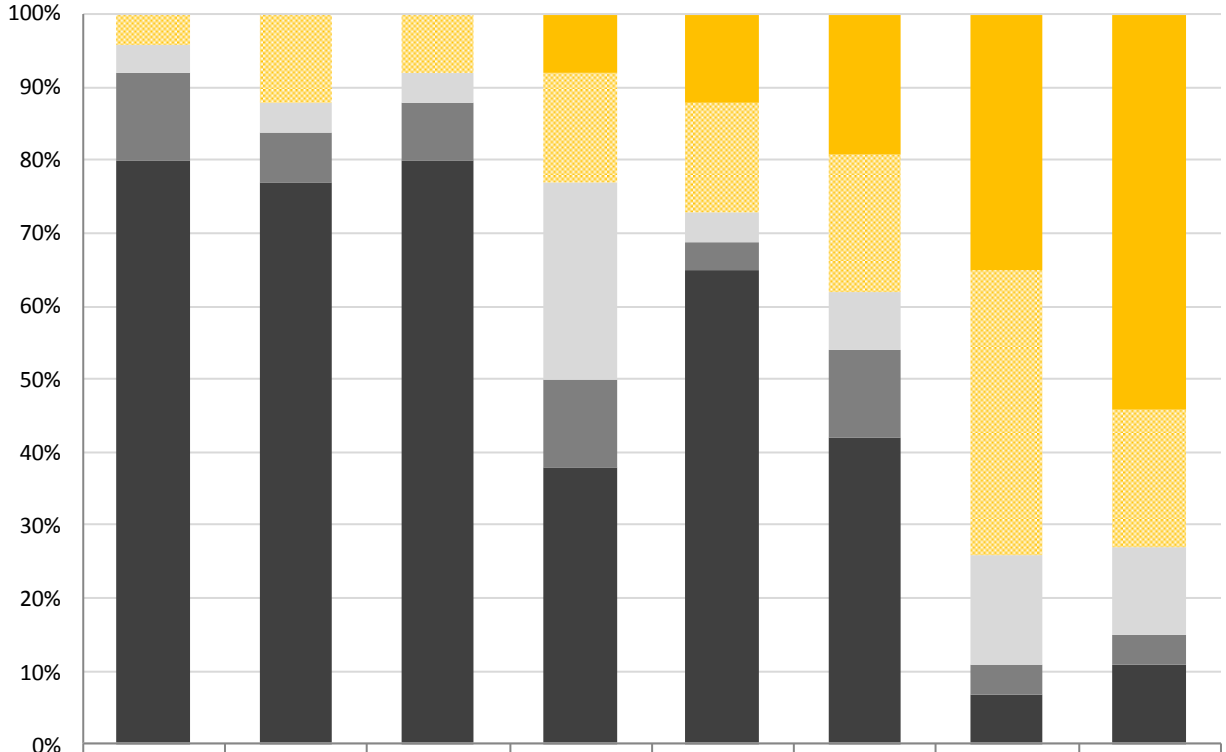
Chart 19: Apprentice Interest in Future AEOP Programs (n = 27)



	GEMS Near Peer Mentor Program	College Qualified Leaders (CQL)	National Defense Science & Engineering Graduate (NDSEG) Fellowship	Science Mathematics, and Research for Transformation (SMART) College Scholarship	Undergraduate Research Apprenticeship Program (URAP)
Very Much	7%	7%	15%	19%	82%
Somewhat	22%	11%	11%	4%	11%
A little	0%	4%	0%	0%	7%
Not at all	59%	59%	55%	47%	0%

Apprentices were asked which resources impacted their awareness of the various AEOPs. As can be seen in Chart 20, URAP mentors (73%) and participating in the program (74%) were most likely to be rated as impacting their awareness "somewhat" or "very much." Beyond these two, most resources were reported to have little or no impact on the majority of responding apprentices' awareness of AEOPs, in part because some participants did not experience these resources.

Chart 20: Impact of Resources on Apprentice Awareness of AEOPs (n = 25-26)

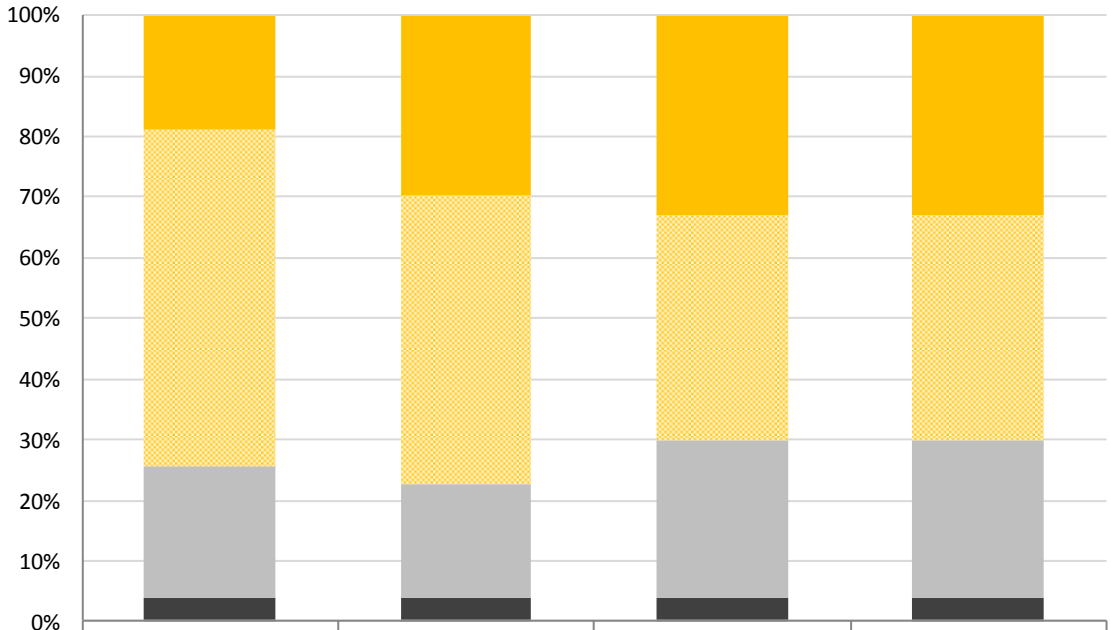


	AEOP on Facebook, Twitter, Pinterest or other social media	AEOP brochure	It Starts Here! Magazine	Army Research Office (ARO) website	Invited speakers or "career" events during URAP	Army Educational Outreach Program (AEOP) website	Participation in URAP	My URAP mentor(s)
Very Much	0%	0%	0%	8%	12%	19%	35%	54%
Somewhat	4%	12%	8%	15%	15%	19%	39%	19%
A little	4%	4%	4%	27%	4%	8%	15%	12%
Not at all	12%	7%	8%	12%	4%	12%	4%	4%
Did not experience	80%	77%	80%	38%	65%	42%	7%	11%

Attitudes toward DoD Research

Apprentices' attitudes about the importance of DoD research are an important prerequisite to their continued interest in the field and potential involvement in the future. In order to examine attitudes in this area, the questionnaire also asked apprentices to report 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 21). For example, 78% agreed or strongly agreed that DoD researchers develop cutting-edge technologies, 70% that DoD researchers solve real-world problems, 70% that DoD research is valuable to society and 75% that DoD researchers advance science and engineering fields.

Chart 21: Apprentice Opinions about DoD Researchers and Research (n = 27)



	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
Strongly Agree	19%	30%	33%	33%
Agree	56%	48%	37%	37%
Neither Agree nor Disagree	22%	19%	26%	26%
Disagree	0%	0%	0%	0%
Strongly disagree or disagree	4%	4%	4%	4%

Education and Career Aspirations

The evaluation examined the program's impact on apprentices' education and career aspirations. Apprentices were asked to report how far they wanted to go in school before and after participating in URAP. As can be seen in Table 22, when asked to think back on how far they wanted to go in school before participating in URAP, 18% indicated that they wanted to either graduate from high school or finish college, with no indication of wanting to pursue additional higher education. After participating in URAP, none of the students indicated that their highest level of desired education was finishing college, only 4% wanted to go to a trade school only and no one indicated only graduating from high school. Overall the apprentices' aspirations for education after high school increased from only an undergraduate degree to a Master's degree or higher.

Table 22. Apprentice Education Aspirations (n = 27)		
	Before URAP	**After URAP**
Go to a trade or vocational school	0%	4%
Go to college for a little while	0%	0%
Finish college (get a Bachelor's degree)	18%	0%
Get more education after college	7%	0%
Get a master's degree	26%	30%
Get a Ph.D.	30%	48%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	15%	7%
Get a combined M.D. / Ph.D.	0%	7%
Get another professional degree (law, business, etc.)	4%	4%

In regards to career aspirations, 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 URAP and after URAP (see Table 23). Most apprentices expressed interest in STEM-related careers both before and after participating in URAP. For example, 33% indicated aspiring to a career in engineering before URAP, with 18% interest in physical science, and another 14% interested in medicine. After URAP, 30% of apprentices expressed interest in engineering, 15% in computer science, 15% in physical science, and 11% in medicine. To examine whether the URAP 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, a similar proportion switched from STEM to non-STEM. Thus, there was not a statistically significant difference in the proportion of apprentices aspiring to a STEM-related career.

Table 23. Apprentice Career Aspirations (n = 27)		
	Before URAP	**After URAP**
Engineering	33%	30%
Computer science	7%	15%
Physical science (physics, chemistry, astronomy, materials science)	18%	11%
Medicine (doctor, dentist, veterinarian, etc.)	14%	11%
Biological science	4%	7%
Mathematics or statistics	4%	7%
Teaching, STEM	4%	7%
Technology	4%	4%
Other, (specify):	4%	4%
Undecided	0%	4%
Science (no specific subject)	4%	0%
Earth, atmospheric or oceanic science	0%	0%
Environmental science	4%	0%
Health (nursing, pharmacy, technician, etc.)	0%	0%
Social science (psychologist, sociologist, etc.)	0%	0%
Teaching, non-STEM	0%	0%
Business	0%	0%
Law	0%	0%
Military, police, or security	0%	0%
Art (writing, dancing, painting, etc.)	0%	0%
Skilled trade (carpenter, electrician, plumber, etc.)	0%	0%

Apprentices reported the extent to which they expect to use their STEM knowledge, skills, and/or abilities in their work when they are age 30. As can be seen in Table 24, all apprentices expect to use STEM somewhat in their career. A majority (96%) expects to use STEM 51-100% of the time in their work.

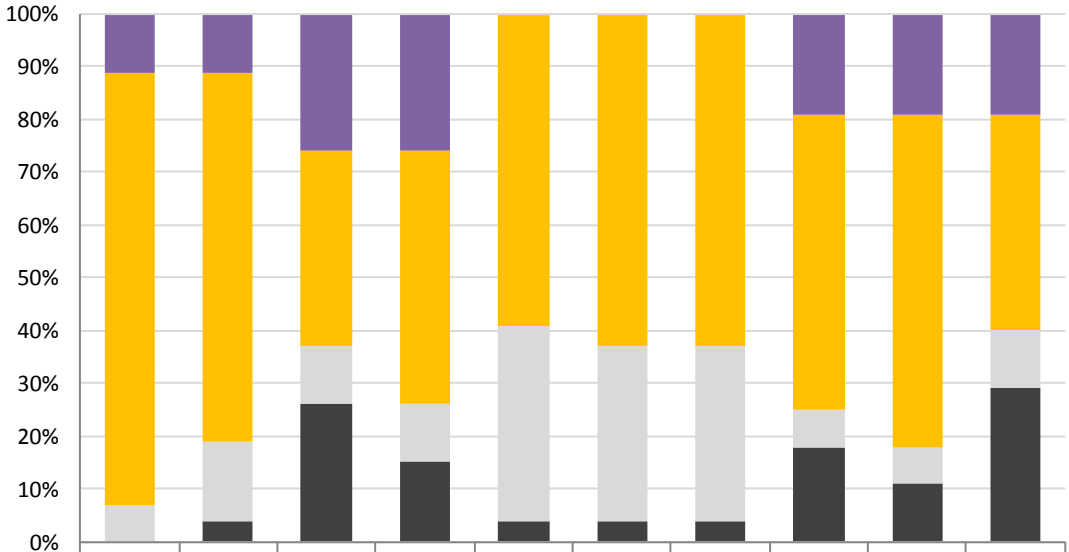
Table 24. Apprentices Expecting to use STEM in Their Work at Age 30 (n = 27)	
	Questionnaire Respondents
Not at all	0%
Less than 25% of the time	4%
26% to 50% of the time	0%
51% to 75% of the time	55%
75% to 100% of the time	41%

Overall Impact

Finally, apprentices were asked to report impacts of participating in URAP more broadly. From these data, it is clear that apprentices thought the program had substantial impacts on them (see Chart 22). For example, a large majority of responding apprentices indicated an impact of participation in URAP on confidence in their STEM knowledge, skills, and abilities, with 82% reporting that URAP contributed to this impact and another 11% reporting that URAP was the primary reason for this impact. Similarly, apprentices reported that participation in URAP had an impact on their awareness of other AEOPs (37% reporting that URAP contributed, 26% reporting that URAP was primary reason) and on their interest in participating in other AEOPs (48% and 26%). Apprentices also reported an impact on their interest in participating in STEM activities outside of school requirements (70% and 11%), appreciation of DoD STEM research and careers (63% and 19%), and awareness of DoD STEM research and careers (56% and 19%). These items were combined into a composite variable[21] to test for differences among subgroups of students; no significant differences were found by gender or race/ethnicity. Mentors were also asked about impacts on apprentices in these areas; in general, their reports of impacts very similar to those of the apprentices.

[21] The Cronbach's alpha reliability for these 10 items was 0.817.

Chart 22: Apprentice Opinions of URAP Impacts (n = 27)



	More confident in my STEM knowledge	More interested in participating in other STEM activities	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 Army or DoD STEM research and careers	Greater appreciation of Army or DoD STEM research	More interested in pursuing a DoD STEM career
URAP was primary	11%	11%	26%	26%	0%	0%	0%	19%	19%	19%
URAP contributed	82%	70%	37%	48%	59%	63%	63%	56%	63%	41%
Happened not because of URAP	7%	15%	11%	11%	37%	33%	33%	7%	7%	11%
Did not happen	0%	4%	26%	15%	4%	4%	4%	18%	11%	29%

An open-ended item on the questionnaire asked apprentices to share the three most important ways they benefited from the program; 25 apprentices provided at least one answer to this question. Apprentice responses addressed a variety of themes. More than half of the responding apprentices (75%) wrote about research, either noting that they had gained research skills or experience, or that they had increased their understanding of what it means to do research. Several referred to information, which helped them, clarify their future goals (34%), either related to Graduate/professional School or potential careers. Some respondents (30% each) mentioned working with a team, without additional specification. Other benefits, each described by only a small number of apprentices, included interpersonal interactions with teachers/mentors or other apprentices, teamwork, stipends, learning about STEM jobs, and having professional experiences. Apprentices' comments from the interviews expanded on some of these impacts. As two said:

> *I've been interested for a long time in being a research associate, and I worked closely with their research associates. I got to see what it's like to have that career day to day. I could draw some better conclusions about whether I wanted to do that. Also, I spent a lot of time with graduate students and learned a little bit more about*

higher education, and what it's actually like to be a grad student. That's why it was good for me. (URAP Apprentice)

I got to be a lot more comfortable with lab equipment and working with other people.. One thing that I was very grateful to see was the difference between chemistry departments, meaning the Chemistry versus Chemical Engineering. (URAP Apprentice)

Summary of Findings

The 2015 evaluation of URAP collected data about participants; participants' perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in Table 25.

Table 25. 2015 URAP Evaluation Findings	
Participant Profiles	
URAP continues to be a popular and selective program	Over 100 applications were received for the URAP program (an increase of 13% from FY14). Of the 104 applications for apprenticeships, only 48 students were selected, yielding an acceptance rate of 46%, which is competitive. The placement rate for FY15 decreased 20% from FY14. 22 URAP sites were also sites for the HSAP program.
Although URAP has increased numbers of Hispanic or Latino/a apprentices, outreach efforts are not motivating other historically underrepresented populations to apply.	More female and Hispanic or Latino/a apprentices participated in 2015 than in 2014. In 2014 there were 28% females and 3% Latino/a apprentices, and in 2015 this increased to 35% females and 11% Latino/a apprentices.
	Black or African American apprentice attendance was similar to 2014 at 13%, and URAP has low proportions of apprentices identify as Native American or Alaskan Native (0%), and Native Hawaiian (0%). Twenty-one percent of the apprentices identify as Asian.
URAP has had some success in recruiting diverse STEM mentors.	The number of overall mentors increased 22% in FY15. Although white mentors increase from 38% in 2014 to 54% in 2015, URAP gained 7% more Black or African American mentors.
Actionable Program Evaluation	
URAP apprentices and mentors marketed almost exclusively by the universities or colleges that host URAP	ARO continued to market and recruit URAP mentors from university or college laboratories that conduct Army-sponsored research. Subsequently, university or college researchers marketed and recruited URAP apprentices using university or college channels.
	There are a variety of ways that apprentices learned about URAP including: through local connections (university personnel, advertisements, classes), or other acquaintances associated with URAP site. Several apprentices reported previous connections with their mentor prior to URAP. One of the primary objectives for the URAP program is to expose new students to research opportunities. However, mentors benefit from having some continuity with apprentices as returning apprentices are able to contribute more to the lab's work. Thus, since this

	recommendation was also made in FY14, the program should continue to try to find the right balance between recruiting new participants and retaining existing students while affirming that each selected apprentice is an appropriate candidate overall.
The 2015 URAP apprentices had few prior experiences with URAP or any other AEOP program.	In 2013 and 2014, many apprentices and mentors had existing associations prior to URAP. Only a few 2015 URAP apprentices had prior experiences with AEOP programs. This could suggest an opportunity to continue this relationship through subsequent years and make the current URAP apprentices aware of the opportunity to reapply. URAP should investigate the application/selection process to ensure it is meeting the goal of involving new students in URAP.
URAP further engages apprentices who come to the experience with high interest in STEM through hands-on activities that are meaningful.	Apprentices reported that they were motivated to participate in URAP by their interests in STEM (47%) and the desire to expand laboratory or research skills (47%).
	Most apprentices (90%) had opportunities to engage in a variety of STEM practices during their URAP experience such as interacting with scientists and engineers and communicating with other students about STEM.
	Most apprentices (70-93%) report participating in hands-on activities, using laboratory procedures and tools, analyzing data, working as a team, and coming up with creative solutions on most days or every day of their URAP experience.
	Apprentices reported increased opportunities to learn about STEM and higher engagement in STEM practices during their URAP experience than compared with their daily school activities.
	Mentors reported making learning activities relevant to apprentices, supporting the needs of diverse learners, developing apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
URAP can improve the communication of STEM careers to the apprentices and marketing of other AEOP opportunities.	Although approximately 90% of apprentices reported engaging in a variety of STEM practices, only 41% reported learning about different careers that use STEM. Many apprentices (63%) reported that they had not learned about any DoD STEM jobs/careers during the program, although 11% indicated that they learned about 5 or more DoD STEM jobs/careers during URAP. These data are similar to the data reported in 2014.
	The majority of mentors had no awareness of or past participation in an AEOP initiative beyond URAP and had not heard of other AEOPs. Mentors were aware of the existence of other AEOP programs but were unable to name any of them in interviews. No strategies for addressing this were discussed in the FY15 URAP Annual Report.
URAP offers meaningful experiences to both apprentices and mentors.	100% of apprentices reported satisfaction with their URAP experience. Among the most appreciated experiences were: opportunities to learn about STEM fields and careers, and opportunities for engaging in STEM learning outside of the classroom.
	Most responding mentors reported a positive and meaningful experience as well and expressed interest in working with URAP again.

Outcomes Evaluation	
URAP positively impacted apprentices' STEM knowledge and competencies, and 21st Century Skills.	Positive impacts on STEM knowledge, competencies, and 21st century skills were reported by participants including: large or extreme gains in 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 ubiquitous across all apprentice groups.
	Apprentices also reported impacts on their abilities to do STEM, including such things as applying knowledge, logic, and creativity to propose solutions that can be tested; making a model that represents the key features or functions of a solution to a problem; communicating information about their design processes and/or solutions in different formats; supporting a proposed explanation with data from investigations; and using mathematics to analyze numeric data.
	Apprentices reported large or extreme gains in their ability to have patience for the slow pace of research, sticking with a task until it is complete, making changes when things do not go as planned, learning to work independently, setting goals and reflecting on performance, building relationships with professionals in a field, and having a sense of being part of a learning community.
URAP helped apprentices' create a stronger STEM identify and gain confidence in learning and doing STEM.	Apprentices reported a large or extreme gain in feeling responsible for a STEM project or activity, confidence to do well in future STEM courses, ability to build academic or professional credentials in STEM, preparedness for more challenging STEM activities, feeling like a STEM professional, feeling like part of a STEM community, and trying out new ideas or procedures on their own in a STEM project.
	Apprentices reported a high likelihood that they would engage in additional STEM activities outside of school. A majority of apprentices indicated that as a result of URAP, they were more likely to work on a STEM project or experiment in a university or professional setting, to talk with friends or family about STEM, and to help with a community service project related to STEM.
URAP raised apprentices' education aspirations, and shifted their career aspirations toward a variety of STEM careers.	Apprentices indicated being more likely to go further in their schooling than they would have before URAP, with the greatest change being in the proportion of apprentices who expected to continue their education to a Ph.D. (30% before URAP, 48% after).
	Apprentices were asked to indicate what kind of work they expected to be doing at age 30. Although many of the students wanted to participate in STEM careers before URAP, some of the apprentices shifted their interest away from medicine to computer science.
URAP apprentices and mentors are largely unaware of AEOP initiatives, and mentors often do not explicitly discuss other AEOPs with apprentices.	Only two of the mentors indicated that they explicitly discussed any specific AEOP programs with the apprentices. The interviews confirmed the survey data, and mentors explained that they were aware of other programs but were not aware of the specifics. URAP should work to communicate information about AEOP opportunities (e.g. webinars, packets, etc.)

Recommendations

Evaluation finding indicate that FY15 was a successful year for the URAP program. URAP had a very competitive 48% acceptance rate of the apprentice applicants, which indicates there is great interest in this program. From the high quality applicants (mentors and apprentices), there were 40 mentors and 48 apprentices selected. URAP has experienced success in recruiting diverse STEM mentors and have had increased numbers of women and Hispanic and Latino/a apprentices in FY15. Mentors overwhelmingly reported their satisfaction with the apprentices and apprentices reported their satisfaction with their mentor and with the URAP experience. Mentors indicated they use innovative and research-based strategies to engage apprentices in STEM activities, and the apprentices similarly report increased ability to engage in STEM activities and have STEM habits of mind, due to the URAP experience. Apprentice educational aspirations were reportedly increased due to the URAP experience, most notably in an 18% increase of apprentices wanting to pursue a Ph.D. after the URAP experience. Additionally, engaging in more hands-on STEM experiences motivated the apprentices, which was delivered by their URAP experience. The URAP program succeeded in increasing STEM knowledge and habits of mind of apprentices, increasing mentor and apprentice diversity, and providing an authentic hands-on experience for apprentices that was a professional development experience for mentors.

While the successes for URAP detailed above 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. AEOP objectives include expanding participation of historically underrepresented and underserved populations. URAP has made some progress in this area, as it was noted as an area for improvement in the FY14 evaluation report. Between 2014 and 2015, URAP has engaged more female and more Hispanic or Latino/a mentors, which is a positive trend. Future marketing efforts could focus on the need for a more diverse pool of STEM professionals, and take the opportunity to showcase the diversity of mentors in electronic and printed materials.

2. A second area that was noted for improvement in FY14 was the need to focus more on recruiting students from underrepresented populations. Similar to past years, in URAP, recruitment of apprentices is largely accomplished with personal interactions, either by knowing a professor or peer who attended URAP previously, using professional or academic connections, or mechanisms available to the university or college site. As a result, the ability of URAP to recruit underserved or underrepresented populations of students depends upon the diversity of the universities or colleges in which recruitment takes place. Additionally, the Army and ARO may need to consider practical solutions to the challenge posed by URAP locations, as the student population of some universities and colleges is likely to advantage some groups of students more than others, particularly in STEM fields. Thus, the program may want to emphasize recruiting a more diverse pool of mentors and apprentices, perhaps specifically targeting Historically Black Colleges and Universities and other Minority Serving Institutions. A focused and strategic plan to engage a more diverse pool of mentors could ultimately engage a more diverse pool of apprentices.

3. URAP is very effective in giving apprentices authentic opportunities to engage in STEM professional activities, and for mentors to build the next generation of STEM professionals. Given the goal of exposing apprentices to Army/DoD STEM research and careers, the program may want to build in systematic opportunities to provide this information to their apprentices. More than half of apprentices who completed the survey reported that they did not learn about any DoD STEM jobs/careers during URAP. Perhaps more importantly, only a few mentors were aware of specific Army/DoD STEM research and careers and even fewer mentors explicitly discussed this with their apprentices. This was an area noted by the FY14 evaluation report as a need for additional focus that has not improved much in FY15. In an effort to increase and standardize the information provided to apprentices, it would be beneficial to create a resource that profiles Army STEM interests and the education, on-the-job training, and related research activities of Army careers. Such a resource could not only start the conversation about Army STEM careers and motivate further exploration beyond the resource itself, but could be used to train the mentors to learn more about specific Army/DoD STEM research and careers. The application to be a URAP site or a mentor could ask for their plan to explicitly discuss these resources (e.g., Army and directorate STEM career webpages, online magazines, federal application guidelines), thus developing a network of ongoing opportunities for the apprentices.

4. Perhaps more importantly, as in FY14 evaluation findings, only a few mentors were aware of specific AEOP programs and even fewer mentors explicitly discussed other AEOP opportunities with their apprentices. This lack of awareness is a barrier in communicating about other AEOP opportunities. In an effort to increase and standardize the information provided to apprentices, it would be beneficial to create a resource that profiles AEOP opportunities and the relationship they have to ongoing education, on-the-job training, and related research activities of Army careers. Such a resource could not only start the conversation about AEOP programs and motivate further exploration beyond the resource itself, but could be used to train the mentors to learn more about specific AEOP opportunities. The application to be a URAP site or a mentor could ask for their plan to explicitly discuss these resources thus expanding the network of ongoing opportunities for the apprentices.

AEOP Priority: Develop and implement a cohesive, coordinated, and sustainable STEM education outreach infrastructure across the Army

1. Efforts should be undertaken to improve participation in evaluation activities, as the low response rates for both the apprentice and mentor questionnaires raise questions about the representativeness of the results. Low response rates were also a concern during the 2013, 2014 and 2015 questionnaire administration. Improved communication with the individual program sites about expectations for the URAP evaluation study may help. In addition, the evaluation instruments may need to be streamlined as the questionnaires are quite lengthy

(estimated response time 45 minutes[22]) and response burden can affect participation. It is recommended that program sites provide time on-site for participants to complete the AEOP evaluation survey.

[22] Berry, S. (2013). How to estimate questionnaire administration time before pretesting: An interactive spreadsheet approach. *Survey Practice, 2*(3). Retrieved from http://www.surveypractice.org/index.php/SurveyPractice/article/view/166. Date accessed: 13 Mar. 2015.

Appendices

Appendix A

FY15 URAP Evaluation Plan

Questionnaires

Purpose

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

1. AEOP Youth Questionnaire to be completed by student participants of the URAP program at all university sites; and
2. AEOP Mentor Questionnaire to be completed by URAP mentors (typically a University Scientist or Engineer), and/or others who support students as they participate in the URAP 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 URAP 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 UNITE). 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' URAP experience;
- Please encourage youth participants to participate in AEOP evaluation efforts. Before, during, and after the URAP 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 URAP students please encourage them to prioritize the completion of AEOP's URAP evaluation survey. These data are critical to maintain funding for URAP. Additionally, evaluators will release de-identified data from these assessments to individual URAP sites to help them focus program improvement efforts;
- The URAP 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 Army Research Office (ARO) and the AEOP through the CVENT portal:

Youth Participants – Evaluation Questionnaire Invitation

Dear URAP participant,

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

Here's how you can help:

1) *Complete the URAP 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.*
   URAP 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 URAP. Ask them to complete the* ***URAP 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 URAP!

Mentor Questionnaire Administration Details

- Distribute the survey near or after the conclusion of the mentors' URAP experience;
- Encourage all adults serving as URAP mentors (typically a University Scientist or Engineer), and others who supported students as they participated in URAP, 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 URAP evaluation survey. These data are critical to maintain funding for URAP. Additionally, evaluators

will release de-identified data from these assessments to URAP sites to help them focus program improvement efforts;

- The URAP 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 ARO 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 Undergraduate Research Apprenticeship Program (URAP) program in support of one or more students' learning experience(s).

Evaluators from Virginia Tech are conducting program evaluation on behalf of the Army Research Office (ARO) 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 URAP in support of students as they participated in the URAP program (URAP Mentors – University Scientists or Engineers). More than 100 students and 90 adults participated in the URAP and URAP programs 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 **URAP Mentor Survey**. The survey will take about 25-30 minutes.*
   ***URAP Mentor Survey Link** provided by the CVENT system*
2) *Pass an email along to those students you supported in URAP 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 URAP.
Regards,

Telephone Interviews

Purpose

Per the FY15 Army Education Outreach Program (AEOP) Annual Program Plan (APP), Virginia Tech will conduct an evaluation study of URAP that includes telephone interviews with URAP mentors and apprentices.

Interviews provide the evaluation team first-hand opportunities to speak with youth and adult URAP participants. The contextual information gleaned from these interviews help evaluators understand the nuance of the evaluation data collected from questionnaires, adding depth to evaluative findings. VT's interview assessment efforts focus on program successes and attempt to inform useful program changes so that URAP can improve in the future.

Evaluation activities during Virginia Tech's Phone Interview

- 8 – 12 one-on-one phone interviews with URAP apprentices (approx. 15-20 min. each);
- 5 – 8 one-on-one phone interviews with URAP mentors (approx. 15-20 min each);

Selecting Interview Participants

VT will purposefully sample from URAP participants using CVENT enrollment data (site name, apprentice/mentor participant names, gender, & race/ethnicity). The IPA and VT will "invite" selected participants that comprise the desired sample to participate via email through the CVENT portal. Participants will each RSVP prior to the scheduled interview date so that an alternate may be identified if needed.

Purposeful sampling is an attempt to assemble a sample of participants that are likely to provide information about the full range of experiences possible in URAP. The interview sample will be selected using the following information:

- Gender
- Grade level
- Racial/ethnic group
- Socio-economic status indicators (e.g., qualification for free or reduced-price lunches)

Scheduling and Technology:

VT will establish dates and times for each interview that accommodate the program activities for each site. The majority of these dates will occur in mid to late July – the purpose of which is to speak with participants after they have experienced the majority of experiences available in their URAP program. VT will attempt to convene interviews between 10 a.m. and 2 p.m. in each site's time zone to minimize disruption to the program.

A simple telephone will be used to conduct each interview. Evaluators at Virginia Tech will also use a recording device to record the interview. All recordings are used for note-taking and transcription purposes only. After transcription, audio files will be destroyed.

Obtaining Informed Assent/Consent: Prior to the Interview

Apprentice and mentor participants should be informed of the evaluation interview *before* it is conducted. This ensures that individuals do not feel pressured to participate. It would be ideal if VT, the IPA, and/or site coordinators work together to invite apprentices and mentors to participate and provide them with demographic surveys and consent/assent forms:

- Use the recruitment email text below to invite apprentices and mentors to volunteer for interviews.
- Be sure to include the date and time of the interview as well as the location of the telephone that they can use for the interview call (if needed).
- Attach the appropriate assent/consent form to the email
    - **"2015.URAP.AdultConsent.PhoneInterview.pdf"**
    - **"2015.URAP.MinorAssent.PhoneInterview.pdf"**
- Attach the appropriate demographic survey for participants to fill out and email to the evaluators

- **"2015.URAP.Adult PhoneInterveiw.DemoSurvey.pdf"**
- **"2015.URAP.Student PhoneInterview.DemoSurvey.pdf"**

- VT evaluators will also provide and review the assent/consent forms with participants just prior to conducting the Interview. Interviews will be audio-recorded for note taking purposes.

Interview Invitation Email:

Dear [participant],

I would like to inform you that evaluators from Virginia Tech will be carrying out interviews with Undergraduate Research Apprenticeship Program (URAP) participants on behalf of the Army Research Office (ARO) and the Army Educational Outreach Program (AEOP). Virginia Tech is very interested in hearing your opinions about URAP and would like to formally invite you to participate in one of the interviews, on the telephone, at a time listed below.

Purpose of the Interview:

Evaluators from Virginia Tech are conducting the evaluation study to determine if URAP is achieving its objective(s) as a program, the results of which will be used by one of the primary sponsors of URAP (U.S. Army) to ensure funding for the program in the future. Interviews provide evaluators the opportunity to speak with students and mentors about their experiences in URAP which helps them illustrate and understanding how the URAP program affects participants. In the end, Virginia Tech's findings will demonstrate URAP's success as a program and to make URAP better for future participants.

Interview Logistics:

We are working with the VT evaluation team to organize an interview during your URAP experience. Interviews are being conducted across the URAP program with student participants and with mentors (anyone who supervises, guides, or supports URAP students) Please look at the dates, times, and locations of the interviews and decide which one you are available to attend:

1. ***Student Interview #1: Date, Time, Location of telephone or quiet room***
2. ***Student Interview #2: Date, Time, Location of telephone or quiet room***
3. ***Mentor Interview: Date, Time, Location of telephone or quiet room***

Participating in the Interview:

Interviews will be conducted with students across all URAP sites and evaluators will ask all participants the same series of questions. The interview will take 15 – 20 minutes of your time. If you do not volunteer, Virginia Tech evaluators would still like to hear from you so they will send you an evaluation questionnaire after URAP.

If you volunteer, please fill out the appropriate forms attached to this message – one for minors (17 yrs. or younger) and one for adults.

If you have questions about the URAP interviews, please contact the VT evaluation team:
Tanner Bateman - tbateman@vt.edu.

Appendix B

FY15 URAP Apprentice Data Summaries

URAP 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.	**%**
12th	0	0%
First-Year college student (13)	5	19%
College sophomore (14)	4	15%
College junior (15)	5	19%
College senior (16)	10	36%
Graduate program (17)	0	0%
Choose not to report	3	11%
Total	**27**	**100%**

What is your gender?		
	Freq.	**%**
Male	9	33%
Female	15	56%
Choose not to report	3	11%
Total	**27**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Asian	6	22%
Black or African American	0	0%
Hispanic or Latino	2	7%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	15	56%
Other race or ethnicity, (specify):†	0	0%
Choose not to report	4	15%
Total	**27**	**100%**

Where was the URAP program located? (Select ONE)						
	Freq.	%			Freq.	%
Alabama State University*	1	3%		University of California, Irvine	1	3%
Arizona State University	2	6%		University of California, Riverside*	3	9%
Brown University	1	3%		University of California, Santa Barbara	4	12%
City University of New York	1	3%		University of Alabama	1	3%
Columbia	1	3%		University of Arizona	1	3%
Cornell	2	6%		University of Chicago	1	3%
Hampton University*---	0	0%		University of Delaware	1	3%
Louisiana State University	2	6%		University of Florida	1	3%
Marshall	1	3%		University of Houston, Victoria*	1	3%
Michigan State University	1	3%		University of Illinois	1	3%
North Carolina A&T*	2	6%		University of Maryland, College Park	1	3%
Rutgers	1	3%		University of Michigan	1	3%
Oklahoma State University	2	6%		University of New Hampshire	1	3%
Ohio State University	1	3%		University of Notre Dame	2	6%
Pennsylvania State University	1	3%		University of Puerto Rico*	1	3%
Purdue	1	3%		University of Rochester	1	3%
San Diego State University*	1	3%		University of the Incarnate Word*	2	6%
University of California, Berkeley	1	3%		University of Utah	1	3%
				Washington University	1	3%
				Total	36	100%

How often do you do each of the following in STEM classes at school this year?								
	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	0.0%	3.7%	3.7%	51.9%	40.7%	27	4.30	.724
	0	1	1	14	11			
Apply STEM learning to real-life situations	0.0%	7.4%	33.3%	44.4%	14.8%	27	3.67	.832
	0	2	9	12	4			
Learn about new discoveries in STEM	0.0%	7.4%	44.4%	40.7%	7.4%	27	3.48	.753
	0	2	12	11	2			
Learn about different careers that use STEM	3.7%	7.4%	55.6%	33.3%	0.0%	27	3.19	.736
	1	2	15	9	0			
Interact with scientists or engineers	7.4%	18.5%	22.2%	22.2%	29.6%	27	3.48	1.312
	2	5	6	6	8			
Communicate with other students about STEM	0.0%	0.0%	11.1%	44.4%	44.4%	27	4.33	.679
	0	0	3	12	12			

How often do you do each of the following in URAP this year?								
	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Learn about science, technology, engineering, or mathematics (STEM) topics that are new to you	0.0%	3.7%	7.4%	40.7%	48.1%	27	4.33	.784
	0	1	2	11	13			
Apply STEM learning to real-life situations	0.0%	3.7%	11.1%	37.0%	48.1%	27	4.30	.823
	0	1	3	10	13			
Learn about new discoveries in STEM	0.0%	3.7%	22.2%	48.1%	25.9%	27	3.96	.808
	0	1	6	13	7			
Learn about different careers that use STEM	3.7%	22.2%	33.3%	37.0%	3.7%	27	3.15	.949
	1	6	9	10	1			
Interact with scientists or engineers	0.0%	3.7%	3.7%	37.0%	55.6%	27	4.44	.751
	0	1	1	10	15			
Communicate with other students about STEM	0.0%	3.7%	11.1%	29.6%	55.6%	27	4.37	.839
	0	1	3	8	15			

How often do you do each of the following in STEM classes at school this year?								
	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Use laboratory procedures and tools	0.0%	0.0%	44.4%	48.1%	7.4%	27	3.63	.629
	0	0	12	13	2			
Participate in hands-on STEM activities	0.0%	3.7%	33.3%	55.6%	7.4%	27	3.67	.679
	0	1	9	15	2			
Work as part of a team	0.0%	11.1%	33.3%	40.7%	14.8%	27	3.59	.888
	0	3	9	11	4			
Identify questions or problems to investigate	3.7%	14.8%	40.7%	22.2%	18.5%	27	3.37	1.079
	1	4	11	6	5			
Design an investigation	14.8%	22.2%	37.0%	18.5%	7.4%	27	2.81	1.145
	4	6	10	5	2			
Carry out an investigation	11.1%	29.6%	37.0%	11.1%	11.1%	27	2.81	1.145
	3	8	10	3	3			
Analyze data or information	0.0%	14.8%	44.4%	25.9%	14.8%	27	3.41	.931
	0	4	12	7	4			
Draw conclusions from an investigation	7.4%	18.5%	40.7%	18.5%	14.8%	27	3.15	1.134
	2	5	11	5	4			
Come up with creative explanations or solutions	0.0%	14.8%	48.1%	29.6%	7.4%	27	3.30	.823
	0	4	13	8	2			
Build or make a computer model	29.6%	11.1%	37.0%	14.8%	7.4%	27	2.59	1.279
	8	3	10	4	2			

How often do you do each of the following in URAP this year?								
	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Use laboratory procedures and tools	3.7%	0.0%	7.4%	33.3%	55.6%	27	4.37	.926
	1	0	2	9	15			
Participate in hands-on STEM activities	0.0%	0.0%	7.4%	33.3%	59.3%	27	4.52	.643
	0	0	2	9	16			
Work as part of a team	3.7%	0.0%	14.8%	40.7%	40.7%	27	4.15	.949
	1	0	4	11	11			
Identify questions or problems to investigate	0.0%	3.7%	25.9%	44.4%	25.9%	27	3.93	.829
	0	1	7	12	7			
Design an investigation	3.7%	14.8%	18.5%	33.3%	29.6%	27	3.70	1.171
	1	4	5	9	8			
Carry out an investigation	0.0%	14.8%	14.8%	33.3%	37.0%	27	3.93	1.072
	0	4	4	9	10			
Analyze data or information	0.0%	7.4%	14.8%	33.3%	44.4%	27	4.15	.949
	0	2	4	9	12			
Draw conclusions from an investigation	0.0%	3.7%	25.9%	33.3%	37.0%	27	4.04	.898
	0	1	7	9	10			
Come up with creative explanations or solutions	0.0%	11.1%	14.8%	48.1%	25.9%	27	3.89	.934
	0	3	4	13	7			
Build or make a computer model	33.3%	7.4%	22.2%	22.2%	14.8%	27	2.78	1.502
	9	2	6	6	4			

How much did each of the following resources help you learn about Army Educational Outreach Programs (AEOPs)?								
	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Army Research Office (ARO) website	38.5%	11.5%	26.9%	15.4%	7.7%	26	2.42	1.362
	10	3	7	4	2			
Army Educational Outreach Program (AEOP) website	42.3%	11.5%	7.7%	19.2%	19.2%	26	2.62	1.651
	11	3	2	5	5			
AEOP on Facebook, Twitter, Pinterest or other social media	80.8%	11.5%	3.8%	3.8%	0.0%	26	1.31	.736
	21	3	1	1	0			
AEOP brochure	76.9%	7.7%	3.8%	11.5%	0.0%	26	1.50	1.030
	20	2	1	3	0			
It Starts Here! Magazine	80.0%	8.0%	4.0%	8.0%	0.0%	25	1.40	.913
	20	2	1	2	0			
My URAP mentor(s)	11.5%	3.8%	11.5%	19.2%	53.8%	26	4.00	1.386
	3	1	3	5	14			
Invited speakers or "career" events during URAP	65.4%	3.8%	3.8%	15.4%	11.5%	26	2.04	1.562
	17	1	1	4	3			
Participation in URAP	7.7%	3.8%	15.4%	38.5%	34.6%	26	3.88	1.177
	2	1	4	10	9			

How much did each of the following resources help you learn about STEM careers in the Army or Department of Defense (DoD)?								
	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Army Research Office (ARO) website	44.4%	7.4%	18.5%	22.2%	7.4%	27	2.41	1.448
	12	2	5	6	2			
Army Educational Outreach Program (AEOP) website	44.4%	7.4%	11.1%	22.2%	14.8%	27	2.56	1.601
	12	2	3	6	4			
AEOP on Facebook, Twitter, Pinterest or other social media	77.8%	11.1%	3.7%	3.7%	3.7%	27	1.44	1.013
	21	3	1	1	1			
AEOP brochure	70.4%	7.4%	3.7%	14.8%	3.7%	27	1.74	1.289
	19	2	1	4	1			
It Starts Here! Magazine	74.1%	7.4%	7.4%	7.4%	3.7%	27	1.59	1.152
	20	2	2	2	1			
My URAP mentor(s)	18.5%	7.4%	22.2%	14.8%	37.0%	27	3.44	1.528
	5	2	6	4	10			
Invited speakers or "career" events during URAP	55.6%	14.8%	11.1%	7.4%	11.1%	27	2.04	1.427
	15	4	3	2	3			
Participation in URAP	22.2%	14.8%	18.5%	22.2%	22.2%	27	3.07	1.492
	6	4	5	6	6			

How SATISFIED were you with each of the following URAP program features?								
	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Applying or registering for the program	0.0%	0.0%	11.1%	25.9%	63.0%	27	4.52	.700
	0	0	3	7	17			
Other administrative tasks (in-processing, network access, etc.)	7.4%	3.7%	11.1%	25.9%	51.9%	27	4.11	1.219
	2	1	3	7	14			
Communicating with your URAP host site organizers	7.4%	3.7%	3.7%	25.9%	59.3%	27	4.26	1.196
	2	1	1	7	16			
The physical location(s) of URAP activities	0.0%	0.0%	11.1%	3.7%	85.2%	27	4.74	.656
	0	0	3	1	23			
The variety of STEM topics available to you in URAP	7.4%	0.0%	11.1%	22.2%	59.3%	27	4.26	1.163
	2	0	3	6	16			
Teaching or mentoring provided during URAP activities	3.7%	3.7%	0.0%	22.2%	70.4%	27	4.52	.975
	1	1	0	6	19			
Stipends (payment)	0.0%	3.7%	7.4%	25.9%	63.0%	27	4.48	.802
	0	1	2	7	17			
Research abstract preparation requirements	0.0%	7.4%	11.1%	40.7%	40.7%	27	4.15	.907
	0	2	3	11	11			

How much input did you have in selecting your URAP research project?		
	Freq.	%
I did not have a project	0	0.00%
I was assigned a project by my mentor	12	44.44%
I worked with my mentor to design a project	5	18.52%
I had a choice among various projects suggested by my mentor	6	22.22%
I worked with my mentor and members of a research team to design a project	4	14.81%
I designed the entire project on my own	0	0.00%
Total	27	100%

How often was your mentor available to you during URAP?		
	Freq.	%
I did not have a mentor	0	0.00%
The mentor was never available	1	3.70%
The mentor was available less than half of the time	1	3.70%
The mentor was available about half of the time of my project	0	0.00%
The mentor was available more than half of the time	13	48.15%
The mentor was always available	12	44.44%
Total	27	100%

To what extent did you work as part of a group or team during URAP?		
	Freq.	%
I worked alone (or alone with my research mentor)	0	0.00%
I worked with others in a shared laboratory or other space, but we work on different projects	13	48.15%
I worked alone on my project and I met with others regularly for general reporting or discussion	2	7.41%
I worked alone on a project that was closely connected with projects of others in my group	6	22.22%
I work with a group who all worked on the same project	6	22.22%
Total	27	100%

How SATISFIED were you with each of the following?								
	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
My working relationship with my mentor	0.0%	7.4%	0.0%	14.8%	77.8%	27	4.63	.839
	0	2	0	4	21			
My working relationship with the group or team	0.0%	0.0%	7.4%	14.8%	77.8%	27	4.70	.609
	0	0	2	4	21			
The amount of time I spent doing meaningful research	0.0%	7.4%	3.7%	29.6%	59.3%	27	4.41	.888
	0	2	1	8	16			
The amount of time I spent with my research mentor	0.0%	3.7%	11.1%	25.9%	59.3%	27	4.41	.844
	0	1	3	7	16			
The research experience overall	0.0%	0.0%	3.7%	18.5%	77.8%	27	4.74	.526
	0	0	1	5	21			

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 URAP:					
		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 STEM in my everyday life	27	17	63.0%	10	37.0%
Helped me understand how I can use STEM to improve my community	27	15	55.6%	12	44.4%
Used a variety of strategies to help me learn	27	23	85.2%	4	14.8%
Gave me extra support when I needed it	27	24	88.9%	3	11.1%
Encouraged me to share ideas with others who have different backgrounds or viewpoints than I do	27	23	85.2%	4	14.8%
Allowed me to work on a team project or activity	27	23	85.2%	4	14.8%
Helped me learn or practice a variety of STEM skills	27	25	92.6%	2	7.4%
Gave me feedback to help me improve in STEM	27	25	92.6%	2	7.4%
Talked to me about the education I need for a STEM career	27	19	70.4%	8	29.6%
Recommended Army Educational Outreach Programs that match my interests	27	10	37.0%	17	63.0%
Discussed STEM careers with the DoD or government	27	5	18.5%	22	81.5%

Which of the following statements apply to your research experience in URAP? (Choose ALL that apply) (n = 22)						
	Freq.	%			Freq.	%
I presented a talk or poster to other students or faculty	8	36.36%		I will present a talk or poster to other students or faculty	7	31.82%
I presented a talk or poster at a professional symposium or conference	3	13.64%		I will present a talk or poster at a professional symposium or conference	2	9.09%
I attended a symposium or conference	8	36.36%		I will attend a symposium or conference	6	27.27%
I wrote or co-wrote a paper that was/will be published in a research journal	2	9.09%		I will write or co-write a paper that was/will be published in a research journal	7	31.82%
I wrote or co-wrote a technical paper or patent	0	0.00%		I will write or co-write a technical paper or patent	0	0.00%
				I won an award or scholarship based on my research	0	0.00%

AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas?								
	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
In depth knowledge of a STEM topic(s)	0.00%	0.0%	18.5%	40.7%	40.7%	27	4.22	.751
	0	0	5	11	11			
Knowledge of research conducted in a STEM topic or field	0.0%	0.0%	14.8%	48.1%	37.0%	27	4.22	.698
	0	0	4	13	10			
Knowledge of research processes, ethics, and rules for conduct in STEM	0.0%	0.0%	29.6%	40.7%	29.6%	27	4.00	.784
	0	0	8	11	8			
Knowledge of how scientists and engineers work on real problems in STEM	0.0%	0.0%	25.9%	37.0%	37.0%	27	4.11	.801
	0	0	7	10	10			
Knowledge of what everyday research work is like in STEM	0.0%	0.0%	22.2%	33.3%	44.4%	27	4.22	.801
	0	0	6	9	12			

Which category best describes the focus of your URAP experience?		
	Freq.	%
Science	15	55.56%
Technology	4	14.81%
Engineering	7	25.93%
Mathematics	1	3.70%
Total	**27**	**100%**

AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas?								
	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	0.0%	6.7%	26.7%	53.3%	13.3%	15	3.73	.799
	0	1	4	8	2			
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	0.0%	13.3%	13.3%	66.7%	6.7%	15	3.67	.816
	0	2	2	10	1			
Making a model of an object or system showing its parts and how they work	20.0%	33.3%	20.0%	20.0%	6.7%	15	2.60	1.242
	3	5	3	3	1			
Designing procedures for an experiment that are appropriate for the question to be answered	0.0%	14.3%	14.3%	64.3%	7.1%	14	3.64	.842
	0	2	2	9	1			
Identifying the limitations of the methods and tools used for data collection	6.7%	13.3%	13.3%	53.3%	13.3%	15	3.53	1.125
	1	2	2	8	2			
Carrying out procedures for an experiment and recording data accurately	13.3%	0.0%	13.3%	33.3%	40.0%	15	3.87	1.356
	2	0	2	5	6			
Using computer models of objects or systems to test cause and effect relationships	40.0%	6.7%	20.0%	26.7%	6.7%	15	2.53	1.457
	6	1	3	4	1			
Organizing data in charts or graphs to find patterns and relationships	13.3%	6.7%	26.7%	26.7%	26.7%	15	3.47	1.356
	2	1	4	4	4			
Considering different interpretations of data when deciding how the data answer a question	6.7%	13.3%	26.7%	46.7%	6.7%	15	3.33	1.047
	1	2	4	7	1			
Supporting an explanation for an observation with data from experiments	6.7%	6.7%	33.3%	33.3%	20.0%	15	3.53	1.125
	1	1	5	5	3			
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	0.0%	26.7%	20.0%	33.3%	20.0%	15	3.47	1.125
	0	4	3	5	3			
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	13.3%	13.3%	20.0%	40.0%	13.3%	15	3.27	1.280
	2	2	3	6	2			
Defending an argument that conveys how an explanation best describes an observation	6.7%	20.0%	33.3%	26.7%	13.3%	15	3.20	1.146
	1	3	5	4	2			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	6.7%	13.3%	33.3%	33.3%	13.3%	15	3.33	1.113
	1	2	5	5	2			
Integrating information from technical or scientific texts and other media to support your explanation of an observation	6.7%	20.0%	13.3%	33.3%	26.7%	15	3.53	1.302
	1	3	2	5	4			
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	0.0%	6.7%	13.3%	46.7%	33.3%	15	4.07	.884
	0	1	2	7	5			

AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas?								
	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	0.0%	8.3%	16.7%	50.0%	25.0%	12	3.92	.900
	0	1	2	6	3			
Using knowledge and creativity to propose a testable solution for a problem	0.0%	8.3%	0.0%	66.7%	25.0%	12	4.08	.793
	0	1	0	8	3			
Making a model of an object or system to show its parts and how they work	8.3%	16.7%	41.7%	8.3%	25.0%	12	3.25	1.288
	1	2	5	1	3			
Designing procedures for an experiment that are appropriate for the question to be answered	8.3%	16.7%	33.3%	16.7%	25.0%	12	3.33	1.303
	1	2	4	2	3			
Identifying the limitations of the methods and tools used for data collection	0.0%	8.3%	33.3%	25.0%	33.3%	12	3.83	1.030
	0	1	4	3	4			
Carrying out procedures for an experiment and recording data accurately	0.0%	16.7%	16.7%	41.7%	25.0%	12	3.75	1.055
	0	2	2	5	3			
Using computer models of an object or system to investigate cause and effect relationships	8.3%	25.0%	16.7%	25.0%	25.0%	12	3.33	1.371
	1	3	2	3	3			
Considering different interpretations of the data when deciding if a solution works as intended	0.0%	16.7%	25.0%	33.3%	25.0%	12	3.67	1.073
	0	2	3	4	3			
Organizing data in charts or graphs to find patterns and relationships	0.0%	16.7%	25.0%	33.3%	25.0%	12	3.67	1.073
	0	2	3	4	3			
Supporting a solution for a problem with data from experiments	0.0%	0.0%	50.0%	25.0%	25.0%	12	3.75	.866
	0	0	6	3	3			
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	0.0%	0.0%	8.3%	58.3%	33.3%	12	4.25	.622
	0	0	1	7	4			
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0.0%	8.3%	25.0%	50.0%	16.7%	12	3.75	.866
	0	1	3	6	2			
Defend an argument that conveys how a solution best meets design criteria	0.0%	25.0%	8.3%	50.0%	16.7%	12	3.58	1.084
	0	3	1	6	2			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0.0%	8.3%	33.3%	41.7%	16.7%	12	3.67	.888
	0	1	4	5	2			
Integrating information from technical or scientific texts and other media to support your solution to a problem	0.0%	8.3%	25.0%	41.7%	25.0%	12	3.83	.937
	0	1	3	5	3			
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	0.0%	8.3%	25.0%	50.0%	16.7%	12	3.75	.866
	0	1	3	6	2			

AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas?								
	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Learning to work independently	0.0%	7.4%	18.5%	51.9%	22.2%	27	3.89	.847
	0	2	5	14	6			
Setting goals and reflecting on performance	0.0%	11.1%	22.2%	44.4%	22.2%	27	3.78	.934
	0	3	6	12	6			
Sticking with a task until it is finished	0.0%	3.7%	29.6%	37.0%	29.6%	27	3.93	.874
	0	1	8	10	8			
Making changes when things do not go as planned	0.0%	0.0%	11.1%	59.3%	29.6%	27	4.19	.622
	0	0	3	16	8			
Working well with people from all backgrounds	0.0%	14.8%	22.2%	40.7%	22.2%	27	3.70	.993
	0	4	6	11	6			
Including others' perspectives when making decisions	0.0%	14.8%	18.5%	37.0%	29.6%	27	3.81	1.039
	0	4	5	10	8			
Communicating effectively with others	0.0%	7.4%	18.5%	48.1%	25.9%	27	3.93	.874
	0	2	5	13	7			
Viewing failure as an opportunity to learn	3.7%	7.4%	7.4%	55.6%	25.9%	27	3.93	.997
	1	2	2	15	7			

AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Interest in a new STEM topic	3.7%	7.4%	25.9%	44.4%	18.5%	27	3.67	1.000
	1	2	7	12	5			
Deciding on a path to pursue a STEM career	3.7%	3.7%	29.6%	37.0%	25.9%	27	3.78	1.013
	1	1	8	10	7			
Sense of accomplishing something in STEM	0.0%	7.4%	11.1%	55.6%	25.9%	27	4.00	.832
	0	2	3	15	7			
Feeling prepared for more challenging STEM activities	0.0%	0.0%	14.8%	51.9%	33.3%	27	4.19	.681
	0	0	4	14	9			
Confidence to try out new ideas or procedures on my own in a STEM project	0.0%	3.7%	18.5%	44.4%	33.3%	27	4.07	.829
	0	1	5	12	9			
Patience for the slow pace of STEM research	0.0%	3.7%	22.2%	40.7%	33.3%	27	4.04	.854
	0	1	6	11	9			
Desire to build relationships with mentors who work in STEM	0.0%	3.8%	26.9%	38.5%	30.8%	26	3.96	.871
	0	1	7	10	8			
Connecting a STEM topic or field to my personal values	0.0%	3.7%	29.6%	40.7%	25.9%	27	3.89	.847
	0	1	8	11	7			

AS A RESULT OF YOUR URAP experience, how much MORE or LESS likely are you to engage in the following activities in science, technology, engineering, or mathematics (STEM) outside of school requirements or activities?								
	Much less likely	Less likely	About the same before and after	More likely	Much more likely	n	Avg.	SD
Watch or read non-fiction STEM	0.0%	3.7%	33.3%	44.4%	18.5%	27	3.78	.801
	0	1	9	12	5			
Tinker (play) with a mechanical or electrical device	0.0%	0.0%	33.3%	44.4%	22.2%	27	3.89	.751
	0	0	9	12	6			
Work on solving mathematical or scientific puzzles	0.0%	3.7%	37.0%	40.7%	18.5%	27	3.74	.813
	0	1	10	11	5			
Use a computer to design or program something	0.0%	3.7%	44.4%	25.9%	25.9%	27	3.74	.903
	0	1	12	7	7			
Talk with friends or family about STEM	0.0%	0.0%	26.9%	42.3%	30.8%	26	4.04	.774
	0	0	7	11	8			
Mentor or teach other students about STEM	0.0%	0.0%	14.8%	59.3%	25.9%	27	4.11	.641
	0	0	4	16	7			
Help with a community service project related to STEM	0.0%	0.0%	25.9%	55.6%	18.5%	27	3.93	.675
	0	0	7	15	5			
Participate in a STEM camp, club, or competition	0.0%	3.7%	29.6%	44.4%	22.2%	27	3.85	.818
	0	1	8	12	6			
Take an elective (not required) STEM class	0.0%	0.0%	33.3%	37.0%	29.6%	27	3.96	.808
	0	0	9	10	8			
Work on a STEM project or experiment in a university or professional setting	0.0%	0.0%	14.8%	37.0%	48.1%	27	4.33	.734
	0	0	4	10	13			

Before you participated in URAP, how far did you want to go in school?		
	Freq.	%
Go to a trade or vocational school	0	0.00%
Go to college for a little while	0	0.00%
Finish college (get a Bachelor's degree)	5	18.52%
Get more education after college	2	7.41%
Get a master's degree	7	25.93%
Get a Ph.D.	8	29.63%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	4	14.81%
Get a combined M.D. / Ph.D.	0	0.00%
Get another professional degree (law, business, etc.)	1	3.70%
Total	27	100%

After you have participated in URAP, how far do you want to go in school?		
	Freq.	**%**
Go to a trade or vocational school	0	0%
Go to college for a little while	0	0%
Finish college (get a Bachelor's degree)	0	0%
Get more education after college	3	9%
Get a master's degree	4	12%
Get a Ph.D.	7	21%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	12	35%
Get a combined M.D. / Ph.D.	3	9%
Get another professional degree (law, business, etc.)	4	12%
Total	**27**	**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	0.00%
less than 25% of the time	1	3.70%
26% to 50% of the time	0	0.00%
51% to 75% of the time	15	55.56%
76% to 100% of the time	11	40.74%
Total	**27**	**100%**

BEFORE URAP, 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 URAP)

	Freq.	%		Freq.	%
Other, (specify):	1	3.70%	Mathematics or statistics	1	3.70%
Undecided	0	0.00%	Medicine (doctor, dentist, veterinarian, etc.)	4	14.81%
Science (no specific subject)	1	3.70%	Health (nursing, pharmacy, technician, etc.)	0	0.00%
Physical science (physics, chemistry, astronomy, materials science)	5	18.52%	Social science (psychologist, sociologist, etc.)	0	0.00%
Biological science	1	3.70%	Teaching, STEM	1	3.70%
Earth, atmospheric or oceanic science	0	0.00%	Teaching, non-STEM	0	0.00%
Environmental science	1	3.70%	Business	0	0.00%
Computer science	2	7.41%	Law	0	0.00%
Technology	1	3.70%	Military, police, or security	0	0.00%
Engineering	9	33.33%	Art (writing, dancing, painting, etc.)	0	0.00%
			Skilled trade (carpenter, electrician, plumber, etc.)	0	0.00%
			Total	27	100%

AFTER URAP, 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 URAP)

	Freq.	%		Freq.	%
Undecided	1	3.70%	Medicine (doctor, dentist, veterinarian, etc.)	3	11.11%
Science (no specific subject)	0	0.00%	Health (nursing, pharmacy, technician, etc.)	0	0.00%
Physical science (physics, chemistry, astronomy, materials science)	3	11.11%	Social science (psychologist, sociologist, etc.)	0	0.00%
Biological science	2	7.41%	Teaching, STEM	2	7.41%
Earth, atmospheric or oceanic science	0	0.00%	Teaching, non-STEM	0	0.00%
Environmental science	0	0.00%	Business	0	0.00%
Computer science	4	14.81%	Law	0	0.00%
Technology	1	3.70%	Military, police, or security	0	0.00%
Engineering	8	29.63%	Art (writing, dancing, painting, etc.)	0	0.00%
Mathematics or statistics	2	7.41%	Skilled trade (carpenter, electrician, plumber, etc.)	0	0.00%
			Other, (specify):	1	3.70%
			Total	27	100%

How interested are you in participating in the following programs in the future?								
	I've never heard of this program	Not at all	A little	Somewhat	Very much	n	Avg.	SD
College Qualified Leaders (CQL)	59.3%	3.7%	11.1%	7.4%	18.5%	27	2.22	1.649
	16	1	3	2	5			
GEMS Near Peer Mentor Program	59.3%	0.0%	22.2%	7.4%	11.1%	27	2.11	1.476
	16	0	6	2	3			
Undergraduate Research Apprenticeship Program (URAP)	0.0%	7.4%	11.1%	18.5%	63.0%	27	4.37	.967
	0	2	3	5	17			
Science Mathematics, and Research for Transformation (SMART) College Scholarship	48.1%	0.0%	3.7%	18.5%	29.6%	27	2.81	1.841
	13	0	1	5	8			
National Defense Science & Engineering Graduate (NDSEG) Fellowship	55.6%	0.0%	11.1%	14.8%	18.5%	27	2.41	1.693
	15	0	3	4	5			

How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during URAP?		
	Freq.	%
None	3	11.11%
1	4	14.81%
2	6	22.22%
3	7	25.93%
4	2	7.41%
5 or more	5	18.52%
Total	27	100%

How many Department of Defense (DoD) STEM jobs/careers did you learn about during URAP?		
	Freq.	%
None	17	62.96%
1	3	11.11%
2	4	14.81%
3	0	0.00%
4	0	0.00%
5 or more	3	11.11%
Total	27	100%

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n	Avg.	SD
DoD researchers advance science and engineering fields	3.7%	0.0%	22.2%	55.6%	18.5%	27	3.85	.864
	1	0	6	15	5			
DoD researchers develop new, cutting edge technologies	3.7%	0.0%	18.5%	48.1%	29.6%	27	4.00	.920
	1	0	5	13	8			
DoD researchers solve real-world problems	3.7%	0.0%	25.9%	37.0%	33.3%	27	3.96	.980
	1	0	7	10	9			
DoD research is valuable to society	3.7%	0.0%	25.9%	37.0%	33.3%	27	3.96	.980
	1	0	7	10	9			

Which of the following statements describe you after participating in URAP?							
	1	2	3	4	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	0.0%	7.4%	81.5%	11.1%	27	3.04	.437
	0	2	22	3			
I am more interested in participating in STEM activities outside of school requirements	3.7%	14.8%	70.4%	11.1%	27	2.89	.641
	1	4	19	3			
I am more aware of other AEOPs	25.9%	11.1%	37.0%	25.9%	27	2.63	1.149
	7	3	10	7			
I am more interested in participating in other AEOPs	14.8%	11.1%	48.1%	25.9%	27	2.85	.989
	4	3	13	7			
I am more interested in taking STEM classes in school	3.7%	37.0%	59.3%	0.0%	27	2.56	.577
	1	10	16	0			
I am more interested in earning a STEM degree	3.7%	33.3%	63.0%	0.0%	27	2.59	.572
	1	9	17	0			
I am more interested in pursuing a career in STEM	3.7%	33.3%	63.0%	0.0%	27	2.59	.572
	1	9	17	0			
I am more aware of Army or DoD STEM research and careers	18.5%	7.4%	55.6%	18.5%	27	2.74	.984
	5	2	15	5			
I have a greater appreciation of Army or DoD STEM research	11.1%	7.4%	63.0%	18.5%	27	2.89	.847
	3	2	17	5			
I am more interested in pursuing a STEM career with the Army or DoD	29.6%	11.1%	40.7%	18.5%	27	2.48	1.122
	8	3	11	5			

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

How did you learn about URAP? (n = 48)		
	Freq.	%
Someone who works at the school or university I attend	16	33%
Someone who works with program	8	17%
School or university newsletter, email, or website	6	7%
Friend	5	6%
Family member	2	3%
Army Educational Outreach Program (AEOP) website	1	2%
Past participant of program	1	2%
Someone who works with the Department of Defense (Army, Navy, Air Force)	1	2%
Community group or program	1	2%

*Note - data from URAP registration/application records

How motivating were the following factors in your decision to participate in URAP? (n=47)	
Teacher or professor encouragement	15 (32%)
The mentor(s)	4 (9%)
Building college application or resume	11 (23%)
Networking opportunities	4 (9%)
Interest in science, technology, engineering, or mathematics (STEM)	22 (47%)
Interest in STEM careers with the Army	7 (15%)
Earning stipends or awards for doing STEM	6 (13%)
Opportunity to use advanced laboratory technology	4 (9%)
Desire to expand laboratory or research skills	22 (47%)
Desire to learn something new or interesting	17 (36%)
Learning in ways that are not possible in school	7 (15%)
Seeing how school learning applies to real life	7 (15%)
Serving the community or country	1 (2%)
Exploring a unique work environment	2 (4%)
Figuring out education or career goals	8 (17%)
An academic requirement or school grade	1 (2%)
Other	0 (0%)

*Note - data from URAP registration/application records

Appendix C

FY15 URAP Mentor Data Summaries

URAP Mentor Data Summary

What is your gender?		
	Freq.	%
Female	5	31%
Male	9	56%
No Response	2	13%
Total	16	100%

What is your race or ethnicity?		
	Freq.	%
Asian	3	19%
Black or African American	0	0%
Hispanic or Latino	1	5%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	10	63%
No Response	2	13%
Asian	3	19%
Total	16	100%

Which of the following BEST describes your current occupation? (select ONE)		
	Freq.	%
Teacher	0	0.00%
Other school staff	0	0.00%
University educator	13	81.25%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	1	6.25%
Scientist, Engineer, or Mathematics professional	1	6.25%
Other, (specify):	1	6.25%
Total	16	100%

Which of the following BEST describes the organization you work for? (select ONE)		
	Freq.	%
No organization	0	0.00%
School or district (K-12)	0	0.00%
State educational agency	1	6.25%
Institution of higher education (vocational school, junior college, college, or university)	15	93.75%
Industry	0	0.00%
Department of Defense or other government agency	0	0.00%
Non-profit	0	0.00%
Other, (specify):	0	0.00%
Total	16	100%

Which of the following best describes your primary area of research?						
	Freq.	**%**			**Freq.**	**%**
Physical science (physics, chemistry, astronomy, materials science, etc.)	7	43.75%		**Technology**	0	0.00%
Biological science	2	12.50%		**Engineering**	4	25.00%
Earth, atmospheric, or oceanic science	0	0.00%		**Mathematics or statistics**	0	0.00%
Environmental science	0	0.00%		**Medical, health, or behavioral science**	1	6.25%
Computer science	2	12.50%		**Social Science (psychology, sociology, anthropology)**	0	0.00%
				Other, (specify):	0	0.00%
				Total	**16**	**100%**

Which of the following BEST describes your role during URAP?		
	Freq.	%
Research Mentor	14	87.50%
Research Team Member but not a Principal Investigator (PI)	1	6.25%
Other, (specify)	1	6.25%
Total	16	100%

How many URAP students did you work with this year?		
# of Students	Freq.	%
1	14	86.67%
2	1	6.67%
3	1	6.67%
4	0	0%
5	0	0%
6	0	0%
Total	15	100%

How did you learn about URAP? (Check all that apply) (n = 16)						
	Freq.	**%**			**Freq.**	**%**
AEOP on Facebook, Twitter, Pinterest, or other social media	0	0%		**Someone who works with the Department of Defense (Army, Navy, Air Force)**	1	6%
A STEM conference or STEM education conference	0	0%		**My supervisor or superior**	2	11%
Past URAP participant	0	0%		**A URAP site host or director**	2	11%
A colleague	0	0%		**An email or newsletter from school, university or a professional organization**	3	21%
Workplace communications	0	0%		**Army Educational Outreach Program (AEOP) website**	4	32%
A student	0	0%		**Army Research Office (ARO)**	14	58%

Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply) (n = 15)						
	Freq.	%			Freq.	%
Applications from Army Research Office (ARO) or the AEOP	12	75.00%		Communication(s) generated by a university or faculty (newsletter, email blast, website)	7	43.75%
Personal acquaintance(s) (friend, family, neighbor, etc.)	3	18.75%		STEM or STEM Education conference(s) or event(s)	0	0.00%
Colleague(s) in my workplace	6	37.50%		Organization(s) that serve underserved or underrepresented populations	2	12.50%
K-12 school teacher(s) outside of my workplace	2	12.50%		The student contacted me (the mentor) about the program	5	31.25%
University faculty outside of my workplace	3	18.75%		I do not know how student(s) were recruited for URAP	1	6.25%
Informational materials sent to K-12 schools or Universities outside of my workplace	3	18.75%		Other, (specify):	0	0.00%
Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)	0	0.00%				

How SATISFIED were you with each of the following URAP program features?								
	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Application or registration process	0.0%	6.7%	6.7%	33.3%	53.3%	15	4.33	0.90
	0	1	1	5	8			
Other administrative tasks (in-processing, network access, etc.)	21.4%	0.0%	14.3%	7.1%	57.1%	14	3.79	1.67
	3	0	2	1	8			
Communicating with Army Research Office (ARO)	6.7%	6.7%	0.0%	20.0%	66.7%	15	4.33	1.23
	1	1	0	3	10			
Communicating with URAP organizers	20.0%	6.7%	0.0%	26.7%	46.7%	15	3.73	1.62
	3	1	0	4	7			
Support for instruction or mentorship during program activities	28.6%	0.0%	14.3%	28.6%	28.6%	14	3.29	1.64
	4	0	2	4	4			
Stipends (payment)	6.7%	0.0%	20.0%	26.7%	46.7%	15	4.07	1.16
	1	0	3	4	7			
Research abstract preparation requirements	0.0%	6.7%	6.7%	33.3%	53.3%	15	4.33	0.90
	0	1	1	5	8			

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 URAP.					
		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 URAP experience	16	14	87.5%	2	12.5%
Giving students real-life problems to investigate or solve	16	15	98.3%	1	6.3%
Selecting readings or activities that relate to students' backgrounds	16	13	81.3%	3	18.8%
Encouraging students to suggest new readings, activities, or projects	16	12	75.0%	4	25.0%
Helping students become aware of the role(s) that STEM plays in their everyday lives	16	10	62.5%	6	37.5%
Helping students understand how STEM can help them improve their own community	16	3	18.8%	13	81.3%
Asking students to relate real-life events or activities to topics covered in URAP	16	5	31.3%	11	68.8%

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 URAP.					
		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 URAP experience	16	10	62.5%	6	37.5%
Interact with students and other personnel the same way regardless of their background	16	9	56.3%	7	43.8%
Use a variety of teaching and/or mentoring activities to meet the needs of all students	16	16	100.0%	0	0.0%
Integrating ideas from education literature to teach/mentor students from groups underrepresented in STEM	16	9	56.3%	7	43.8%
Providing extra readings, activities, or learning support for students who lack essential background knowledge or skills	16	13	81.3%	3	18.8%
Directing students to other individuals or programs for additional support as needed	16	9	56.3%	7	46.8%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	16	6	37.5%	10	62.5%

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 URAP.

		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 interests	16	13	81.3%	3	18.8%
Having my student(s) explain difficult ideas to others	16	13	81.3%	3	18.8%
Having my student(s) listen to the ideas of others with an open mind	16	14	87.5%	2	12.5%
Having my student(s) exchange ideas with others whose backgrounds or viewpoints are different from their own	16	8	50.0%	8	50.0%
Having my student(s) give and receive constructive feedback with others	16	13	81.3%	3	18.8%
Having students work on collaborative activities or projects as a member of a team	16	12	75.0%	4	25.0%
Allowing my student(s) to resolve conflicts and reach agreement within their team	16	9	56.3%	7	43.8%

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 URAP.

		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Teaching (or assigning readings) about specific STEM subject matter	16	14	87.5%	2	12.5%
Having my student(s) search for and review technical research to support their work	16	15	93.8%	1	6.3%
Demonstrating laboratory/field techniques, procedures, and tools for my student(s)	16	15	93.8%	1	6.3%
Supervising my student(s) while they practice STEM research skills	16	15	93.8%	1	6.3%
Providing my student(s) with constructive feedback to improve their STEM competencies	16	14	87.5%	2	12.5%
Allowing students to work independently to improve their self-management abilities	16	15	93.8%	1	6.3%
Encouraging students to learn collaboratively (team projects, team meetings, journal clubs, etc.)	16	13	81.3%	3	18.8%
Encouraging students to seek support from other team members	16	14	87.5%	2	12.5%

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 URAP.					
		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	15	15	100.0%	0	0.0%
Recommending extracurricular programs that align with students' goals	16	7	43.8%	9	56.3%
Recommending Army Educational Outreach Programs that align with students' goals	16	4	25.0%	12	25.0%
Providing guidance about educational pathways that will prepare my student(s) for a STEM career	16	13	81.3%	3	18.8%
Discussing STEM career opportunities within the DoD or other government agencies	16	6	37.5%	10	62.5%
Discussing STEM career opportunities in private industry or academia	16	9	56.3%	7	43.8%
Discussing the economic, political, ethical, and/or social context of a STEM career	15	4	26.7%	11	73.3%
Recommending student and professional organizations in STEM to my student(s)	16	8	50.0%	8	50.0%
Helping students build a professional network in a STEM field	16	7	43.8%	9	56.3%
Helping my student(s) with their resume, application, personal statement, and/or interview preparations	16	6	37.5%	10	62.5%

How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during URAP?								
	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Army Research Office (ARO) website	37.5%	6.3%	31.3%	12.5%	12.5%	**16**	2.56	1.46
	6	1	5	2	2			
Army Educational Outreach Program (AEOP) website	37.5%	6.3%	18.8%	18.8%	18.8%	**16**	2.75	1.61
	6	1	3	3	3			
AEOP on Facebook, Twitter, Pinterest or other social media	75.0%	6.3%	12.5%	0.0%	6.3%	**16**	1.56	1.15
	12	1	2	0	1			
AEOP brochure	66.7%	6.7%	13.3%	13.3%	0.0%	**15**	1.73	1.16
	10	1	2	2	0			
It Starts Here! Magazine	81.3%	12.5%	6.3%	0.0%	0.0%	**16**	1.25	0.58
	13	2	1	0	0			
URAP Program administrator or site coordinator	43.8%	6.3%	6.3%	12.5%	31.3%	**16**	2.81	1.83
	7	1	1	2	5			
Invited speakers or "career" events	56.3%	6.3%	18.8%	18.8%	0.0%	**16**	2.00	1.26
	9	1	3	3	0			
Participation in URAP	18.8%	0.0%	12.5%	12.5%	56.3%	**16**	3.88	1.59
	3	0	2	2	9			

Which of the following AEOPs did you EXPLICITLY DISCUSS with your student(s) during URAP?					
		Yes - I discussed this program with my student(s)		No - I did not discuss this program with my student(s)	
	n	Freq.	%	Freq.	%
Camp Invention	14	2	14%	12	86%
eCYBERMISSION	14	2	14%	12	86%
Junior Solar Sprint (JSS)	14	2	14%	12	86%
West Point Bridge Design Contest (WPBDC)	14	2	14%	12	86%
Junior Science & Humanities Symposium (JSHS)	14	2	14%	12	86%
Gains in the Education of Mathematics and Science (GEMS)	14	2	14%	12	86%
GEMS Near Peers	14	2	14%	12	86%
UNITE	14	2	14%	12	86%
Science & Engineering Apprenticeship Program (SEAP)	14	2	14%	12	86%
Research & Engineering Apprenticeship Program (REAP)	14	2	14%	12	86%
High School Apprenticeship Program (HSAP)	15	5	33%	10	67%
College Qualified Leaders (CQL)	14	3	21%	11	79%
Undergraduate Research Apprenticeship Program (URAP)	15	13	87%	2	13%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	14	6	43%	8	57%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	14	5	36%	9	64%
I discussed AEOP with my student(s) but did not discuss any specific program	15	10	67%	5	33%

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

	Did not experience	Not at all	A little	Somewhat	Very much	n	Avg.	SD
Army Research Office (ARO) website	62.5%	6.3%	12.5%	12.5%	6.3%	**16**	1.94	1.39
	10	1	2	2	1			
Army Educational Outreach Program (AEOP) website	62.5%	6.3%	6.3%	12.5%	12.5%	**16**	2.06	1.57
	10	1	1	2	2			
AEOP on Facebook, Twitter, Pinterest or other social media	75.0%	6.3%	12.5%	0.0%	6.3%	**16**	1.56	1.15
	12	1	2	0	1			
AEOP brochure	73.3%	6.7%	13.3%	6.7%	0.0%	**15**	1.53	0.99
	11	1	2	1	0			
It Starts Here! Magazine	81.3%	6.3%	12.5%	0.0%	0.0%	**16**	1.31	0.70
	13	1	2	0	0			
URAP Program administrator or site coordinator	62.5%	6.3%	12.5%	12.5%	6.3%	**16**	1.94	1.39
	10	1	2	2	1			
Invited speakers or "career" events	75.0%	12.5%	12.5%	0.0%	0.0%	**16**	1.38	0.72
	12	2	2	0	0			
Participation in URAP	37.5%	6.3%	6.3%	12.5%	37.5%	**16**	3.06	1.84
	6	1	1	2	6			

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

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n	Avg.	SD
DoD researchers advance science and engineering fields	0.0%	0.0%	0.0%	31.3%	68.8%	**16**	4.69	0.48
	0	0	0	5	11			
DoD researchers develop new, cutting edge technologies	0.0%	0.0%	0.0%	12.5%	87.5%	**16**	4.88	0.34
	0	0	0	2	14			
DoD researchers solve real-world problems	0.0%	0.0%	0.0%	37.5%	62.5%	**16**	4.63	0.50
	0	0	0	6	10			
DoD research is valuable to society	0.0%	0.0%	0.0%	18.8%	81.3%	**16**	4.81	0.40
	0	0	0	3	13			

How often did YOUR STUDENT(S) have opportunities do each of the following in URAP?	Not at all	At least once	A few times	Most days	Every day	n	Avg.	SD
Learn new science, technology, engineering, or mathematics (STEM) topics	0.0%	0.0%	6.3%	37.5%	56.3%	16	4.50	0.63
	0	0	1	6	9			
Apply STEM knowledge to real-life situations	0.0%	0.0%	25.0%	50.0%	25.0%	16	4.00	0.73
	0	0	4	8	4			
Learn about new discoveries in STEM	0.0%	6.3%	25.0%	37.5%	31.3%	16	3.94	0.93
	0	1	4	6	5			
Learn about different careers that use STEM	0.0%	12.5%	37.5%	31.3%	18.8%	16	3.56	0.96
	0	2	6	5	3			
Interact with STEM professionals	0.0%	0.0%	25.0%	25.0%	50.0%	16	4.25	0.86
	0	0	4	4	8			
Communicate with other students about STEM	0.0%	6.3%	6.3%	43.8%	43.8%	16	4.25	0.86
	0	1	1	7	7			
Use laboratory or field techniques, procedures, and tools	0.0%	6.3%	0.0%	18.8%	75.0%	16	4.63	0.81
	0	1	0	3	12			
Participate in hands-on STEM activities	0.0%	6.3%	0.0%	18.8%	75.0%	16	4.63	0.81
	0	1	0	3	12			
Work as part of a team	0.0%	18.8%	0.0%	18.8%	62.5%	16	4.25	1.18
	0	3	0	3	10			
Identify questions or problems to investigate	0.0%	0.0%	12.5%	56.3%	31.3%	16	4.19	0.66
	0	0	2	9	5			
Design an investigation	0.0%	0.0%	25.0%	43.8%	31.3%	16	4.06	0.77
	0	0	4	7	5			
Carry out an investigation	0.0%	0.0%	0.0%	43.8%	56.3%	16	4.56	0.51
	0	0	0	7	9			
Analyze data or information	0.0%	0.0%	25.0%	18.8%	56.3%	16	4.31	0.87
	0	0	4	3	9			
Draw conclusions from an investigation	0.0%	0.0%	18.8%	31.3%	50.0%	16	4.31	0.79
	0	0	3	5	8			
Come up with creative explanations or solutions	0.0%	0.0%	18.8%	37.5%	43.8%	16	4.25	0.77
	0	0	3	6	7			
Build or make a computer model	50.0%	12.5%	12.5%	12.5%	12.5%	16	2.25	1.53
	8	2	2	2	2			

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 URAP project?		
	Freq.	%
Science	10	62.50%
Technology	2	12.50%
Engineering	4	25.00%
Mathematics	0	0.00%
Total	16	100%

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	No gain	**A little gain**	**Some gain**	**Large gain**	**Extreme gain**	**n**	**Avg.**	**SD**
In depth knowledge of a STEM topic(s)	0.0%	0.0%	18.8%	50.0%	31.3%	16	4.13	0.72
	0	0	3	8	5			
Knowledge of research conducted in a STEM topic or field	0.0%	0.0%	6.3%	62.5%	31.3%	16	4.25	0.58
	0	0	1	10	5			
Knowledge of research processes, ethics, and rules for conduct in STEM	0.0%	6.3%	12.5%	50.0%	31.3%	16	4.06	0.85
	0	1	2	8	5			
Knowledge of how professionals work on real problems in STEM	0.0%	0.0%	12.5%	56.3%	31.3%	16	4.19	0.66
	0	0	2	9	5			
Knowledge of what everyday research work is like in STEM	0.0%	6.3%	0.0%	56.3%	37.5%	16	4.25	0.77
	0	1	0	9	6			

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Asking a question that can be answered with one or more scientific experiments	0.0%	0.0%	50.0%	40.0%	10.0%	10	3.60	0.70
	0	0	5	4	1			
Using knowledge and creativity to suggest a testable explanation (hypothesis) for an observation	0.0%	10.0%	30.0%	40.0%	20.0%	10	3.70	0.95
	0	1	3	4	2			
Making a model of an object or system showing its parts and how they work	40.0%	10.0%	30.0%	20.0%	0.0%	10	2.30	1.25
	4	1	3	2	0			
Designing procedures for an experiment that are appropriate for the question to be answered	0.0%	0.0%	30.0%	50.0%	20.0%	10	3.90	0.74
	0	0	3	5	2			
Identifying the limitations of the methods and tools used for data collection	0.0%	10.0%	40.0%	30.0%	20.0%	10	3.60	0.97
	0	1	4	3	2			
Carrying out procedures for an experiment and recording data accurately	0.0%	10.0%	10.0%	60.0%	20.0%	10	3.90	0.88
	0	1	1	6	2			
Using computer models of objects or systems to test cause and effect relationships	80.0%	10.0%	0.0%	10.0%	0.0%	10	1.40	0.97
	8	1	0	1	0			
Organizing data in charts or graphs to find patterns and relationships	20.0%	10.0%	20.0%	10.0%	40.0%	10	3.40	1.65
	2	1	2	1	4			
Considering different interpretations of data when deciding how the data answer a question	0.0%	30.0%	30.0%	10.0%	30.0%	10	3.40	1.26
	0	3	3	1	3			
Supporting an explanation for an observation with data from experiments	0.0%	10.0%	40.0%	20.0%	30.0%	10	3.70	1.06
	0	1	4	2	3			
Supporting an explanation with relevant scientific, mathematical, and/or engineering knowledge	0.0%	20.0%	30.0%	20.0%	30.0%	10	3.60	1.17
	0	2	3	2	3			
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	0.0%	20.0%	40.0%	10.0%	30.0%	10	3.50	1.18
	0	2	4	1	3			
Defending an argument that conveys how an explanation best describes an observation	0.0%	30.0%	30.0%	10.0%	30.0%	10	3.40	1.26
	0	3	3	1	3			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	10.0%	10.0%	30.0%	20.0%	30.0%	10	3.50	1.35
	1	1	3	2	3			
Integrating information from technical or scientific texts and other media to support your explanation of an observation	10.0%	10.0%	50.0%	0.0%	30.0%	10	3.30	1.34
	1	1	5	0	3			
Communicating about your experiments and explanations in different ways (through talking, writing, graphics, or mathematics)	10.0%	10.0%	30.0%	10.0%	40.0%	10	3.60	1.43
	1	1	3	1	4			

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Defining a problem that can be solved by developing a new or improved object, process, or system	0.0%	0.0%	60.0%	40.0%	0.0%	5	3.40	0.55
	0	0	3	2	0			
Using knowledge and creativity to propose a testable solution for a problem	0.0%	0.0%	80.0%	20.0%	0.0%	5	3.20	0.45
	0	0	4	1	0			
Making a model of an object or system to show its parts and how they work	0.0%	20.0%	0.0%	80.0%	0.0%	5	3.60	0.89
	0	1	0	4	0			
Designing procedures for an experiment that are appropriate for the question to be answered	20.0%	0.0%	20.0%	60.0%	0.0%	5	3.20	1.30
	1	0	1	3	0			
Identifying the limitations of the methods and tools used for data collection	0.0%	20.0%	20.0%	40.0%	20.0%	5	3.60	1.14
	0	1	1	2	1			
Carrying out procedures for an experiment and recording data accurately	20.0%	0.0%	20.0%	60.0%	0.0%	5	3.20	1.30
	1	0	1	3	0			
Using computer models of an object or system to investigate cause and effect relationships	0.0%	0.0%	20.0%	60.0%	20.0%	5	4.00	0.71
	0	0	1	3	1			
Considering different interpretations of the data when deciding if a solution works as intended	0.0%	0.0%	40.0%	60.0%	0.0%	5	3.60	0.55
	0	0	2	3	0			
Organizing data in charts or graphs to find patterns and relationships	0.0%	40.0%	0.0%	40.0%	20.0%	5	3.40	1.34
	0	2	0	2	1			
Supporting a solution for a problem with data from experiments	20.0%	0.0%	60.0%	20.0%	0.0%	5	2.80	1.10
	1	0	3	1	0			
Supporting a solution with relevant scientific, mathematical, and/or engineering knowledge	0.0%	0.0%	20.0%	60.0%	20.0%	5	4.00	0.71
	0	0	1	3	1			
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0.0%	20.0%	40.0%	40.0%	0.0%	5	3.20	0.84
	0	1	2	2	0			
Defend an argument that conveys how a solution best meets design criteria	0.0%	20.0%	40.0%	20.0%	20.0%	5	3.40	1.14
	0	1	2	1	1			
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0.0%	0.0%	40.0%	0.0%	60.0%	5	4.20	1.10
	0	0	2	0	3			
Integrating information from technical or scientific texts and other media to support your solution to a problem	0.0%	20.0%	40.0%	20.0%	20.0%	5	3.40	1.14
	0	1	2	1	1			
Communicating information about your design experiments and solutions in different ways (through talking, writing, graphics, or math equations)	0.0%	0.0%	60.0%	0.0%	40.0%	5	3.80	1.10
	0	0	3	0	2			

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?								
	No gain	A little gain	Some gain	Large gain	Extreme gain	n	Avg.	SD
Learning to work independently	0.0%	0.0%	0.0%	60.0%	40.0%	15	4.40	0.51
	0	0	0	9	6			
Setting goals and reflecting on performance	0.0%	0.0%	13.3%	60.0%	26.7%	15	4.13	0.64
	0	0	2	9	4			
Sticking with a task until it is finished	0.0%	0.0%	0.0%	53.3%	46.7%	15	4.47	0.52
	0	0	0	8	7			
Making changes when things do not go as planned	0.0%	0.0%	26.7%	33.3%	40.0%	15	4.13	0.83
	0	0	4	5	6			
Including others' perspectives when making decisions	0.0%	6.7%	20.0%	46.7%	26.7%	15	3.93	0.88
	0	1	3	7	4			
Communicating effectively with others	0.0%	0.0%	40.0%	26.7%	33.3%	15	3.93	0.88
	0	0	6	4	5			
Confidence with new ideas or procedures in a STEM project	0.0%	0.0%	33.3%	33.3%	33.3%	15	4.00	0.85
	0	0	5	5	5			
Patience for the slow pace of research	0.0%	6.7%	20.0%	46.7%	26.7%	15	3.93	0.88
	0	1	3	7	4			
Desire to build relationships with professionals in a field	0.0%	6.7%	46.7%	33.3%	13.3%	15	3.53	0.83
	0	1	7	5	2			
Connecting a topic or field with their personal values	0.0%	20.0%	40.0%	26.7%	13.3%	15	3.33	0.98
	0	3	6	4	2			

Which of the following statements describe YOUR STUDENT(S) after participating in the URAP program?							
	1	**2**	**3**	**4**	**n**	**Avg.**	**SD**
More confident in STEM knowledge, skills, and abilities	0.0%	6.7%	80.0%	13.3%	15	3.07	0.46
	0	1	12	2			
More interested in participating in STEM activities outside of school requirements	6.7%	13.3%	66.7%	13.3%	15	2.87	0.74
	1	2	10	2			
More aware of other AEOPs	40.0%	6.7%	46.7%	6.7%	15	2.20	1.08
	6	1	7	1			
More interested in participating in other AEOPs	46.7%	13.3%	26.7%	13.3%	14	2.07	1.16
	7	2	4	2			
More interested in taking STEM classes in school	6.7%	20.0%	66.7%	6.7%	15	2.73	0.70
	1	3	10	1			
More interested in earning a STEM degree	0.0%	13.3%	80.0%	6.7%	15	2.93	0.46
	0	2	12	1			
More interested in pursuing a career in STEM	0.0%	20.0%	73.3%	6.7%	15	2.87	0.52
	0	3	11	1			
More aware of DoD STEM research and careers	13.3%	6.7%	66.7%	13.3%	15	2.80	0.86
	2	1	10	2			
Greater appreciation of DoD STEM research	7.1%	7.1%	78.6%	7.1%	15	2.86	0.66
	1	1	11	1			
More interested in pursuing a STEM career with the DoD	13.3%	20.0%	60.0%	6.7%	15	2.60	0.83
	2	3	9	1			

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

Appendix D

FY15 URAP Apprentice and Mentor Focus Group Protocol

2015 URAP Evaluation Study
Student Interview or Focus Group Protocol

Facilitator: My name is [evaluator] and I'd like to thank you for meeting with us today! We are really excited to learn more about your experiences in URAP. In case you have not been in an evaluation interview before, I'd like to give you some ground rules that I like to use in interviews. They seem to help the interview move forward and make everyone a little more comfortable:

1. What is shared in the interview stays in the room.
2. It is important for us to hear the positive and negative sides of all issues.
3. Only one person speaks at a time.
4. This is voluntary - you may choose not to answer any question, or stop participating at any time.
5. We will be audio recording the session for note-taking purposes only. Audio will be destroyed.
6. Do you have any questions before we begin?

Key Questions

1. **Why did you choose to participate in URAP this year?**
    - How did you hear about URAP?
    - Who did you hear about it from?

The Army Educational Outreach Program (AEOP) is a primary sponsor of URAP. We do these interviews to help the AEOP create reports and defend funding for the program. They need specific information to defend the money for the program.

2. **We need to understand more about how URAP is teaching students about STEM career opportunities in the Army and Department of Defense.**
    - During URAP, did you learn anything about STEM careers in the Army or Department of Defense?
    - How did you learn about them (e.g., field trips, invited speakers, other activities, etc.)?
    - Are you interested in pursuing a career in STEM with the Army or Department of Defense?
3. **The AEOP sponsors a wide range of national STEM outreach programs other than URAP. You are definitely eligible to participate in some of these programs and we need to know if you learned about them during URAP**
    - During URAP, did you learn about any of the outreach programs that the AEOP sponsors? (SMART, NDSEG, URAP, etc.)
    - How did you learn about them?
    - Do you think that you will try to participate in any of those programs?
4. **Tell us about your experiences in URAP this year.**
    - What, specifically do you think you got out of participating in URAP?
    - How do your experiences in URAP compare to your school experiences in STEM?
    - What would you say was the biggest benefit you gained from participating in URAP?
5. **Do you have any suggestions for improving URAP for other students in the future?**
6. **Last Chance - Have we missed anything? Tell us anything you want us to know that we didn't ask about.**

2015 URAP Evaluation Study
Mentor Interview or Focus Group Protocol

Facilitator: My name is [evaluator] and I'd like to thank you for meeting with us today! We are really excited to learn more about your experiences in URAP. In case you haven't been in a focus group before, I'd like to give you some ground rules that I like to use in focus groups. They seem to help the group move forward and make everyone a little more comfortable:

7. What is shared in the room stays in the room.
8. Only one person speaks at a time.
9. If you disagree please do so respectfully.
10. It is important for us to hear the positive and negative sides of all issues.
11. We will be audio recording the session for note-taking purposes only. Audio will be destroyed.
12. Do you have any questions about participating in the focus group?

Key Questions:

1. **When you think about URAP, what kind of value does this program add**?
    - How do you think students benefit from participating in URAP?
    - Can you think of a particular student or group of students that benefit the most from URAP?
    - How have you benefited from participating in URAP?

One of the primary sponsors of the URAP program is the Army Educational Outreach Program (AEOP). The AEOP needs specific information to create reports and defend funding for its outreach programs, URAP included.

2. **We need to understand more about how URAP is helping students know more about STEM career opportunities in the Department of Defense, especially civilian positions.**
    - Have you seen any efforts by URAP to educate participants about the Army, DoD, or careers in the DoD?
    - What strategies seem to be the most effective for URAP students?
    - Do you have any suggestions for helping URAP teach students about careers in the DoD?

The AEOP sponsors a wide range of national STEM outreach programs that these students qualify for.

3. **The AEOP needs to know if URAP is teaching students about the other STEM outreach programs that it sponsors.**
    - First, are you aware of the other programs offered by the AEOP? (e.g., REAP, CQL, CQL, SMART, etc)
    - Have you seen any efforts at URAP to educate adults or students about the other AEOP programs?
    - What seems to work the best? The worst?
    - Any suggestions for helping the AEOP educate these students about the other programs?

4. **The AEOP is trying to make sure that its programs become more effective at reaching adult and youth participants from underserved and underrepresented groups (racial/ethnic groups, low SES, etc.).**
    - Have you seen any efforts by URAP to help engage underserved or underrepresented groups of adults and youth?
    - What strategies seem to work the best? The worst?
    - Any suggestions for helping URAP reach new populations of adult and youth participants?

5. **What suggestions do you have for improving URAP?**
6. **Last Chance - Have we missed anything? Tell us anything you want us to know that we didn't ask about.**

Appendix E

FY15 URAP Apprentice Questionnaire

2014 Undergraduate Research Apprentice Program (URAP): URAP Youth Survey

Virginia Tech conducts program evaluation on behalf of the Army Research Office and U.S. Army to determine how well the Army Educational outreach Program (AEOP) is achieving its goals of promoting student interest and engagement in science, technology, engineering, and mathematics (STEM). As part of this study Virginia Tech is surveying students (like you) who have participated in the Undergraduate Research Apprenticeship Program (URAP). The survey will collect information about you, your experiences in school, and your experiences in URAP.

About this survey:

- While this survey is not anonymous, your responses are CONFIDENTIAL. When analyzing data and reporting results, your name will not be linked to any item responses or any comments you make.
- Responding to this survey is VOLUNTARY. You are not required to participate, although we hope you do because your responses will provide valuable information for meaningful and continuous improvement.
- If you provide your email address, the AEOP may contact you in the future to ask about your academic and career success. The survey takes about 25-30 minutes to complete on average, but could take less time. In the online survey you can scroll over purple print in the survey to see definitions of words or phrases.

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. 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	○	○	○	○	○

9. How often did you do each of the following in URAP 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	○	○	○	○	○

10. 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	○	○	○	○	○

11. How often did you do each of the following in URAP 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	○	○	○	○	○

12. 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*
Army Research Office (ARO) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My URAP mentor(s)	○	○	○	○	○
Invited speakers or “career” events during URAP	○	○	○	○	○
Participation in URAP	○	○	○	○	○

13. 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*
Army Research Office (ARO) website	○	○	○	○	○
Army Educational Outreach Program (AEOP) website	○	○	○	○	○
AEOP on Facebook, Twitter, Pinterest or other social media	○	○	○	○	○
AEOP brochure	○	○	○	○	○
It Starts Here! Magazine	○	○	○	○	○
My URAP mentor(s)	○	○	○	○	○
Invited speakers or “career” events during URAP	○	○	○	○	○
Participation in URAP	○	○	○	○	○

14. How SATISFIED were you with the following URAP features?

Select one per row.

	Did not experience	*Not at all*	*A little*	*Somewhat*	*Very much*
Applying or registering for the program	○	○	○	○	○
Other administrative tasks (in-processing, network access, etc.)	○	○	○	○	○
Communicating with your URAP host site organizers	○	○	○	○	○
The physical location(s) of URAP activities	○	○	○	○	○
The variety of STEM topics available to you in URAP	○	○	○	○	○
Teaching or mentoring provided during URAP activities	○	○	○	○	○
Stipends (payment)	○	○	○	○	○
Research abstract preparation requirements	○	○	○	○	○

15. How much input did you have in selecting your URAP 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

16. How often was your mentor available to you during URAP?

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

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

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

18. 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	○	○	○	○	○

19. 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 URAP:

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	○	○

20. Which of the following statements apply to your research experience in URAP? (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

21. As a result of your URAP 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	○	○	○	○	○

22. Which category best describes the focus of your URAP activities?

Select one.

○	Science	(Go to question number 23.)
○	Technology	(Go to question number 24.)
○	Engineering	(Go to question number 24.)
○	Mathematics	(Go to question number 24.)

23. As a result of your URAP 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 25.

	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)	○	○	○	○	○

24. As a result of your URAP 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)	○	○	○	○	○

25. As a result of your URAP 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	○	○	○	○	○

26. As a result of your URAP 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	○	○	○	○	○

27. AS A RESULT OF YOUR URAP 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	○	○	○	○	○

28. Before you participated in URAP, how far did you want to go in school?

Select one.

○	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.)

29. After you have participated in URAP, how far do you want to go in school?

Select one.

○	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. 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

31. Before you participated in URAP, 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, electrician, plumber, etc.)
○	Other, (specify)::

32. After you participated in URAP, 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)::

33. 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*
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	○	○	○	○	○

34. How many jobs/careers in STEM did you learn about during URAP?

Select one.

○	None
○	1
○	2
○	3
○	4
○	5 or more

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

Select one.

○	None
○	1
○	2
○	3
○	4
○	5 or more

36. 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	○	○	○	○	○

37. Which of the following statements describe you after participating in the URAP program?

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of URAP*	*Agree - URAP contributed*	*Agree - URAP 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	○	○	○	○

38. What are the three most important ways that URAP has helped you?

Benefit #1:	
Benefit #2:	
Benefit #3:	

39. What are the three ways that URAP should be improved for future participants?

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

40. Please tell us about your overall satisfaction with your URAP experience.

Appendix F

FY15 URAP Mentor Questionnaire

2015 Undergraduate Research Apprentice Program (URAP): URAP Mentor Survey

Virginia Tech is conducting an evaluation study on behalf of the Army Research Office 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

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 URAP?

Select one.

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

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

_____ students.

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 Army Research Office (ARO) 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 URAP
☐	Other, (specify)::

20. How SATISFIED were you with the following URAP 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 Army Research Office (ARO)	○	○	○	○	○
Communicating with URAP 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 URAP.

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 URAP 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 URAP	○	○

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 URAP.

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 URAP 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 URAP.

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 URAP.

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 URAP.

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 URAP?

Select one per row.

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

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

Select one per row.

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

28. Which of the following AEOPs did YOU EXPLICITLY DISCUSS with your student(s) during URAP? (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)*
College Qualified Leaders (CQL)	○	○
GEMS Near Peer Mentor Program	○	○
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 URAP?

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 URAP 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) URAP 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 URAP 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 URAP 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 URAP 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 URAP program?

Select one per row.

	Disagree - This did not happen	*Disagree - This happened but not because of URAP*	*Agree - URAP contributed*	*Agree - URAP 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 URAP?

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

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

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

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

Appendix G

Army Research Office (ARO)
FY15 Evaluation Report Response

The ARO office did not provide a formal response to be included in the report.