Army Educational Outreach Program

Undergraduate Research Apprentice Program

2014 Annual Program Evaluation Report

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U.S. Army Contacts

Jagadeesh Pamulapati, Ph.D.
Acting Executive Director, Strategic & Program Planning
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 Managers

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

Jennifer Carroll
AEOP Deputy Cooperative Agreement Manager
U.S. Army Research, Development, and
Engineering Command (RDECOM)
(410) 306-0009
jennifer.j.carroll2.civ@mail.mil

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 Contacts

Tanner Bateman
Senior Project Associate, AEOP CA
Virginia Tech
(703) 336-7922
tbateman@vt.edu

Donna Augustine Burnette
Program Director, AEOP CA
Virginia Tech
(540) 315-5807
donna.augustine@vt.edu

Eric Banilower
Senior Researchers
Horizon Research, Inc.
(919) 489-1725
erb@horizon-research.com

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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 final reports for submission to the US Army Research Office Youth Science programs office.

In 2014, URAP provided outreach to 59 apprentices and their mentors at 27 Army-sponsored university or college laboratory sites (herein called URAP sites).

This report documents the evaluation of the 2014 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 focus groups with apprentices and mentors (conducted online or over the telephone) and online post-program questionnaires distributed to all apprentices and mentors.

2014 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	90
No. of Students (Apprentices)	59
Placement Rate	66%
No. of Adults (Mentors)	31
No. of College/University S&Es	31
No. of College/Universities	27
No. of HBCU/MSIs	10
Total Cost	$210,185
Admin/Overhead Costs (Host Sites)	$30,719
Stipend Cost (Paid by AEOP and ARO)	$179,466
Cost Per Student Participant	$3,562

Summary of Findings

The 2014 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.

2014 URAP Evaluation Findings	
Participant Profiles	
URAP continues to have difficulty providing outreach to participants from historically underrepresented and underserved populations.	• URAP had difficulty attracting participation from female apprentices—a population that is historically underrepresented and underserved in specific STEM fields. URAP apprentices included far more males (71%) than females (27%).
	• URAP had difficulty providing outreach to apprentices from historically underrepresented and underserved race/ethnicity groups (15%). Low proportions of apprentices identify as Native American or Alaskan Native (0%), Native Hawaiian (0%), Hispanic or Latino (7%), and Black or African American (8%).
URAP STEM mentors were lacking in diversity as well.	• Although there were more female than male (69% and 31%, respectively) mentors among questionnaire respondents, the majority identified as either Asian (56%) or White (38%). Only one responding mentor identified as Hispanic or Latino and none identified as Black or African American.
Actionable Program Evaluation	
Marketing and recruitment of URAP apprentices and mentors depends almost entirely on the universities or colleges that host URAP	• ARO marketed and recruited 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. • Apprentices learned about URAP through university personnel, advertisements, classes, or other acquaintances associated with URAP site. Many apprentices had existing associations with their mentor prior to working as a URAP apprentice. 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, 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. • Most mentors reported recruiting apprentices within the university or college context. Some mentors had a previous association with the apprentice prior to URAP through a course or previous research. • In both 2013 and 2014, many apprentices and mentors had existing associations prior to URAP, though most mentors reported selecting apprentices from the AEOP applicant pool. This pattern of responses suggests

	that apprentices are first recruited within universities and colleges and subsequently directed to the AEOP application as a formality. The program may want to collect additional information about previous relationships between mentors and apprentices as part of their application process to help ensure it is meeting its goal of involving new students in the URAP research experience.
URAP apprentices are motivated by opportunities to learn about STEM in ways not possible in school.	• Apprentices were most frequently motivated to participate in URAP by the desire to expand laboratory or research skills (98%), because of their interest in STEM (97%), to learn in ways not possible in school (88%), and by the opportunity to use advanced laboratory technology (87%).
URAP engages apprentices in meaningful STEM learning, through team-based and hands-on activities.	• Most apprentices (71-91%) report learning about STEM topics, applications of STEM to real-life situations, and communicating with other students about STEM on most days or every day of their URAP experience.
	• Most apprentices had opportunities to engage in a variety of STEM practices during their URAP experience. For example, 86% reported practicing using laboratory or field techniques, procedures, or tools; 86% participating in hands-on activities; 83% reported working as part of a team; 83% building or simulating something; and 83% analyzing or interpreting data on most days or every day.
	• Apprentices reported greater opportunities to learn about STEM and greater engagement in STEM practices in their URAP experience than they typically have in school.
	• Large proportions of mentors report using strategies to help make learning activities relevant to apprentices, support the needs of diverse learners, develop apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
URAP promotes DoD STEM research and careers but can improve marketing of other AEOP opportunities.	• More than half of mentors (53%) indicated discussing DoD STEM career opportunities with their apprentices. As a result, more than 60% of apprentices reported that they had a greater awareness and appreciation of DoD STEM careers.
	• Most mentors had no awareness of or past participation in an AEOP initiative beyond URAP. Similarly, a substantial proportion of apprentices, when asked what AEOPs they had participated in, indicated never hearing of most of the AEOP programs. However, when asked about their awareness of other AEOPs, most apprentices reported an increase in awareness as a result of participating in URAP. This apparent contradiction may be a result of apprentices learning that AEOP offers several other programs, but not receiving specific information about the various other offerings.
The URAP experience is greatly valued by apprentices and mentors.	• All responding apprentices indicated being satisfied with their URAP experience, highlighting the opportunity to learn about STEM fields and career opportunities. Apprentices also commented on how URAP provided opportunities they do not get in school and would not have otherwise.

	• The vast majority of responding mentors indicated having a positive experience. Further, many commented on the benefits the program provides apprentices, including deepening their knowledge about and confidence in STEM.
Outcomes Evaluation	
URAP had positive impacts on apprentices' STEM knowledge and competencies.	• A majority of apprentices reported large or extreme gains in their knowledge of how professionals work on real problems in STEM; what everyday research work is like in STEM; a STEM topic or field in depth; the research processes, ethics, and rules for conduct in STEM; and research conducted in a STEM topic or field. These impacts were identified across all apprentice groups.
	• Many 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.
URAP had positive impacts on apprentices' 21st Century Skills.	• A large majority of 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 positively impacted apprentices' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many apprentices reported a large or extreme gain in feeling responsible for a STEM project or activity (88%), confidence to do well in future STEM courses (79%), ability to build academic or professional credentials in STEM (76%), preparedness for more challenging STEM activities (73%), feeling like a STEM professional (73%), feeling like part of a STEM community (73%) and trying out new ideas or procedures on their own in a STEM project (73%).
	• Apprentices also reported on the 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 (82%), to talk with friends or family about STEM (72%), and to help with a community service project related to STEM (69%).
URAP succeeded in raising apprentices' education aspirations, but did not	• After participating in URAP, 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 beyond a Bachelor's degree (79% before URAP, 91% after).

change their career aspirations.	• Apprentices were asked to indicate what kind of work they expected to be doing at age 30, and the data were coded as STEM-related or non-STEM-related. Although many apprentices indicated interest in a STEM-related career, there was not a statistically significant difference from before URAP to after. This result is likely due to the requirement for students to demonstrate interest in STEM in order to be selected for the program.
URAP apprentices are largely unaware of AEOP initiatives, but apprentices show substantial interest in future AEOP opportunities.	• About three-quarters of apprentices indicated that URAP made them more aware of other AEOPs (74%), and credited URAP with increasing their interest in participating in other programs (76%).
URAP raised apprentice awareness and appreciation of DoD STEM research and careers, as well as their interest in pursuing a STEM career with the DoD.	• A majority of apprentices reported that they had a greater awareness (62%) and appreciation (68%) of DoD STEM research and careers. In addition, 59% indicated that URAP raised their interest in pursuing a STEM career with the DoD.

Recommendations

1. AEOP objectives include expanding participation of historically underrepresented and underserved populations. Similar to past years, 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 underrepresented populations of students depends upon the diversity of the universities or colleges in which recruitment takes place. Indications are that many URAP apprentices are informally selected by mentors and subsequently sent to the AEOP application site as a mere formality. Guidance ensuring that "connected" applicants (e.g., those with family, family friends, or school-based connections to the site) are not disproportionately advantaged over qualified but "un-vetted" candidates who apply through the AEOP website is likely to help in recruitment efforts. 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.

2. Given the goal of exposing apprentices to other AEOP initiatives and encouraging continued participation (including as a mentor or volunteer) in programs which are available, URAP may want to work with sites to increase both mentors' and apprentices' exposure to AEOP. Evaluation data suggests that URAP apprentices and mentors were largely unaware of other AEOP initiatives and that URAP served as an entry point into the AEOP for students who have not yet been exposed the Army STEM outreach. Yet, substantial apprentice interest exists in participating in AEOPs moving forward. This interest could be cultivated with more attention by ARO and mentors

during URAP program activities. Continued guidance by ARO is needed to educate mentors about AEOP opportunities nationwide. Adequate resources and guidance for using resources with apprentices should be provided to mentors such that that all apprentices leave URAP with an idea of their next steps in AEOP and/or the capability to serve as an AEOP ambassador.

3. Similarly, given the goal of exposing apprentices to Army/DoD STEM research and careers, the program may want to build in opportunities to provide this information to their apprentices. More than half of apprentices who completed the survey (68%) reported that they did not learn about any DoD STEM jobs/careers during URAP. 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 start the conversation about Army STEM careers and motivate further exploration beyond the resource itself. A repository of public, web-based and print resources (e.g., Army and directorate STEM career webpages, online magazines, federal application guidelines) could also be disseminated to each mentor and/or apprentice to help guide their exploration of Army/DoD STEM interests, careers, and available positions.

4. Additional 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 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.[2] In particular, consideration should be given to whether the parallel nature of the apprentice and mentor questionnaires is necessary, with items being asked only of the most appropriate data source.

[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.

[2] When asked about potential improvements to URAP, one apprentice wrote "This survey is the worst part about URAP -- please shorten it for the sake of future URAP undergraduates."

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.

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 Virginia Tech, the Lead Organization (LO) in the AEOP CA consortium. Data analyses and reports were prepared in collaboration with Horizon Research, Inc.

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.

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 2014, 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 apprentices 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 27 Army-funded university and college research laboratories in 17 U.S states, summarized in Table 1; 10 of the 27 institutions have Historically Black College and University (HBCU) or Minority-serving Institution (MSI) status (denoted with an asterisk below). In 2014, URAP provided outreach to 59 apprentices and their mentors at these 27 university and college research laboratory sites (herein called URAP sites).

Table 1. 2014 URAP Sites

University/College	City	State	University/College	City	State
Alabama State University*	Montgomery	AL	Mississippi State University	Starkville	MS
Arizona State University	Glendale	AZ	University of Missouri	Columbia	MO
University of California - Berkeley	Berkeley	CA	Princeton University	Princeton	NJ
University of California – Irvine*	Irvine	CA	Polytechnic University of New York	New York	NY
University of California – Merced*	Merced	CA	St. John's University - New York	Jamaica	NY
University of California – Riverside*	Riverside	CA	North Carolina A&T*	Greensboro	NC
University of California - Santa Barbara	Santa Barbara	CA	Ohio State University	Columbus	OH
Indiana University	Bloomington	IN	Oklahoma State University	Stillwater	OK
University of Notre Dame	Notre Dame	IN	University of the Incarnate Word*	San Antonio	TX
Louisiana State University	Baton Rouge	LA	University of North Texas*	Denton	TX
Bowie State University*	Bowie	MD	Hampton University*	Hampton	VA
Northeastern University	Boston	MA	California State University*	Long Beach	CA
Oakland University	Rochester	MI	University of Texas	Austin	TX
University of Michigan - Ann Arbor	Ann Arbor	MI	**Total Universities**	**27**	

The total cost of 2014 URAP was approximately $210,185 including $179,466 for participant stipends. Funding was provided by ARO via Director discretionary funds matching program manager funds. The average cost per 2014 URAP participant taken across all URAP sites was $3,562. Table 3 summarizes these and other 2014 URAP program costs.

Table 2. 2014 URAP Program Costs	
2014 URAP - Cost Per Student Participant	
Total Student Participants (Apprentices)	59
Total Cost	$210,185
Admin/Overhead Costs (Host Sites)	$30,719
Stipend Cost (paid by AEOP and ARO)	$179,466
Cost Per Participant	**$3,562**

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 FY13 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. Student recruiting and selection criteria were more clearly outlined and used in the Broad Agency Announcement (BAA) and RFP process. An educational merit review criteria, which required proposals to clearly articulate the strategy for mentorship and facilitation of follow-on opportunities, was added to the BAA. This change was made in an effort to clearly define learning and research objectives to ensure student success in short term research programs.
   b. The criteria used to select participants included transcripts, resumes and essays. The program administrator provided guidance to the professors by attempting to highlight the target audience upon transferring the student information to the university.
   c. The program administrator performed marketing and recruiting activities by distributing AEOP marketing materials at various events (science fairs, local JSHS events, local site visits, etc.).

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

a. The program partnered with national schools and educators with shared interest in science, technology, engineering and mathematics to expand mentorship capacity of Army-sponsored researchers across the nation.

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

a. The URAP program administrator also spoke on behalf of the AEOP at various events, including those internal to ARO, to promote awareness among ARO scientists and engineers.

FY14 Evaluation At-A-Glance

Virginia Tech, in collaboration with ARO, conducted a comprehensive evaluation study 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)
• Army sponsorship • ARO providing oversight of site programming • 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 online focus groups with apprentices and 1 with mentors. Tables 3-7 outline the information collected in apprentice and mentor questionnaires and focus groups.

Table 3. 2014 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. 2014 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. 2014 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. 2014 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

Apprentices from 23 of 27 URAP sites responded to questionnaires, as did mentors from 14 of the 27 sites. Table 7 shows the number of apprentice and mentor respondents by site.

Table 7. 2014 URAP Site Survey Respondent Numbers				
2014 URAP Site	**Apprentices**		**Mentors**	
	No. of Participants	**No. of Survey Respondents**	**No. of Participants**	**No. of Survey Respondents**
Alabama State University	2	2	1	1
Arizona State University	6	1	3	2
University of California - Berkeley	2	1	1	0
University of California - Irvine	1	1	1	0
University of California - Merced	1	1	1	1
University of California - Riverside	2	0	1	0
University of California - Santa Barbara	7	4	2	1
Indiana University	2	0	1	0
University of Notre Dame	2	2	1	0
Louisiana State University	3	1	2	0
Bowie State University	2	1	1	0
Northeastern University	1	1	1	0
Oakland University	2	1	1	1
University of Michigan - Ann Arbor	1	1	1	1
Mississippi State University	2	1	1	0
University of Missouri	2	1	1	1
Princeton University	1	1	1	0
Polytechnic University of New York	2	2	1	2
St. John's University - New York	2	1	1	1
North Carolina A&T	2	0	1	1
Ohio State University	2	1	1	0
Oklahoma State University	2	0	1	1
University of the Incarnate Word	2	2	1	1
University of North Texas	2	2	1	1
Hampton University	2	2	1	0
California State University	2	2	1	1
University of Texas	2	2	1	0
Other[†]	0	1	0	0
Unspecified[‡]	0	1	0	0
Total	**59**	**36**	**31**	**16**

[†] Other = "California State University, Northridge."

[‡] One apprentice did not indicate which URAP location s/he was affiliated with.

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 2013 (which had a response rate of 77%). The mentor questionnaire response rate was the same for 2013 and this year.

Table 8. 2014 URAP Questionnaire Participation

Participant Group	Respondents (Sample)	Total Participants (Population)	Participation Rate	Margin of Error @ 95% Confidence[3]
Apprentices	36	59	61%	10.29
Mentors	16	31	52%	17.32

Three apprentice focus groups were conducted that included 10 apprentices (7 males, 3 females) ranging from first-year undergraduates to graduate students. One mentor focus group was also conducted, which included 5 mentors (2 males, 3 females) from 5 sites. Mentors included four university educators and a university student majoring in STEM. Focus groups 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

Demographic information collected from URAP questionnaire respondents is summarized in Table 9.[4] More males (72%) than females (28%) completed the questionnaire. 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 (83%). The survey respondent demographics aligned with those of the overall population of participating students with respect to gender (71% male, 27% female), and race/ethnicity (58% White, 20% Asian, 8% Black or African American, and 7% Hispanic or Latino).

[3] "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.

[4] 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.

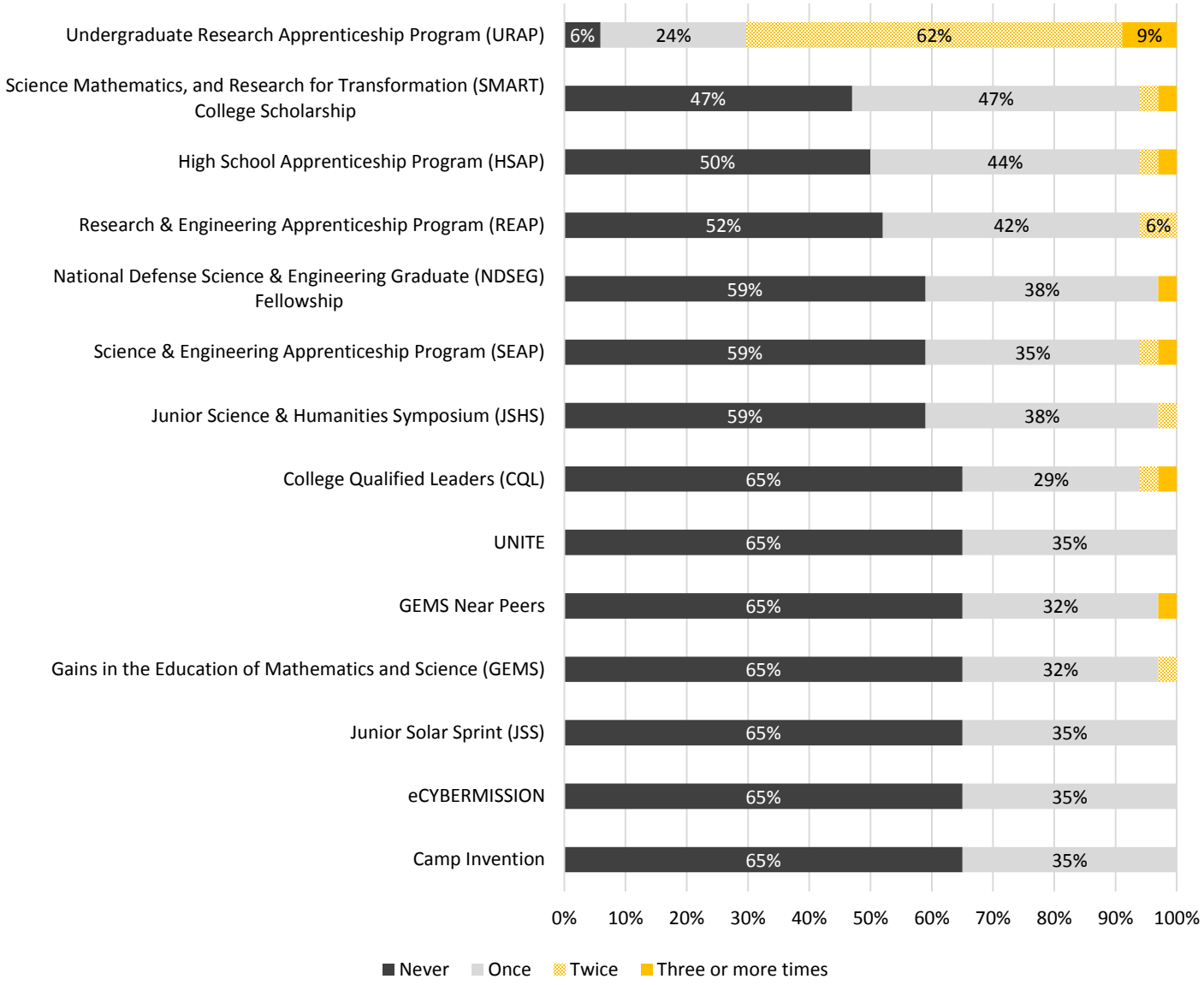
One objective of all AEOPs is to involve a larger percentage of students from previously underrepresented and underserved segments of our population, such as women, American Indians, African Americans, and Hispanics, in pursuing science and engineering careers through participation in Army-sponsored programs. The 2014 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.

Table 9. 2014 URAP Apprentice Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 36)		
Female	10	28%
Male	26	72%
Respondent Race/Ethnicity (n = 36)		
Asian	8	22%
Black or African American	4	11%
Hispanic or Latino	1	3%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	20	56%
Other race or ethnicity, (specify):†	1	3%
Choose not to report	2	6%
Respondent Grade Level (n = 36)		
12th	1	3%
First-Year college student (13)	1	3%
College sophomore (14)	3	8%
College junior (15)	7	19%
College senior (16)	18	50%
Graduate program (17)	5	14%
Choose not to report	1	3%

† Other = "Armenian."

In addition, apprentices were asked how many times they participated in each of the AEOP programs. As can be seen in Chart 1, 95% of responding apprentices reported participating in URAP at least once. Several participants indicated participating at least once in another program, 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). Previous participation in AEOPs was greatly increased from the 2013 implementation of the program, at which time only 3% of apprentices reported having participated in URAP previously. Prior participation in other AEOPs was also uncommon in 2013, with CQL having 18%, and JSS, JSHS, UNITE, and eCYBERMISSION each having 3%.

Chart 1: Student Participation in AEOP Programs (n = 33-34)



Mentor Demographics

The 2014 Mentor Questionnaire, compared to past years, collected more extensive demographic information on the mentors, which is summarized in Table 10. More responding mentors were female than male (69% vs. 31%). In contrast to responding apprentices, over half of the responding mentors identified themselves as Asian (56%). Mentors primarily identified as university educators for their occupation (69%). In the URAP program, the large majority of responding mentors served as research mentors (89%).

Table 10. 2014 URAP Mentor Respondent Profile		
Demographic Category	**Questionnaire Respondents**	
Respondent Gender (n = 16)		
Female	11	69%
Male	5	31%
Respondent Race/Ethnicity (n = 16)		
Asian	9	56%
Black or African American	0	0%
Hispanic or Latino	1	6%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	6	38%
Respondent Occupation (n = 16)		
Teacher	1	6%
University educator	11	69%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate apprentice, etc.)	2	13%
Scientist, Engineer, or Mathematics professional	2	13%
Respondent Role in URAP (n = 16)		
Research Mentor	14	88%
Research Team Member but not a Principal Investigator	1	6%
Other, (specify) †	1	6%

† Other = "Program Coordinator."

Actionable Program Evaluation

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

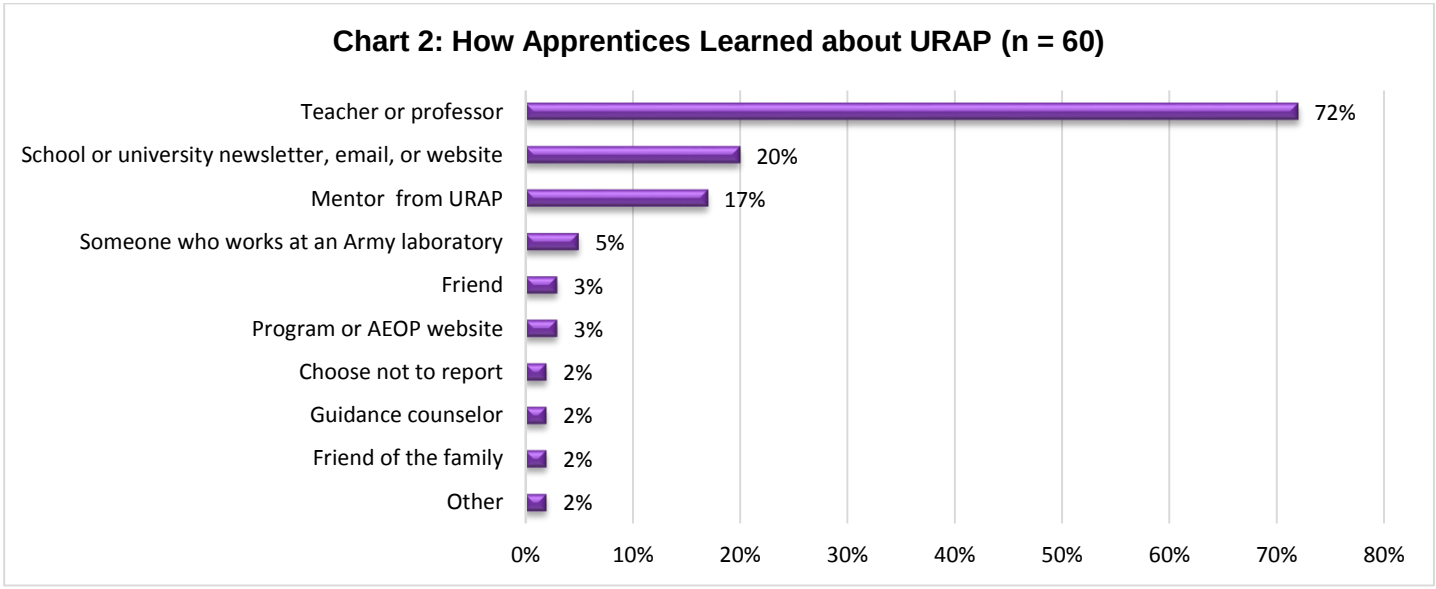
place on program activities, and what recommendations participants have for program improvement. The following sections report perceptions of apprentices and mentors that pertain to current programmatic efforts and recommend evidence-based improvements to help URAP achieve outcomes related to AEOP programs 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

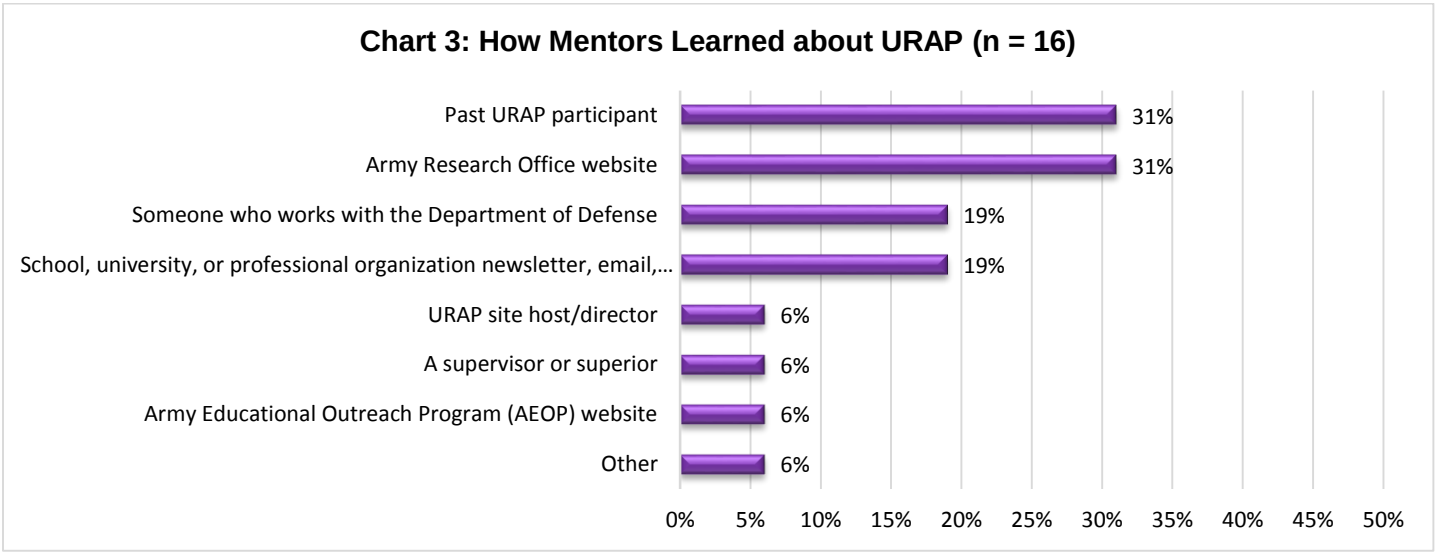
The URAP manager, ARO, regularly conducts two independent marketing and recruitment efforts. First, distribution of email and print advertising to Army-funded university and college research laboratories nationwide are intended to reach ARO-funded personnel who then submit proposals requesting funds for URAP apprenticeships. Second, for students, URAP is advertised with the AEOP portfolio of programs, primarily through social media and traditional print campaigns, in an effort to attract students to apply online at www.usaeop.com. In addition, during FY14 the program administrator distributed URAP and AEOP marketing materials at various events including science fairs and JSHS events as well as speaking on behalf of URAP and other AEOPs during those events.

Once URAP host sites are selected by ARO, the host site becomes primarily responsible for recruiting and selecting apprentices. This responsibility includes local marketing of the program as well as any special efforts to attract apprentices from underrepresented and underserved populations. URAP mentors review all applicants to their site – this includes applicants who were attracted to the program via general AEOP marketing as well as those who were attracted via the mentor's localized marketing efforts.

In order to understand which recruitment methods are most effective, data from program registration/application records were compiled. Chart 2 summarizes the responses given by students on their applications when asked how they learned about URAP. The most frequently mentioned source of information was a teacher or professor (72%). Other sources mentioned relatively frequently were a school or university newsletter, email, or website (20%), and a mentor from URAP (17%).



Mentors were also asked how they learned about URAP as part of their post-program questionnaire (see Chart 3). The two most common ways that mentors indicated learning about the program were through the ARO website (31%) and from past URAP participants (31%). Additionally, several mentors reported learning about URAP from someone who works in the DoD (19%) or from a school, university, or professional organization newsletter, email, or website (19%).



To examine whether mentors are expanding their participation in AEOP programs, the questionnaire asked how many times they had participated in each of the AEOP programs. With the exception of some mentors having participated at

least once in HSAP (14%), REAP (14%), and SEAP (7%), mentors indicated never hearing of or never participating in the other AEOP programs (apart from URAP).

Factors Motivating Apprentice Participation

Data from apprentice registrations and applications were also used to explore what motivated apprentices to participate in URAP. Specifically, the registration/application asked how motivating a number of factors were in their decision to participate. As can be seen in Table 11,[5] more than 8 in 10 students indicated that a desire to expand laboratory or research skills (97%), an interest in STEM (97%), learning in ways that are not possible in school (88%), the opportunity to use advanced laboratory technology (87%), and exploring a unique work environment (83%) were very motivating factors. Interest in STEM careers with the Army (32%) and the opportunity to do something with friends (25%) were considered by relatively few students to be very motivating.

Table 11. Factors Which Were Very Motivating for Apprentices to Participate in URAP (n = 60)

Item	Questionnaire Respondents
Desire to expand laboratory or research skills	98%
Interest in science, technology, engineering, or mathematics (STEM)	97%
Learning in ways that are not possible in school	88%
Opportunity to use advanced laboratory technology	87%
Exploring a unique work environment	83%
The program mentor(s)	78%
Teacher or professor encouragement	73%
Having fun	62%
Building college application or résumé	58%
Serving the community or country	55%
Networking opportunities	50%
Earning stipend or award during summer	47%
Parent encouragement	43%
Interest in STEM careers with the Army	32%
Opportunity to do something with friends	25%
Other, (specify)[†]	73%

[†] Other = “Learning and Service!”, ”my desire to learn more about scientific techniques”, “the thrill of doing something so exciting putting my skills to the test”, “a rare opportunity to work in a clean room”, “Building a bright future”, “Application of biochemical principles to research, contribution to biochemical research”, “finding out what I want to do with science”, “To learn new things to teach my nieces.”, “My desire to learn and apply what I learn in a real laboratory setting that could prepare me for a future career.”, “The strong emphasis on undergraduate research at my institution.”, “I have considered being a military contractor, so I'd like to work with them to get some experience.”, “Exploring new advancements for mankind”,

[5] Data from Table 11 were compiled from URAP participant application/registration information rather than from survey responses. Although 60 participants registered for and started the program, only 59 completed the program.

"I want to use my summer to learn and expand my horizons, and I feel that HSAP/URAP is my best opportunity to do that.", "PI encouragement", and "expand knowledge and current skill set."

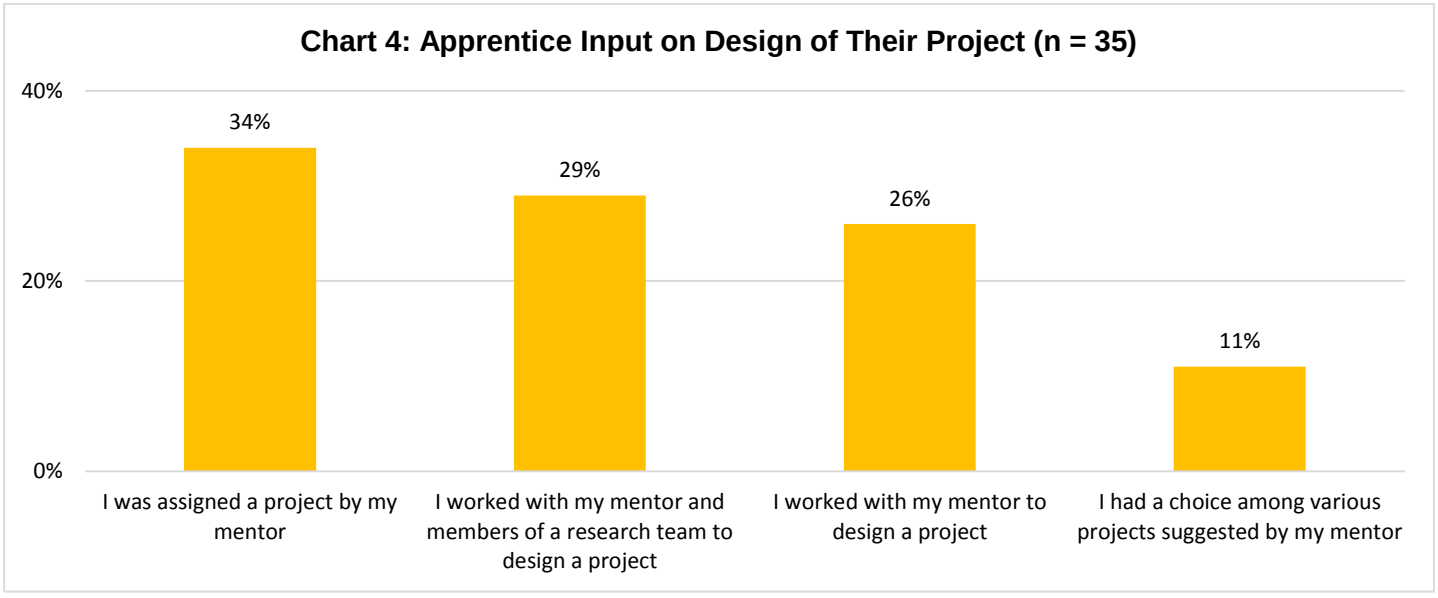
During focus groups, several apprentices mentioned their desire to expand their research skills and interest in STEM as reasons for their participation URAP. When asked why they chose to participate, two said:

> *I'm really interested in doing research this summer, in particular chemistry research, so this program kind of gave me the conduit to research in an area that I was really interested in. Kind of a similar thing, I needed to fill up my summer with, and I hoped it would be a good experience in something I wanted to do in the summer.* (URAP Apprentice)

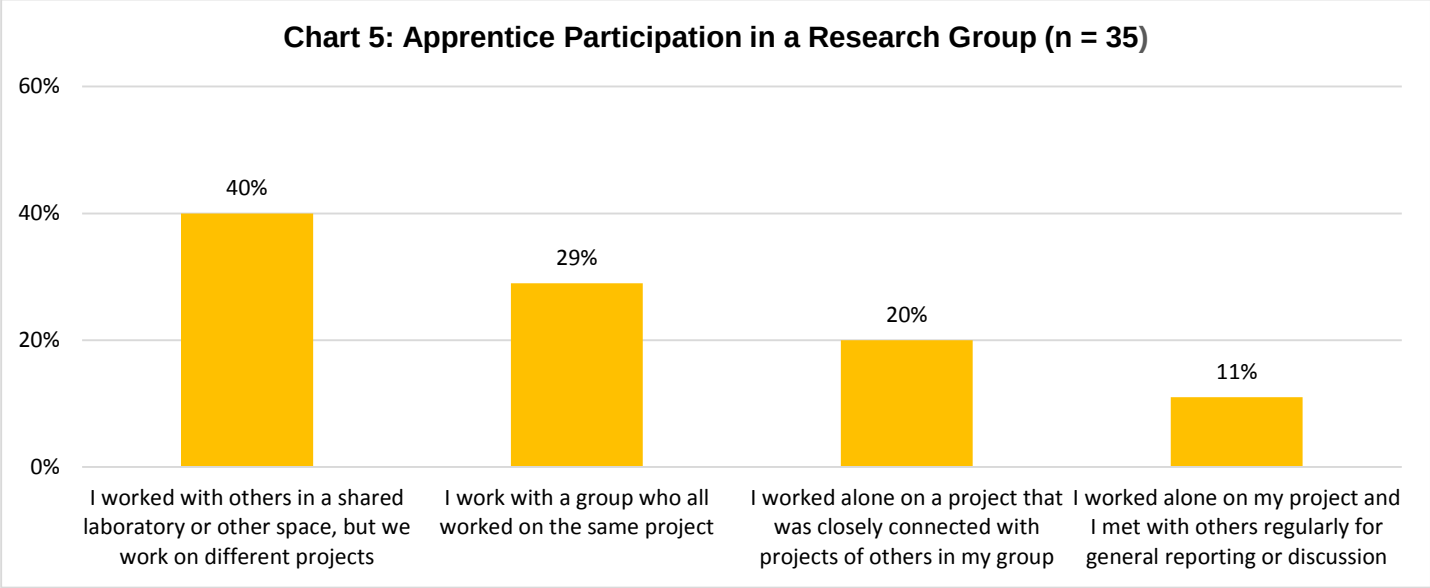
> *I have done past research before. I've done heat transfer in thermal devices. This research I'm doing now is fluid structures, which is a nice mixture of fluid and transfer, so I got this project to make myself a more well-rounded researcher.* (URAP Apprentice)

The URAP Experience

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, 63% of responding apprentices selected science, 23% engineering, 9% technology, and 6% mathematics. As can be seen in Chart 4, roughly equal numbers of apprentices indicated that they were assigned a project for the experience by their mentor (34%), worked with a research team to design a project (29%), or worked with their mentor to design a project (26%). The remaining apprentices reported that they had a choice among various projects suggested by their mentor (11%).



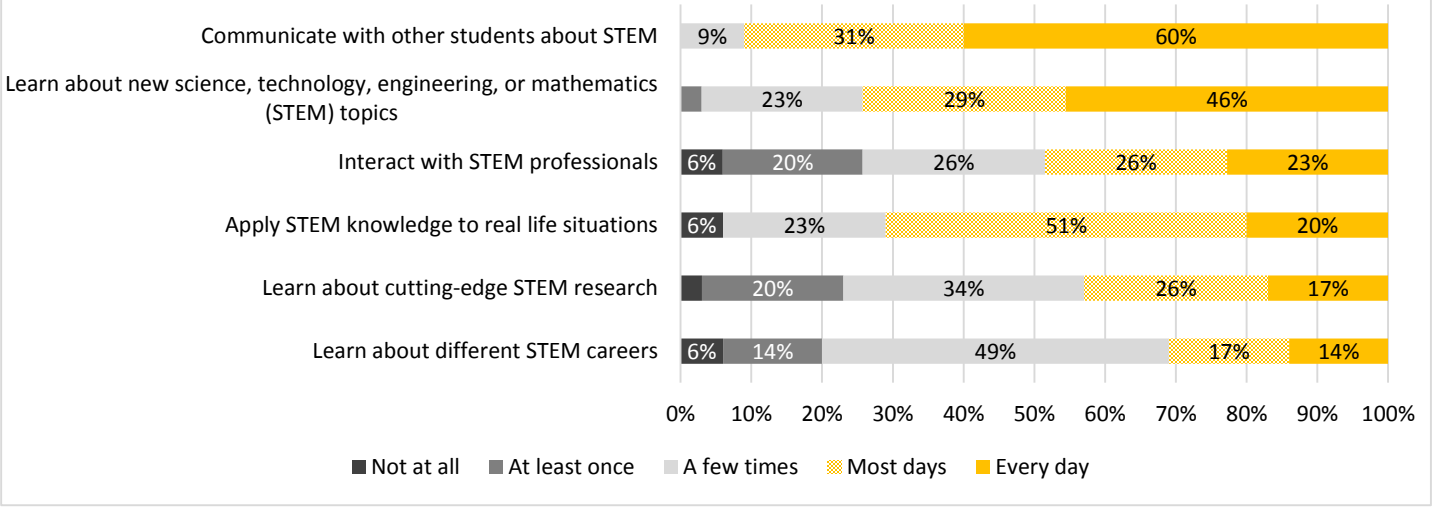
Although most apprentices worked in close proximity with others during their experience (see Chart 5), they tended to work independently on their projects. For example, 40% reported working in a shared laboratory/space with others, but on different projects, 20% indicated working alone on a project closely connected to other projects in their group, and 11% alone with regular meetings for reporting progress. Only 29% indicated they worked with a group on the same project.



Apprentices were also asked about the types of activities they engaged in during their experience. As can be seen in Chart 6, the vast majority of respondents indicated communicating with other students about STEM, learning about new STEM topics, and applying STEM knowledge to real-life situations on most or every day of the experience. Apprentices also reported interacting with STEM professionals, learning about different STEM careers, and learning about cutting-edge STEM research slightly less often, with many students indicating that these activities were done only a few times. Mentors were asked similar questions about the nature of their students' experiences. Overall, their responses paint a similar picture of the URAP experience (responses to these items can be found in Appendix C).[6]

[6] 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 = 35)



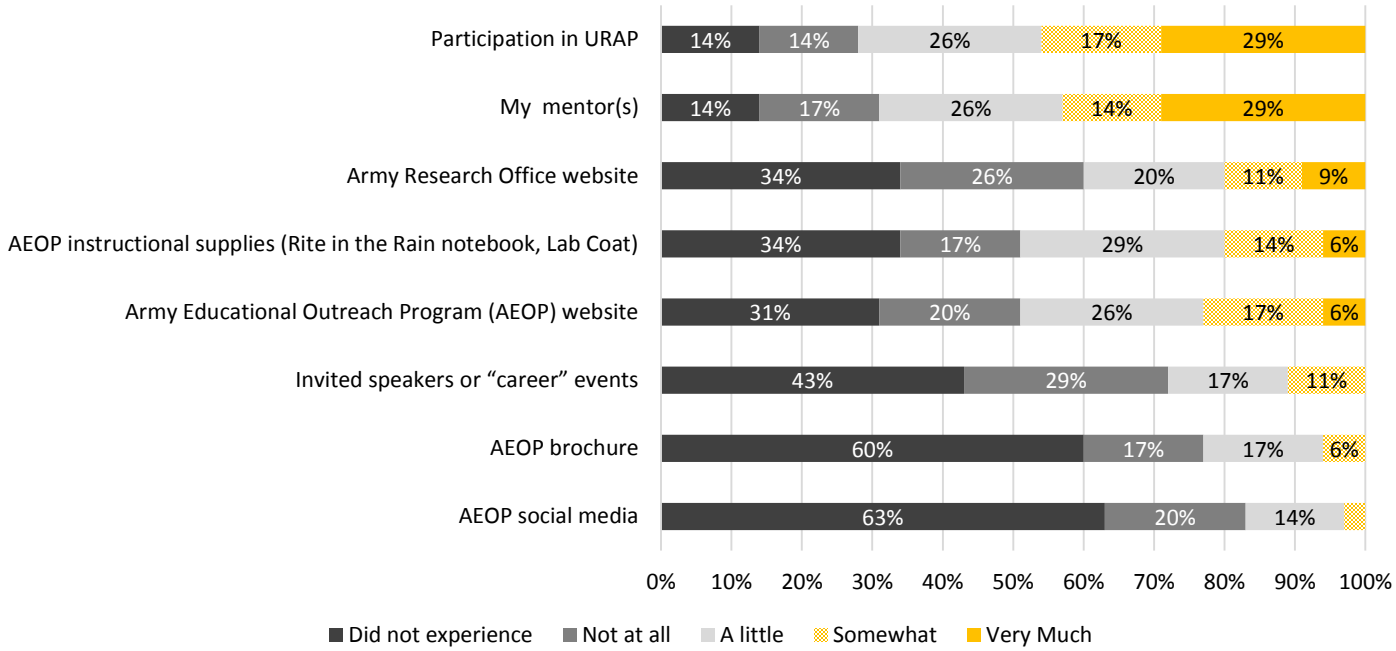
Because increasing the number and diversity of apprentices who pursue STEM careers is one goal of the URAP program, the apprentice questionnaire also asked how many jobs/careers in STEM in general, and STEM jobs/careers in the DoD more specifically, apprentices learned about during their experience. As can be seen in Table 12, the vast majority of apprentices reported learning about at least one STEM job/career. However, 68% of apprentices reported that they had not learned about any DoD STEM jobs/careers during the program.

Table 12. Number of STEM Jobs/Careers Apprentices Learned about During URAP (n = 34)

	STEM Jobs/Careers	DoD STEM Jobs/Careers
None	18%	68%
1	15%	6%
2	18%	12%
3	24%	9%
4	6%	3%
5 or more	21%	3%

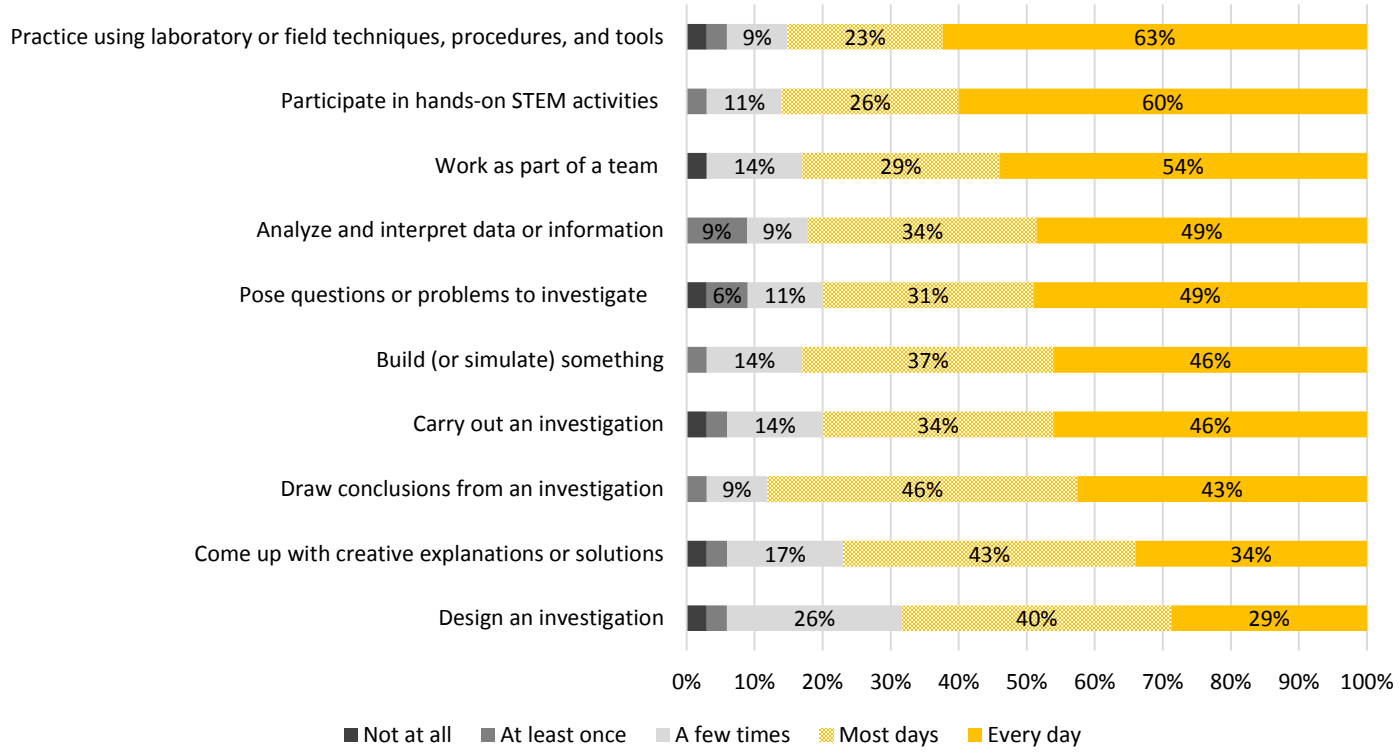
Apprentices were also asked which resources impacted their awareness of DoD STEM careers. Although about two-thirds of apprentices indicated that they did not learn about any DoD STEM careers, they still reported participation in URAP (46%) and their mentors (43%) as being somewhat or very much responsible for impacting their awareness of DoD STEM careers (see Chart 7). 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. However, 80% of mentors reported that participation in URAP was "somewhat" or "very much" useful for increasing apprentice awareness of DoD STEM careers.

Chart 7: Impact of Resources on Apprentice Awareness of DoD STEM Careers (n = 35)



The questionnaire also asked apprentices how often they engaged in various STEM practices during URAP. Results indicate that apprentices were very actively engaged in doing STEM during the program (see Chart 8). For example, 86% of responding apprentices indicated practicing using laboratory or field techniques, procedures, and tools on most days or every day; 86% reported participating in hands-on activities; 83% noted working as part of a team; and 83% reported building/simulating something. In addition, apprentices indicated being integrally involved the work of STEM on most days or every day, including posing questions to investigate (80%), designing investigations (69%), carry out investigations (80%), analyzing or interpreting data (83%), and drawing conclusions from an investigation (89%). Data from the URAP mentor questionnaire generally aligned with data from the apprentice questionnaire.

Chart 8: Apprentice Engagement in STEM Practices in URAP (n = 35)



A composite score[7] was calculated for each of these two sets of items, the first titled "Learning about STEM in URAP,"[8] and the second "Engaging in STEM Practices in URAP."[9] Response categories were converted to a scale of 1 = "Not at all" to 5 = "Every day" and the average across all items in the scale was calculated. The composite scores were used to test whether there were differences in apprentice experiences by gender and race/ethnic group (minority vs. non-minority apprentices). There were no significant differences by gender or race/ethnicity.

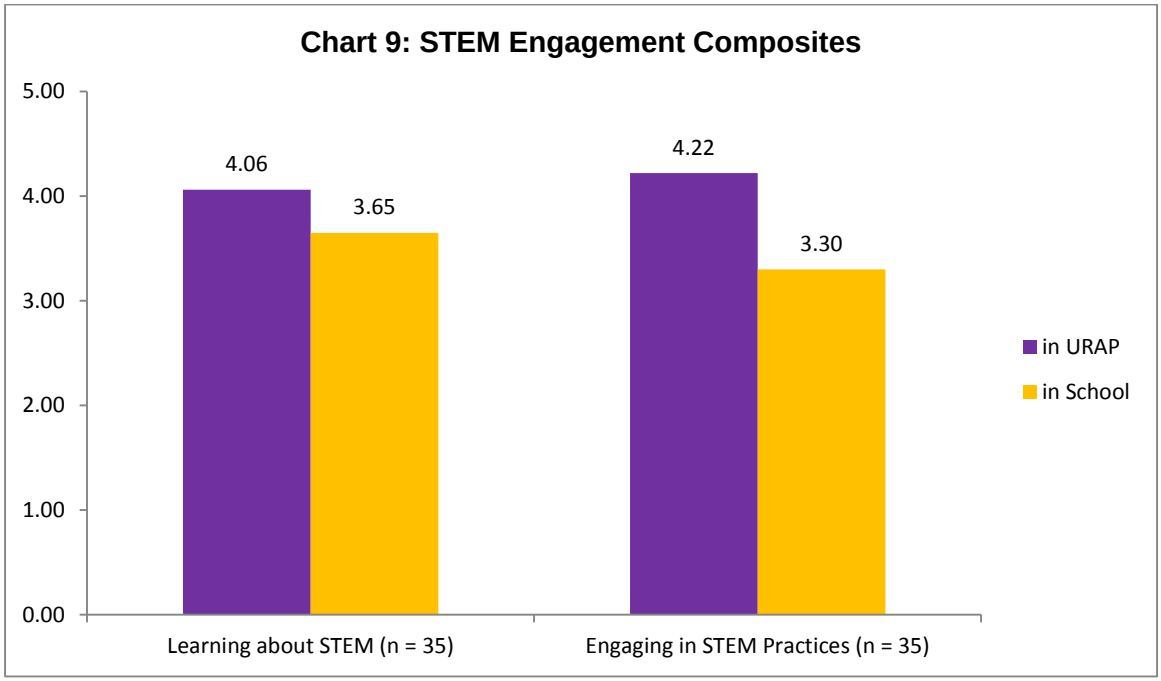
To examine how the URAP experience compares to their typical school experience, apprentices were asked how often they engaged in the same activities in school (individual item responses can be found in Appendix B). These responses

[7] 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.

[8] The Cronbach's alpha reliability for these 6 items was 0.712.

[9] The Cronbach's alpha reliability for these 10 items was 0.918.

were also combined into two composite variables: "Learning about STEM in School,"[10] and "Engaging in STEM Practices in School"[11] 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 (moderate and large effects[12] of d = 0.718 standard deviations and d = 1.308 standard deviations, respectively).[13] 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 play a critical role in the URAP program. The nature and quality of mentoring is a critical factor in maximizing apprentice participation in these opportunities, and sustaining or inspiring their interest in future STEM work. Consequently, both the apprentice and mentor questionnaires asked about the role of mentors in the program. Because of the nature of the program, it is not surprising that 13% of mentors responding to the questionnaire indicated working

[10] The Cronbach's alpha reliability for these 5 items was 0.863.

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

[12] 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.

[13] Two-tailed independent samples t-tests: Learning about STEM, $t(34) = 4.25$, $p < 0.001$; Engaging in STEM Practices, $t(34) = 7.74$, $p < 0.001$

with one apprentice and 80% reported working with two apprentices. Only one mentor reported working with more than two apprentices; this mentor worked with a group of six.

Mentors were asked whether or not they used a number of strategies when working with apprentices.[14] These strategies comprised five main areas of effective mentoring: [15]

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

Large proportions of responding mentors used each of several strategies to help make the learning activities relevant to students (see Table 13). For example, all mentors reported finding out about students' backgrounds and interests at the beginning of the program. In addition, nearly all reported making explicit provisions for students who wished to carry out independent studies (94%) and giving them real-life problems (94%). A large majority also encouraged students to suggest new readings, activities, or projects (75%), or selected readings or activities that related to students' backgrounds (69%), and many tried to help students become aware of the roles STEM plays in their everyday lives (69%). Fewer asked students to relate outside events or activities to topics covered in the program (56%) or helped them understand how STEM can help them improve their communities (47%).

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

[15] 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 = 15-16)	
Item	**Questionnaire Respondents**
Finding out about students' backgrounds and interests at the beginning of the program	100%
Giving students real-life problems to investigate or solve	94%
Making explicit provisions for students who wish to carry out independent studies	94%
Encouraging students to suggest new readings, activities, or projects	75%
Selecting readings or activities that relate to students' backgrounds	69%
Helping students become aware of the roles STEM plays in their everyday lives	69%
Asking students to relate outside events or activities to topics covered in the program	56%
Helping students understand how STEM can help them improve their communities	47%

Similarly, mentors reported using a variety of strategies to support the diverse needs of students as learners. As can be seen in Table 14, 93% of mentors reported each of treating all students the same way, regardless of gender or race/ethnicity; using gender neutral language; and providing extra readings, activities, or other support for students who lack essential background knowledge or skills. Many mentors used diverse teaching/mentoring activities (80%), helped students find additional support if needed (80%), and tried to find out about student learning styles (60%).

Table 14. Mentors Using Strategies to Support the Diverse Needs of Students as Learners (n = 15)	
Item	**Questionnaire Respondents**
Interacting with all students in the same way regardless of their gender or race and ethnicity	93%
Using gender neutral language	93%
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	93%
Using diverse teaching/mentoring activities to address a broad spectrum of students	80%
Directing students to other individuals or programs if I can only provide limited support	80%
Finding out about students' learning styles at the beginning of the program	60%
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	40%

Mentors reported using a variety of strategies to support students' development of collaboration and interpersonal skills (see Table 15). For example, all mentors responding to the questionnaire indicated having students explain difficult ideas to others and work as members of a team on activities or projects. The vast majority also had students participate in giving and receiving feedback (94%), listen to the ideas of others with an open mind (94%), pay attention to the feelings of all team members (81%), and tell others about their backgrounds and interests (75%).

Table 15. Mentors Using Strategies to Support Student Development of Collaboration and Interpersonal Skills (n = 16)	
Item	**Questionnaire Respondents**
Having students explain difficult ideas to others	100%
Having students work on collaborative activities or projects as a member of a team	100%
Having students participate in giving and receiving feedback	94%
Having students listen to the ideas of others with an open mind	94%
Having students pay attention to the feelings of all team members	81%
Having students tell others about their backgrounds and interests	75%
Having students develop ways to resolve conflict and reach agreement among the team	63%
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	56%

When asked about strategies used to support student engagement in authentic STEM activities, a large proportion of URAP mentors noted using of each of these approaches (see Table 16). All responding mentors reported demonstrating the use of laboratory/field techniques, procedures, and tools; giving constructive feedback to improve students' STEM competencies; allowing students to work independently as appropriate for their self-management abilities and STEM competencies; encouraging students to seek support from other team members; and encouraging opportunities in which students could learn from others. Other widely used strategies were helping students practice STEM skills with supervision (93%), teaching/assigning readings about specific STEM subject matter (87%), and having students access and critically review technical texts or media (87%).

Table 16. Mentors Using Strategies to Support Student Engagement in "Authentic" STEM Activities (n = 15)	
Item	**Questionnaire Respondents**
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	100%
Giving constructive feedback to improve students' STEM competencies	100%
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	100%
Encouraging students to seek support from other team members	100%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	100%
Helping students practice STEM skills with supervision	93%
Teaching (or assigning readings) about specific STEM subject matter	87%
Having students access and critically review technical texts or media to support their work	87%

The last series of items about mentoring strategies focused on supporting students' STEM educational and career pathways (see Table 17).[16] Nearly all of the responding mentors reported asking students about their educational and career interests (94%). Many also indicated critically reviewing students' résumé, application, or interview preparations (87%); providing guidance to students about educational pathways that would prepare them for a STEM career (81%); and sharing their own experiences, attitudes, and values about STEM (80%).

However, given the URAP program's goals of broadening the talent pool in STEM fields, it is somewhat surprising that two-thirds or fewer of the responding mentors reported discussing STEM careers within the DOD or government (53%), helping students build effective STEM networks (53%), or highlighting the under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM (33%). In addition, given the interest in having apprentices graduate into other AEOP opportunities, it is also surprising that only 44% of mentors recommended other AEOP programs to apprentices. Similarly in 2013, only half of mentor interviewees reported passing out AEOP brochures to their apprentices during the program.

Table 17. Mentors Using Strategies to Support Student STEM Educational and Career Pathways (n = 45-47)

Item	Questionnaire Respondents
Asking about students' educational and career interests	94%
Critically reviewing students' résumé, application, or interview preparations	87%
Providing guidance about educational pathways that would prepare students for a STEM career	81%
Sharing personal experiences, attitudes, and values pertaining to STEM	80%
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	73%
Recommending extracurricular programs that align with students' educational goals	63%
Discussing STEM career opportunities with the DoD or other government agencies	53%
Recommending student and professional organizations in STEM	53%
Helping students build effective STEM networks	53%
Recommending Army Educational Outreach Programs that align with students' educational goals	44%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	33%

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

Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	33%

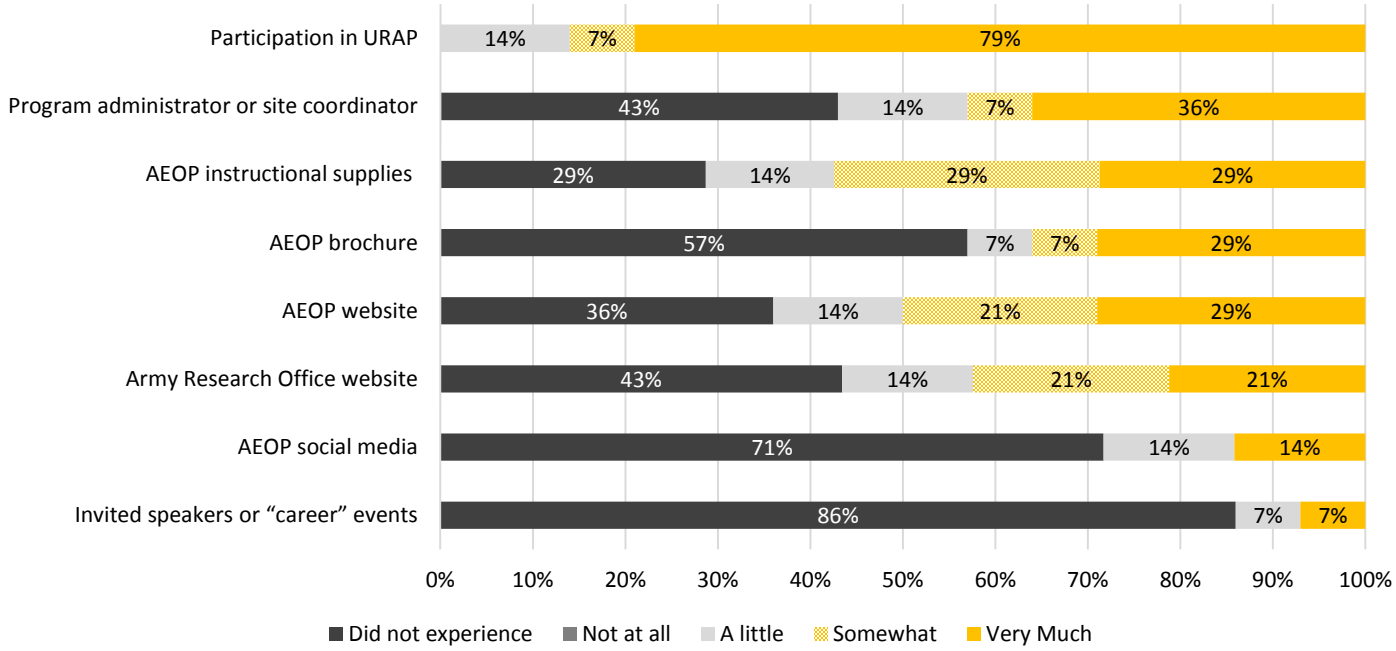
A separate item on the mentor questionnaire asked which of the AEOP programs mentors explicitly discussed with their apprentices during URAP. Not surprisingly, the most frequently discussed program was URAP (87%), as can be seen in Table 18. About two-thirds of the responding mentors indicated that they discussed AEOP with their students, but did not discuss any specific program. Of the other programs which were explicitly discussed, the most commonly mentioned were SMART (43%) and NDSEG (36%).

Table 18. Mentors Explicitly Discussing AEOPs with Apprentices (n = 14-15)

Item	Questionnaire Respondents
Undergraduate Research Apprenticeship Program (URAP)	87%
Science Mathematics, and Research for Transformation (SMART) College Scholarship	43%
National Defense Science & Engineering Graduate (NDSEG) Fellowship	36%
College Qualified Leaders (CQL)	21%
GEMS Near Peers	14%

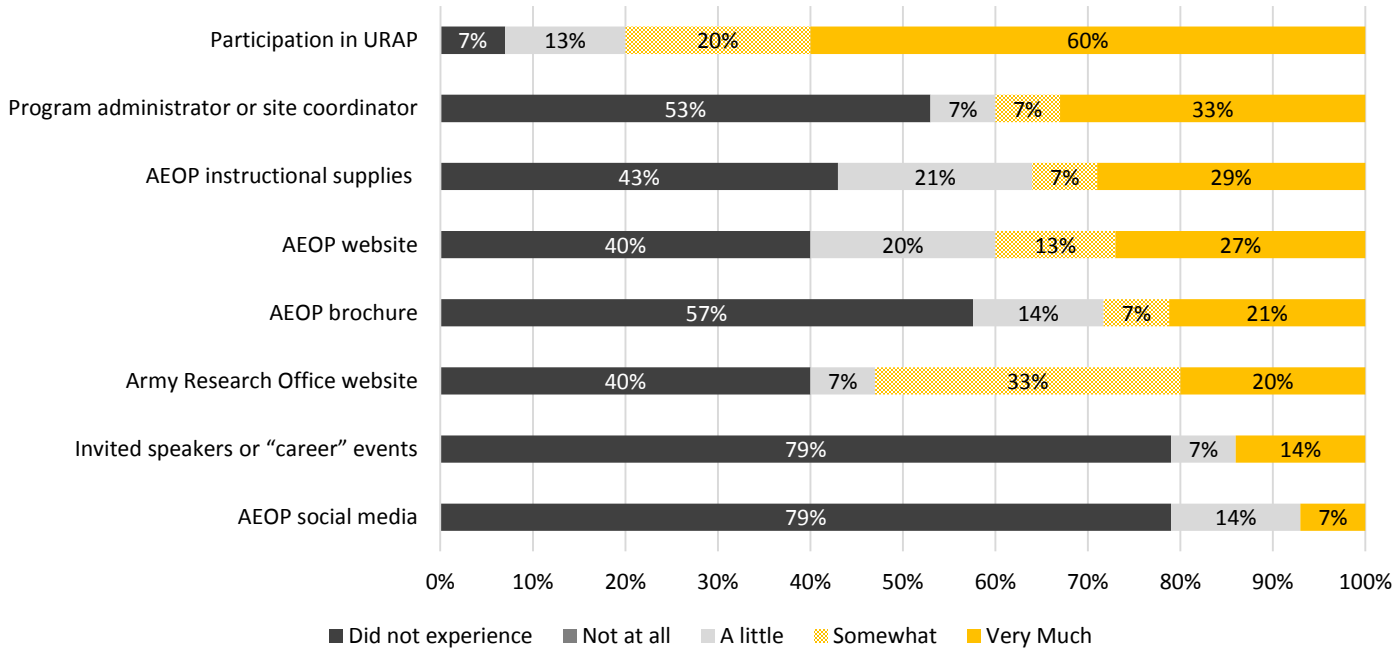
Mentors were also asked how useful various resources were in their efforts to expose students to the different AEOPs. As can be seen in Chart 8, participation in URAP (79%) was the only resource which more than half of responding mentors rated as "very much" useful. Beyond participation in URAP, respondents 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, AEOP social media, or invited speakers or career events.

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



Mentors were also asked how useful these resources were for exposing apprentices to DoD STEM careers (see Chart 11). As with the previous item, mentors were most likely to rate participation in URAP as useful, with 60% selecting "very much." Again, as with exposing students to AEOPs, less than a third 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 40-79% of responding mentors.

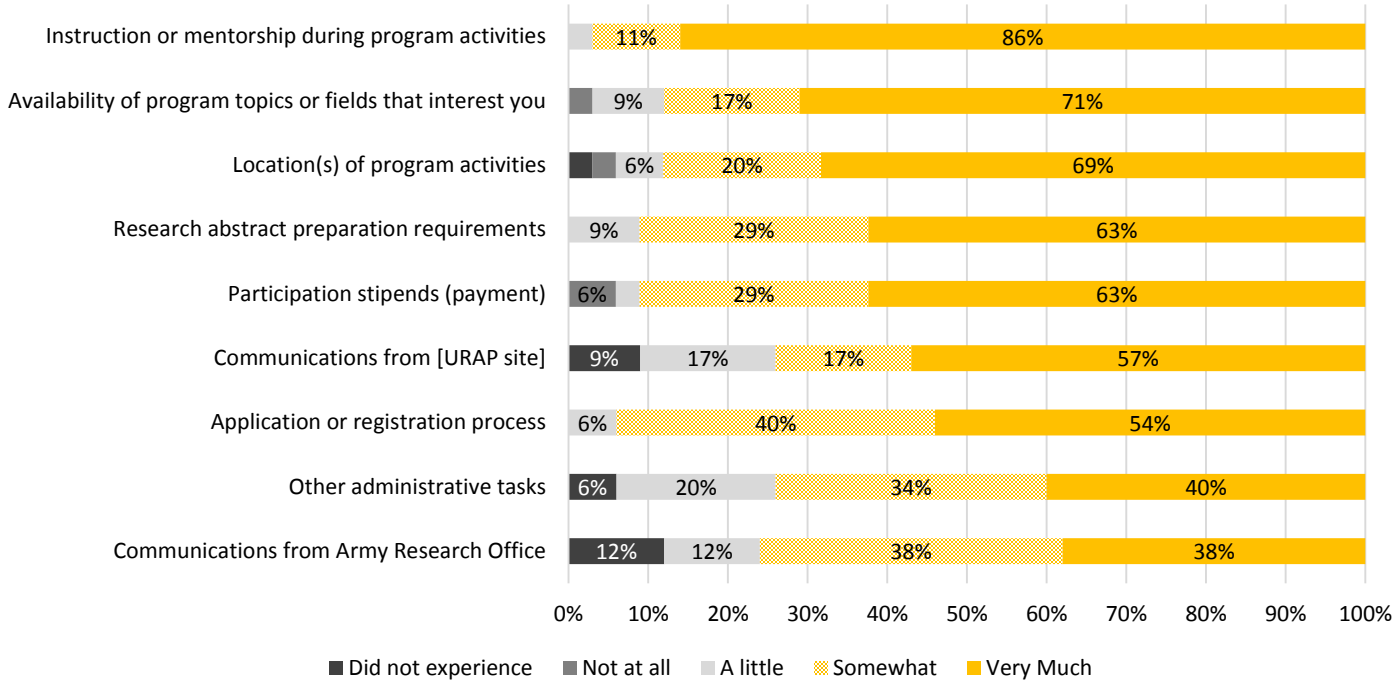
Chart 11: Usefulness of Resources for Exposing Apprentices to DoD STEM Careers (n = 14-15)



Satisfaction with URAP

Apprentices and mentors were asked how satisfied they were with a number of features of the URAP program. As can be seen in Chart 12, the vast majority of responding apprentices were somewhat or very much satisfied with each of the listed program features. For example, more than 90% of responding participants reported being at least somewhat satisfied with instruction or mentorship during program activities (97%), the application or registration process (94%), the availability of interesting program topics or fields (92%), and the participant stipends (92%).

Chart 12: Apprentice Satisfaction with URAP Program Features (n = 34-35)



Apprentices were also asked about their satisfaction with access to their mentor. As can be seen in Table 19, 83% of responding apprentices indicated their mentor was always available, and 11% 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.

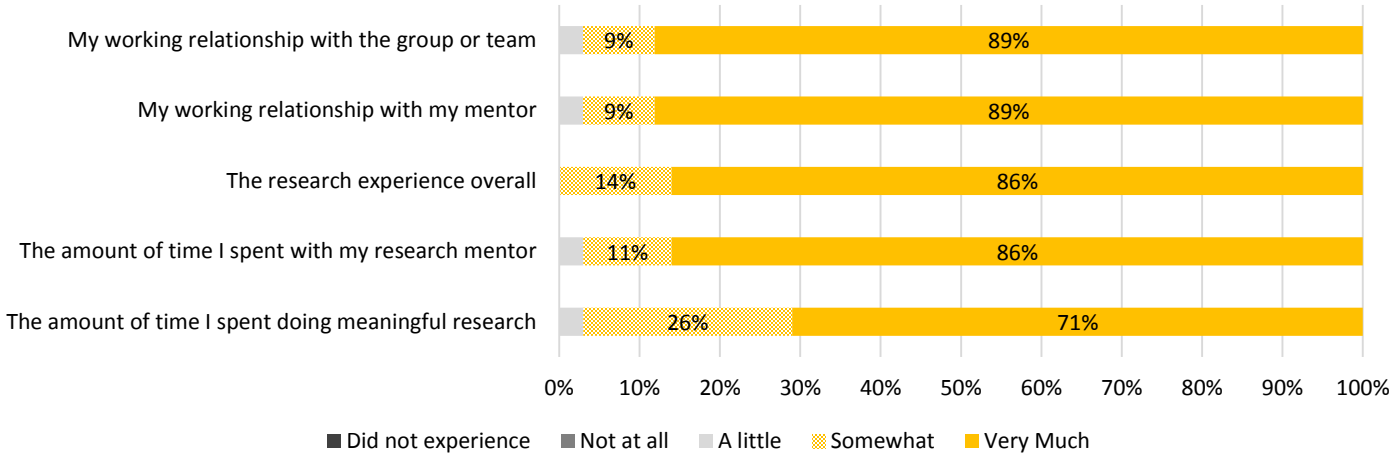
Table 19. Apprentice Reports of Availability of Mentors (n = 35)

Item	Questionnaire Respondents
The mentor was always available	83%
The mentor was available more than half of the time	11%
The mentor was available about half of the time of my project	6%
The mentor was available less than half of the time	0%

Another question asked apprentices to rate their satisfaction with their mentors and the research experience (see Chart 13). 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 = 35)



An open-ended item on the questionnaire asked apprentices about their overall satisfaction with their URAP experience. The responses were overwhelmingly positive. Of the 27 apprentices who answered this question, all but one commented on only positive aspects of the program (this one exception also referenced the need to attend to suggestions for improvement). These responses were sometimes as simple as, "I was very satisfied with the program." Other times, apprentices provided more detail about what they enjoyed about the program, as in the following examples:

> *URAP provided me with the opportunity to work in a real research environment. I was able to interact with graduate students, faculty, and other URAP participants to learn more about what it means to do research. Because of URAP, I intend to pursue a graduate degree in engineering.* (URAP apprentice)

> *It's been an extraordinary experience for me. At first, I wasn't sure if I really want to go to graduate school and do research for the rest of my life. This program gives me the opportunity to gain a first-hand experience of what*

"URAP provided me with the opportunity to work in a real research environment. I was able to interact with graduate students, faculty, and other URAP participants to learn more about what it means to do research. Because of URAP, I intend to pursue a graduate degree in engineering." -- URAP Apprentice

doing research really is like and helps me decide the field of research that I will focus on in graduate school. (URAP apprentice)

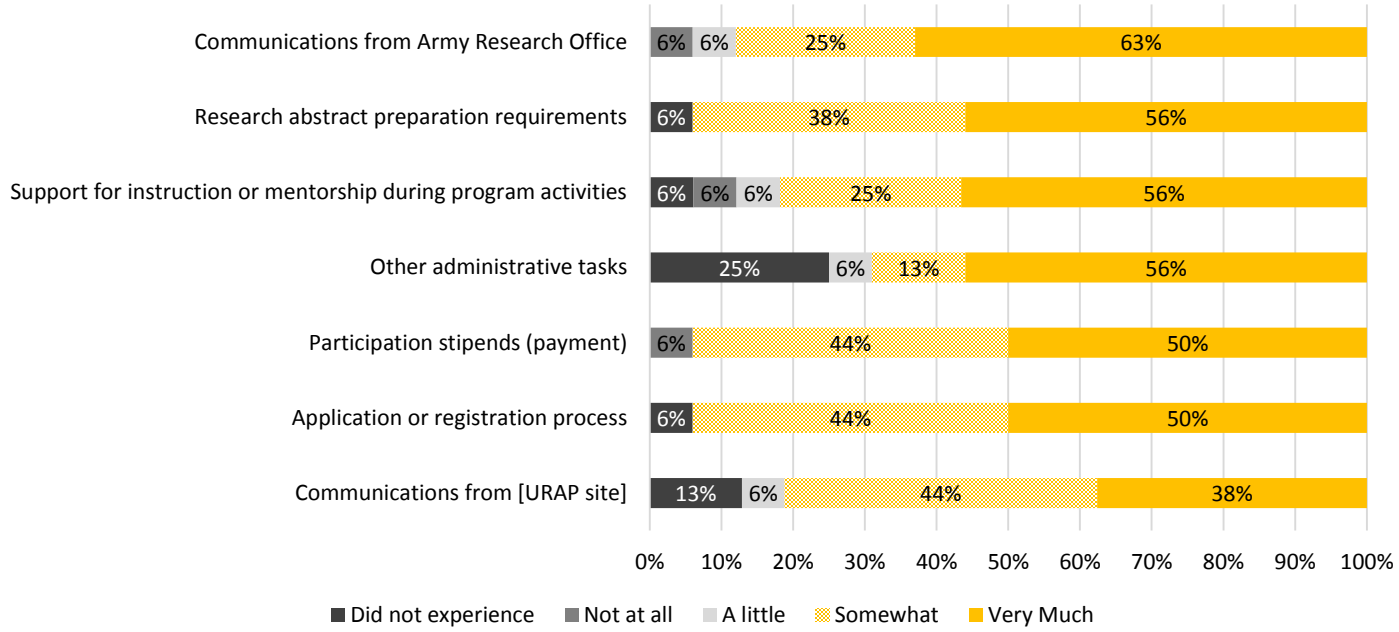
The URAP experience was a phenomenal experience for me. I learned new forms of technologies, science, and how to combine the two in research. The professionals I worked with were great people and helped and informed me throughout the entire research. I was timid at first, but from day one I was accepted and encouraged to use my ideas and work alongside everyone. I recommend this program for any and every one. (URAP apprentice)

When asked how the program could be improved, 26 apprentices answered, though 4 of these (15%) indicated that no improvements were necessary. The most common theme in the responses to this open-ended item, described by 14 apprentices (54%) related to increasing communication between students and mentors/program directors. Several respondents mentioned simply wanting "better communication," while others specified areas such as application approval and mentor assignment, initial information related to the research topic, or guidelines for presentations. Other suggestions included increasing opportunities for research dissemination (23%), increasing funding/resources for apprentices (23%), allowing for more access to and information about the Army and other AEOPs (15%), and utilizing more and diversified methods for advertising and marketing to future participants (12%). In contrast, improvements suggested by apprentices in 2013 were focused on increasing the capacity of URAP to reach more students by improving outreach, and/or improving the visibility of the URAP program.

Mentors also reported being somewhat or very much satisfied with the program components they experienced (see Chart 14). For example 94% were at least somewhat satisfied with each of the research abstract preparation requirements, the application or registration process, and participation stipends. With the exception of other administrative tasks (69%), at least 8 in 10 responding mentors indicated being at least somewhat satisfied with all other program features.

"It's been an extraordinary experience for me….This program gives me the opportunity to gain a first-hand experience of what doing research really is like and helps me decide the field of research that I will focus on in graduate school." -- URAP Apprentice

Chart 14: Mentor Satisfaction with URAP Program Features (n = 16)



As with the apprentice questionnaire, the mentor questionnaire included open-ended items asking for opinions about the program. One item asked mentors to identify the three most important strengths of URAP; 13 mentors responded to this question. Although several important aspects of the program were listed, the most frequently described was providing students the opportunity to engage in hands-on research (8 mentors, or 62%), characterized by responses such as "exposure to leading-edge research methods" and "student participation in academic research." This sentiment was echoed in the mentor focus group. As one mentor said:

> *Exposing the undergraduates to research and getting them excited about research and pursuing a future career in research is the largest value added to these types of programs.* (URAP mentor)

Other responses to this open-ended questionnaire item about strengths of the program included URAP apprentice stipends (46%); student opportunities for learning (38%); the capacity to network with graduate students, professors, and STEM professionals (38%); and increasing awareness of STEM opportunities with DoD (15%).

Mentors were also asked to note three ways in which URAP should be improved for future participants. Of the 11 individuals who responded to this question, comments were relatively evenly split across several areas. Several mentors recommended that the program include a provision for students to be able to extend their research (36%). Others suggested increasing funding (to include more students and to provide students with greater stipends) (27%), providing a forum for students to share their research findings with others (27%), improving communication (18%), and increasing opportunities for undergraduate networking (18%).

Lastly, mentors were asked to share their overall satisfaction with their URAP experience. For the 8 mentors who responded to this question, each response was largely 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:

> *I am very satisfied with my experience with the URAP program. The students I have been able to mentor as a result of their participation in URAP have made meaningful contributions to the ARO research and will be encouraged to remain in the research group as undergraduate or graduate research assistants.* (URAP mentor)

One mentor's response, while mostly positive, also recommended that the URAP program should foster "a community of scholars" by creating weekly assignments and more structured mentoring activities.

In summary, findings from the Actionable Program Evaluation indicate that URAP is having increasing success in providing a program that actively engages apprentices in authentic STEM experiences. Once in the program, apprentices are learning about STEM job/careers, with most mentors crediting student participation in the program as useful in this process. DoD STEM jobs/careers, however, have not been emphasized equally across program sites. In an attempt to catalyze continued student engagement in the AEOP programs, mentors also discussed other AEOPs with apprentices, with URAP and CQL being the most commonly discussed AEOPs.

The URAP program actively engages apprentices in learning about STEM and in STEM practices, more than they would typically experience in school. As part of this engagement, large proportions of mentors employed strategies to help make the learning activities relevant to 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. Overall, apprentices and mentors were somewhat or very much satisfied with the URAP program.

"Exposing the undergraduates to research and getting them excited about research and pursuing a future career in research is the largest value added to these types of programs." -- URAP Mentor

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.[17] 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 can be seen in Chart 15, nearly all responding apprentices reported gains in their STEM knowledge as a result of the URAP program, with large majorities indicating large or extreme gains in each area. For example, large or extreme gains were reported by 95% of apprentices in their knowledge of what everyday research work is like in STEM, and by 94% 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 (91%); knowledge of a STEM topic or field in depth (89%); and knowledge of research processes, ethics, and rules for conduct in STEM (80%). Mentors reported similar impacts on their apprentices' STEM knowledge (see Appendix C).

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

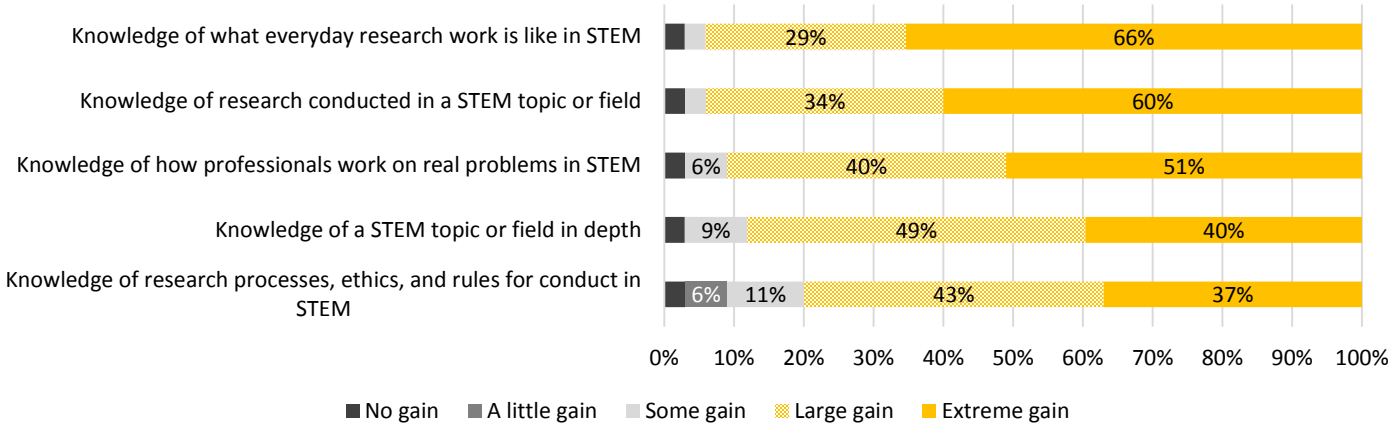
Committee on STEM Education. (2013*). Federal Science, Technology, Engineering, and Mathematics (STEM) education 5-year strategic plan: A report from the Committee on STEM Education, National Science and Technology Council.* Washington, DC: The White House, Office of Science and Technology Policy.

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 on STEM Knoweldge (n = 108-109)



The apprentice questionnaire items were combined into a composite variable[18] 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.

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 nearly all competencies, with the exception of using computer-based models to investigate cause and effect relationships of a simulated phenomenon (45%) and making a model to represent the key features and functions of an observed phenomenon (41%). Most apprentices reported large or extreme gains in their ability to decide what type of data to collect in order to answer a question (81%), carry out procedures for an investigation and recording data accurately (77%), ask a question (about a phenomenon) that can be answered with one or more investigations (73%), identify the limitations of data collected in an investigation (73%), ask questions to understand the data and interpretations others use to support their explanations (73%), and design procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected (72%).

[18] The Cronbach's alpha reliability for these 5 items was 0.939.

Table 20. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Science Practices (n = 22)	
Item	**Questionnaire Respondents**
Deciding what type of data to collect in order to answer a question	81%
Carrying out procedures for an investigation and recording data accurately	77%
Asking a question (about a phenomenon) that can be answered with one or more investigations	73%
Identifying the limitations of data collected in an investigation	73%
Asking questions to understand the data and interpretations others use to support their explanations	73%
Designing procedures for investigations, including selecting methods/tools that are appropriate for the data to be collected	72%
Displaying numeric data from an investigation in charts/graphs to identify patterns/relationships	68%
Asking questions based on observations of real-world phenomena	68%
Supporting a proposed explanation (for a phenomenon) with data from investigations	68%
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	68%
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	64%
Supporting a proposed explanation with relevant STEM knowledge	64%
Using data or interpretations from other researchers or investigations to improve an explanation	64%
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	64%
Communicating information about your investigations/explanations in different formats	63%
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	59%
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	55%
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	55%
Integrating information from multiple sources to support your explanations of phenomena	55%
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	55%
Testing how changing one variable affects another variable, in order to understand relationships between variables	50%
Using mathematics or computers to analyze numeric data	50%
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	45%
Making a model to represent the key features and functions of an observed phenomenon	41%

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 quite similar to those reporting on science-related practices. Again, more than half of respondents indicated large or extreme gains in all competencies except one, using data from investigations to defend an argument that conveys how a solution meets design criteria (46%). When asked about apprentices' gains in science and engineering practices, mentors reported similar results.

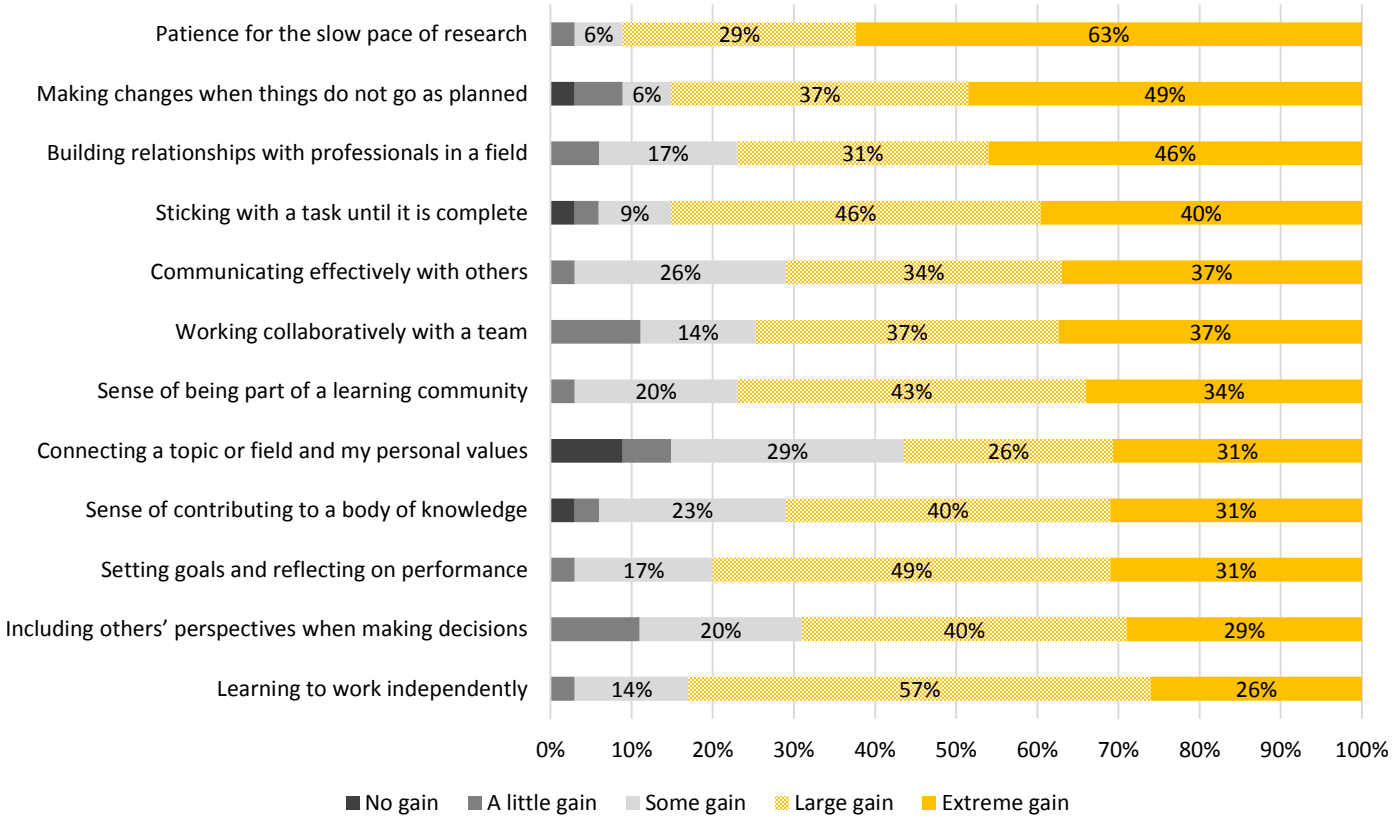
Table 21. Apprentices Reporting Large or Extreme Gains in their STEM Competencies – Engineering Practices (n = 13)	
Item	**Questionnaire Respondents**
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	92%
Defining a problem that can be solved by developing a new or improved object, process, or system	85%
Making a model that represents the key features or functions of a solution to a problem	84%
Designing procedures for investigations, including selecting appropriate methods/tools for the data	84%
Deciding what type of data to collect in order to test if a solution functions as intended	77%
Identifying the limitations of the data collected in an investigation	77%
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	77%
Reading technical or scientific texts to learn about the natural or designed worlds	77%
Identifying the strengths/limitations of data, interpretations, or arguments presented in technical or scientific texts	76%
Integrating information from multiple sources to support your solution to a problem	76%
Asking questions to understand the data and interpretations others use to support their solutions	70%
Identifying real-world problems based on social, technological, or environmental issues	69%
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	69%
Carrying out procedures for an investigation and recording data accurately	69%
Deciding what additional data or information may be needed to find the best solution to a problem	69%
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	62%
Using computer-based models to investigate cause and effect relationships of a simulated solution	61%
Using data or interpretations from other researchers or investigations to improve a solution	61%
Communicating information about your design processes and/or solutions in different formats	61%
Displaying numeric data in charts or graphs to identify patterns and relationships	58%
Supporting a proposed solution (for a problem) with data from investigations	54%
Considering alternative interpretations of data when deciding if a solution functions as intended	53%
Using mathematics or computers to analyze numeric data	53%
Using data from investigations to defend an argument that conveys how a solution meets design criteria	46%

Composite scores were calculated for each set of practices items[19] 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.

The apprentice questionnaire also asked apprentices 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, more than three-fourths of responding apprentices reported large or extreme gains for several of these skills, patience for the slow pace of research (92%), sticking with a task until it is complete (86%), making changes when things do not go as planned (86%), learning to work independently (83%), setting goals and reflecting on performance (80%), building relationships with professionals in a field (77%), and having a sense of being part of a learning community (77%). 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.

[19] 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.

Chart 16: Apprentice Report of Impacts on 21st Century Skills (n = 35)



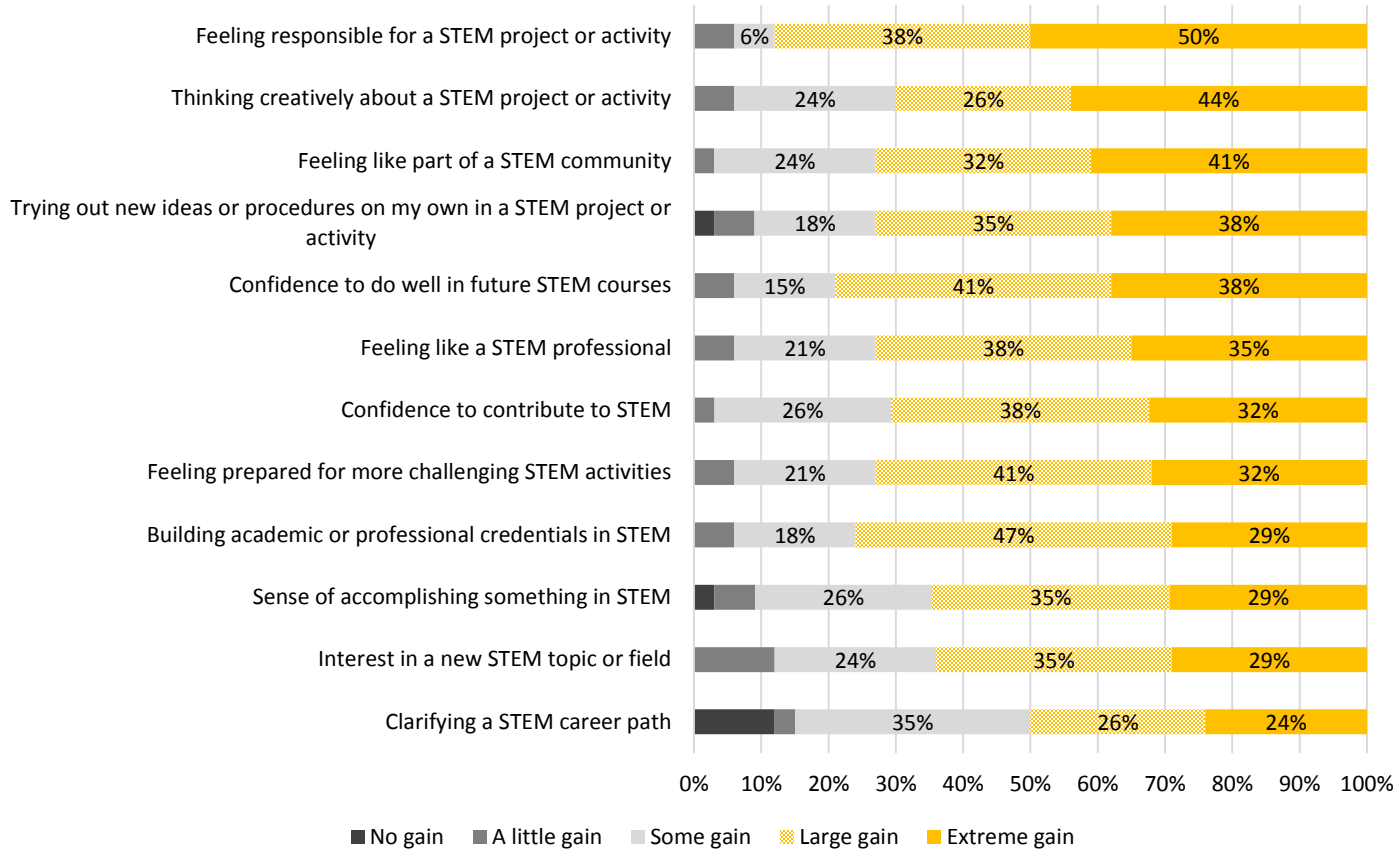
STEM Identity and Confidence

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.[20] Consequently, the apprentice questionnaire included a series of items intended to measure 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, 88% of responding apprentices reported a large or extreme gain in feeling responsible for a STEM project or activity and 79% reported gains in their confidence to do well in future STEM courses. Similarly, substantial proportions of apprentices reported large or extreme gains in their ability to build academic or professional credentials in STEM (76%), their preparedness for more challenging STEM activities (73%), feeling like a STEM professional (73%), feeling like part of a STEM community (73%), and trying out new ideas or procedures on their

[20] 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.

own in a STEM project (73%). Comparing results on the composite created from these items,[21] there were no differences in impact based on gender or race/ethnicity.

Chart 17: Apprentice Report of Impacts on STEM Identity (n = 34)



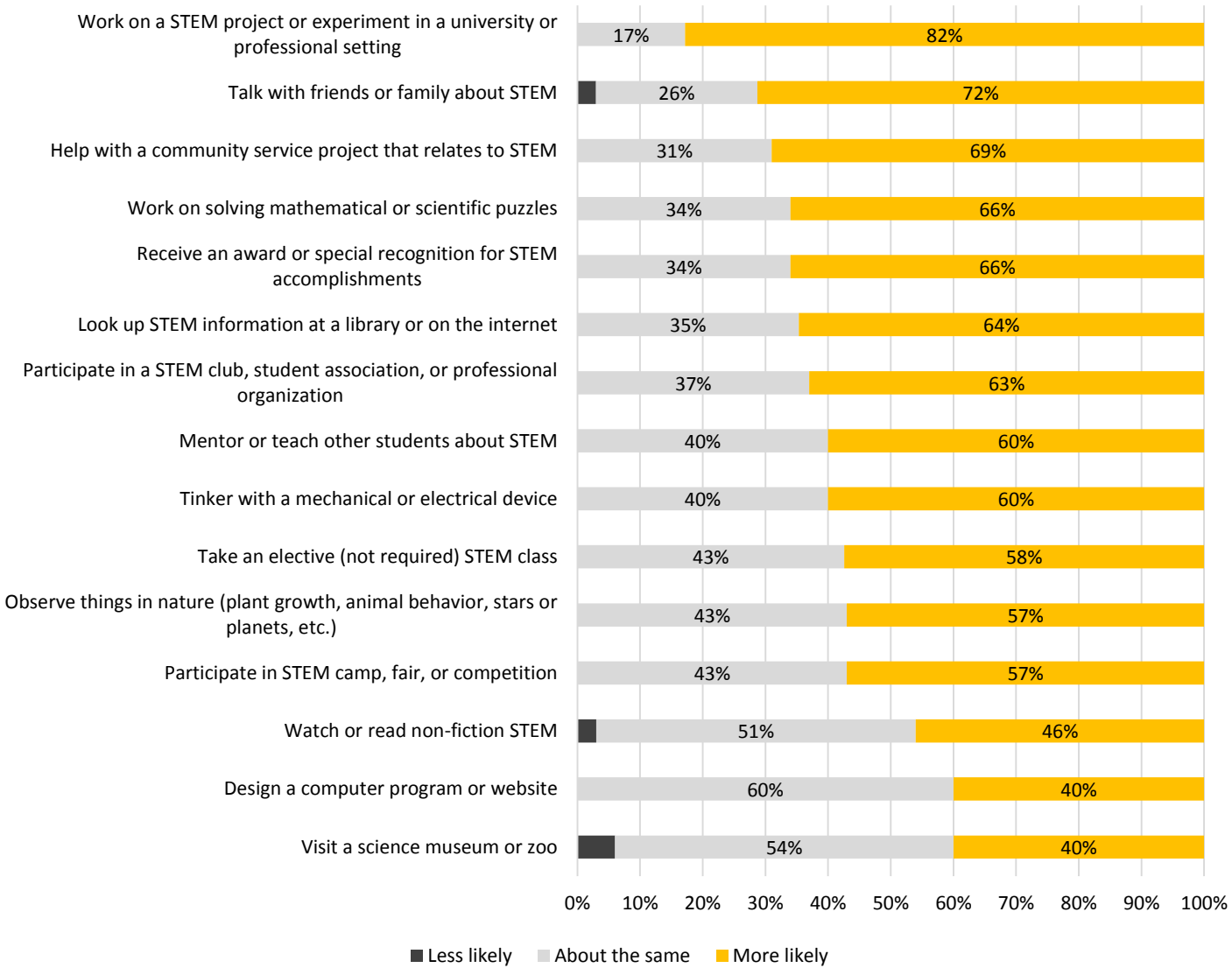
Interest and Future Engagement in STEM

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, 82% reported being more likely to work on a STEM project or experiment in a university or professional setting, 72% to talk with friends or family about STEM, and 69% to help with a community service project

[21] The Cronbach's alpha reliability for these 8 items was 0.932.

related to STEM. A composite score was created from these items,[22] and composite scores were compared across subgroups of apprentices. There were no statistically significant differences for these composites by gender or race/ethnicity.

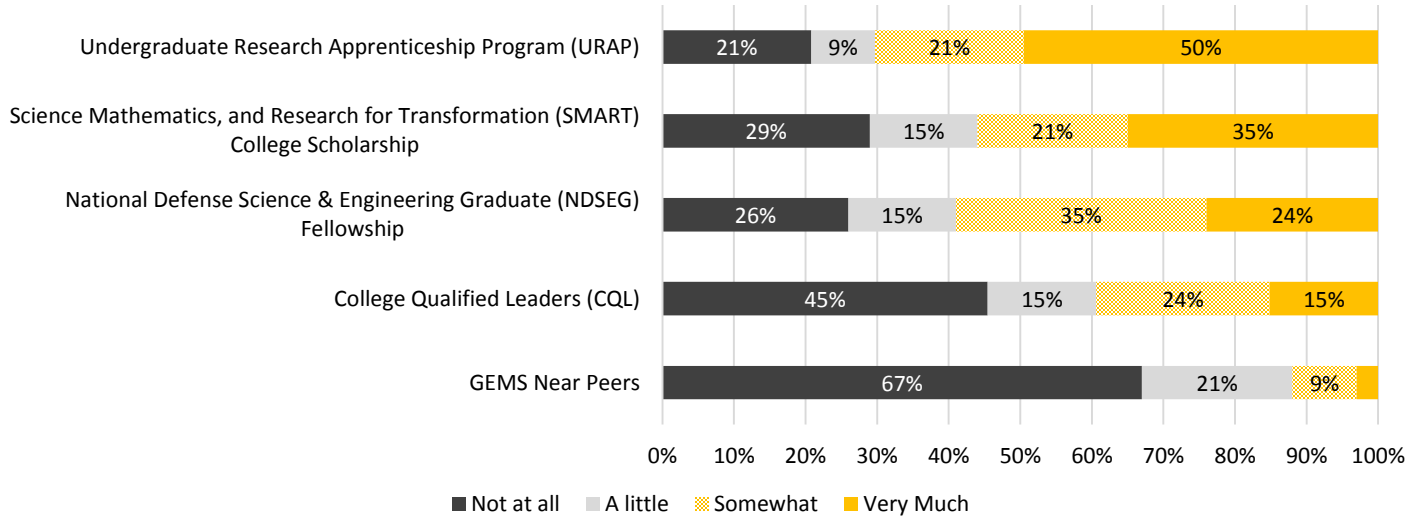
Chart 18: Change in Likelihood Apprentices Will Engage in STEM Activities Outside of School (n = 34-35)



[22] These 15 items had a Cronbach's alpha reliability of 0.920.

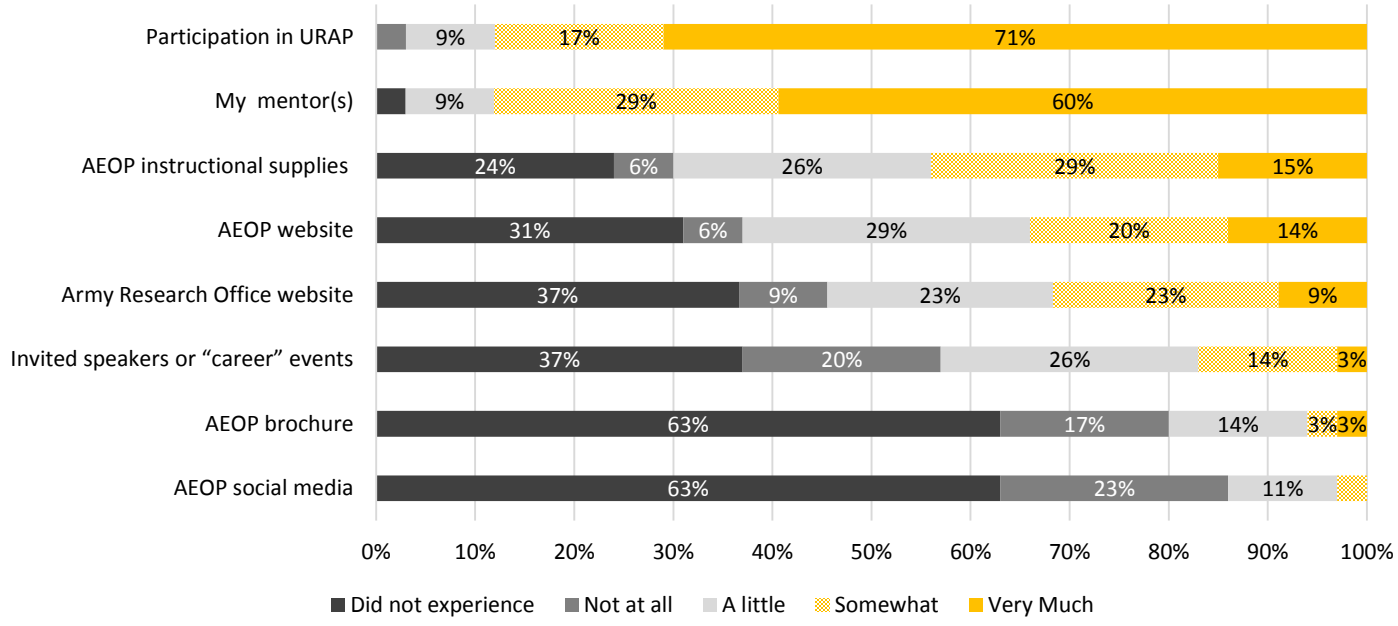
When asked how interested they are in participating in future AEOP programs, a majority (71%) indicated being at least somewhat interested in participating in URAP again, in NDSEG (59%), and in SMART (56%) (see Chart 19). URAP participants are ineligible for many of the other available AEOPs based on their level of education.

Chart 19: Apprentice Interest in Future AEOP Programs (n = 33-34)



Apprentices were asked which resources impacted their awareness of the various AEOPs. As can be seen in Chart 20, URAP mentors (89%) and participating in the program (88%) 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.

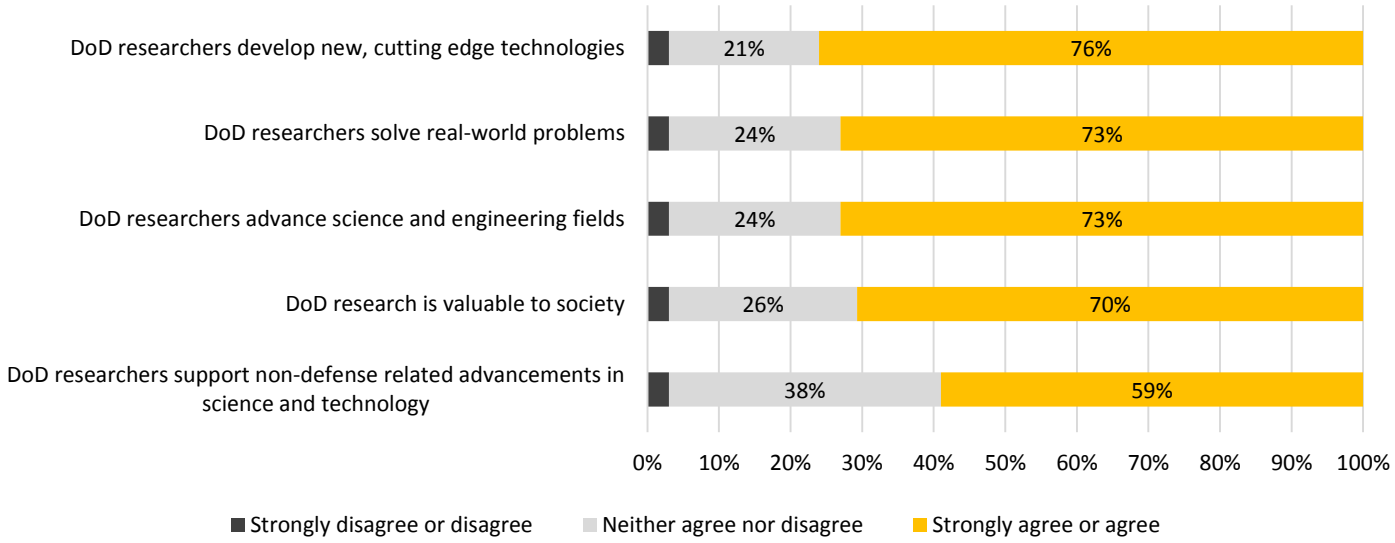
Chart 20: Impact of Resources on Apprentice Awareness of AEOPs (n = 35)



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 gauge apprentices attitudes in this area, the questionnaire also asked apprentices about their opinions of what DoD researchers do and the value of DoD research more broadly. The data indicate that most responding apprentices have favorable opinions (see Chart 21). For example, 76% agreed or strongly agreed that DoD researchers develop cutting-edge technologies, 73% that DoD researchers solve real-world problems, and 73% that DoD researchers advance science and engineering fields.

Chart 21: Apprentice Opinions about DoD Researchers and Research (n = 34)



Education and Career Aspirations

The evaluation examined the program's impact on apprentices' education and career aspirations. In terms of education, the questionnaire asked apprentices 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, 21% 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, only 9% indicated that their highest level of desired education was finishing college, and no one indicated only graduating from high school. This shift towards more education was statistically significant[23] and quite substantial in size (effect size[24] ϕ= 0.797).

[23] Chi-square test of independence, $\chi^2(2) = 21.588$, $p = 0.000$.

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

Table 22. Apprentice Education Aspirations (n = 34)		
	Before URAP	**After URAP**
Graduate from high school	3%	0%
Finish college (get a Bachelor's degree)	18%	9%
Get more education after college	9%	12%
Get a master's degree	21%	21%
Get a Ph.D.	29%	35%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	15%	9%
Get a combined M.D. / Ph.D.	3%	12%
Get another professional degree (law, business, etc.)	3%	3%

In terms of 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). A substantial portion of responding apprentices expressed interest in STEM-related careers both before and after participating in URAP. For example, 41% indicated aspiring to a career in engineering before URAP, with another 15% interested in medicine. After URAP, 32% of apprentices expressed interest in engineering, and 18% 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 = 34)		
	Before URAP	**After URAP**
Engineering	41%	32%
Medicine (doctor, dentist, veterinarian, etc.)	15%	18%
Physical science (physics, chemistry, astronomy, materials science, etc.)	6%	12%
Biological science	12%	12%
Undecided	9%	3%
Science (no specific subject)	3%	3%
Environmental science	0%	3%
Technology	0%	3%
Teaching, STEM	3%	3%
Health (nursing, pharmacy, technician, etc.)	0%	3%
Computer science	3%	0%
Other[†]	9%	9%

[†] Before, other includes "Computer Science/Electrical Engineering", "forensics", and "work for NASA." After, other includes "Computer Science/Electrical Engineering", "forensic toxicology", and "work for NASA."

Apprentices were also asked the extent to which they expect to use their STEM knowledge, skills, and/or abilities in their work when they are age 30. As can be seen in Table 24, all apprentices expect to use STEM somewhat in their career. A majority (76%) expects to use STEM 76-100% of the time in their work, 21% expect to use STEM 51-75% of the time, and 3% expect to use STEM 26-50% of the time.

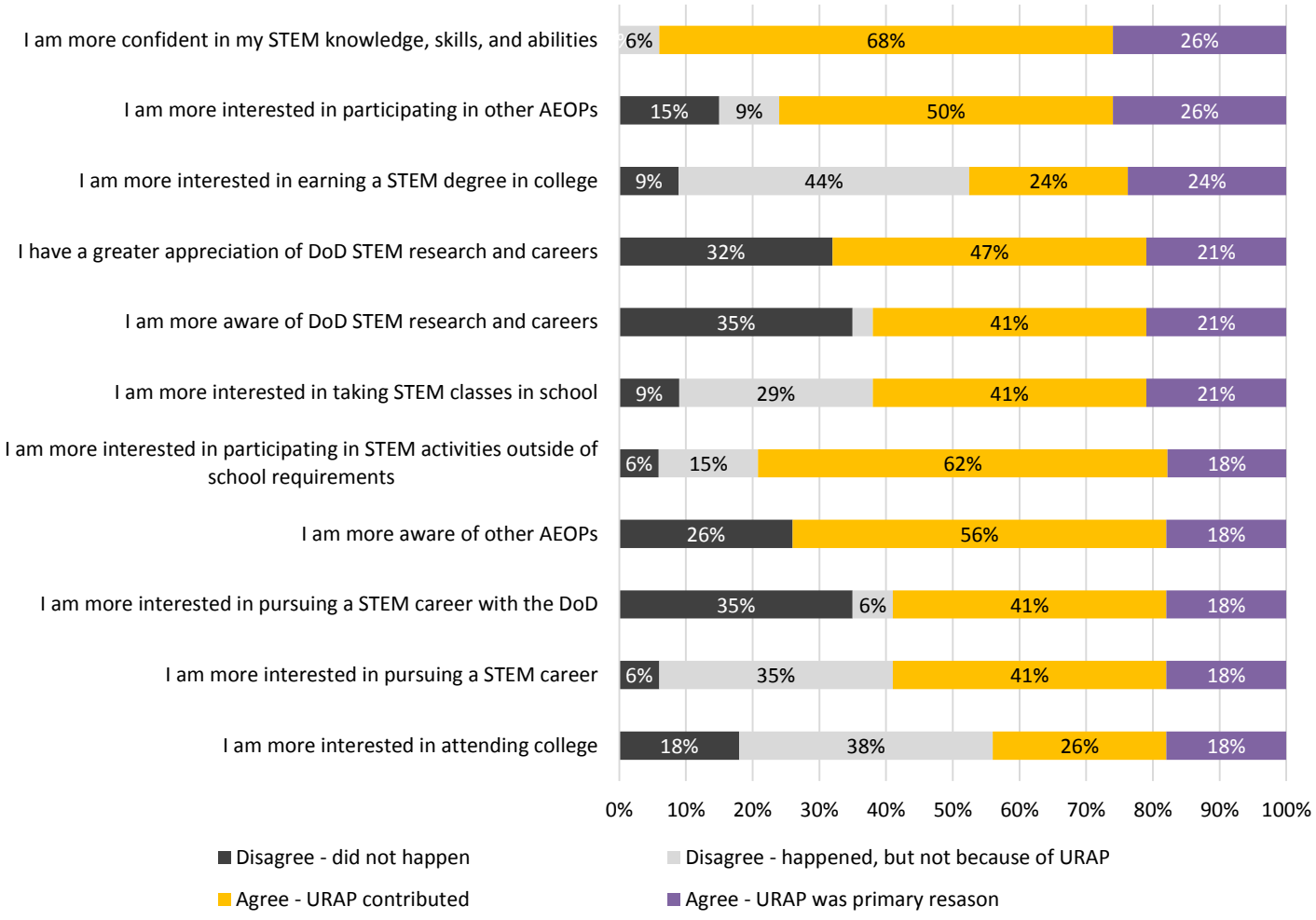
Table 24. Apprentices Expecting to use STEM in Their Work at Age 30 (n = 34)	
	Questionnaire Respondents
Not at all	0%
Less than 25% of the time	0%
26% to 50% of the time	3%
51% to 75% of the time	21%
75% to 100% of the time	76%

Overall Impact

Lastly, apprentices were asked about 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 68% reporting that URAP contributed to this impact and another 26% 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 (56% reporting that URAP contributed, 18% reporting that URAP was primary reason) and on their interest

in participating in other AEOPs (50% and 26%). Apprentices also reported an impact on their interest in participating in STEM activities outside of school requirements (62% and 18%), appreciation of DoD STEM research and careers (47% and 21%), awareness of DoD STEM research and careers (41% and 21%), and interest in taking STEM classes in school (41% and 21%). These items were combined into a composite variable[25] 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.

Chart 22: Apprentice Opinions of URAP Impacts (n = 34)



[25] The Cronbach's alpha reliability for these 11 items was 0.913.

An open-ended item on the questionnaire asked apprentices to list the three most important ways they benefited from the program; 33 apprentices provided at least one answer to this question. Apprentice responses addressed a variety of themes. More than half of the responding apprentices (61%) 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. Just over one-third of the responding apprentices listed gaining some form of laboratory skills or experience. Several referred to information which helped them plan for the future (30%), either related to graduate/professional school or potential careers. Some respondents (30% each) mentioned gaining knowledge or experience, 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 focus groups expanded on some of these impacts. As two said:

> *I definitely am happy that I decided to participate. Mainly because before when coming to work here I really didn't know a lot about research or graduate school. After coming here, I think I learned a lot just because- I feel like I know about that school and I learn more. I also know that after this experience I want to continue pursuing research and science and I would think that I definitely learned a lot through this program. My professor and the graduate students and the postdoc that trained me, I feel like I learned a lot from them too.* (URAP Apprentice)

> *I've really enjoyed my experience here. I feel like I've learned a lot and the people that I work under are very friendly. It has really helped me to further decide what I want to do in the future. I've got a lot of use out of my time here; I've learned a lot of different techniques, and kind of learned a lot about working in a lab.* (URAP Apprentice)

Summary of Findings

The FY14 evaluation of URAP collected data about participants; their perceptions of program processes, resources, and activities; and indicators of achievement in outcomes related to AEOP and program objectives. A summary of findings is provided in Table 25.

Table 25. 2014 URAP Evaluation Findings	
Participant Profiles	
URAP continues to have difficulty providing outreach to participants from historically underrepresented and underserved populations.	• URAP had difficulty attracting participation from female apprentices—a population that is historically underrepresented and underserved in specific STEM fields. URAP apprentices included far more males (71%) than females (27%).
	• URAP had difficulty providing outreach to apprentices from historically underrepresented and underserved race/ethnicity groups (15%). Low proportions of apprentices identify as Native American or Alaskan Native (0%), Native Hawaiian (0%), Hispanic or Latino (7%), and Black or African American (8%).
URAP STEM mentors were lacking in diversity as well.	• Although there were more female than male (69% and 31%, respectively) mentors among questionnaire respondents, the majority identified as either Asian (56%) or White (38%). Only one responding mentor identified as Hispanic or Latino and none identified as Black or African American.
Actionable Program Evaluation	
Marketing and recruitment of URAP apprentices and mentors depends almost entirely on the universities or colleges that host URAP	• ARO marketed and recruited 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. • Apprentices learned about URAP through university personnel, advertisements, classes, or other acquaintances associated with URAP site. Many apprentices had existing associations with their mentor prior to working as a URAP apprentice. 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, 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. • Most mentors reported recruiting apprentices within the university or college context. Some mentors had a previous association with the apprentice prior to URAP through a course or previous research. • In both 2013 and 2014, many apprentices and mentors had existing associations prior to URAP, though most mentors reported selecting

	apprentices from the AEOP applicant pool. This pattern of responses suggests that apprentices are first recruited within universities and colleges and subsequently directed to the AEOP application as a formality. The program may want to collect additional information about previous relationships between mentors and apprentices as part of their application process to help ensure it is meeting its goal of involving new students in the URAP research experience.
URAP apprentices are motivated by opportunities to learn about STEM in ways not possible in school.	• Apprentices were most frequently motivated to participate in URAP by the desire to expand laboratory or research skills (98%), because of their interest in STEM (97%), to learn in ways not possible in school (88%), and by the opportunity to use advanced laboratory technology (87%).
URAP engages apprentices in meaningful STEM learning, through team-based and hands-on activities.	• Most apprentices (71-91%) report learning about STEM topics, applications of STEM to real-life situations, and communicating with other students about STEM on most days or every day of their URAP experience.
	• Most apprentices had opportunities to engage in a variety of STEM practices during their URAP experience. For example, 86% reported practicing using laboratory or field techniques, procedures, or tools; 86% participating in hands-on activities; 83% reported working as part of a team; 83% building or simulating something; and 83% analyzing or interpreting data on most days or every day.
	• Apprentices reported greater opportunities to learn about STEM and greater engagement in STEM practices in their URAP experience than they typically have in school.
	• Large proportions of mentors report using strategies to help make learning activities relevant to apprentices, support the needs of diverse learners, develop apprentices' collaboration and interpersonal skills, and engage apprentices in "authentic" STEM activities.
URAP promotes DoD STEM research and careers but can improve marketing of other AEOP opportunities.	• More than half of mentors (53%) indicated discussing DoD STEM career opportunities with their apprentices. As a result, more than 60% of apprentices reported that they had a greater awareness and appreciation of DoD STEM careers.
	• Most mentors had no awareness of or past participation in an AEOP initiative beyond URAP. Similarly, a substantial proportion of apprentices, when asked what AEOPs they had participated in, indicated never hearing of most of the AEOP programs. However, when asked about their awareness of other AEOPs, most apprentices reported an increase in awareness as a result of participating in URAP. This apparent contradiction may be a result of apprentices learning that AEOP offers several other programs, but not receiving specific information about the various other offerings.
The URAP experience is greatly valued by apprentices and mentors.	• All responding apprentices indicated being satisfied with their URAP experience, highlighting the opportunity to learn about STEM fields and career opportunities. Apprentices also commented on how URAP provided opportunities they do not get in school and would not have otherwise.

	• The vast majority of responding mentors indicated having a positive experience. Further, many commented on the benefits the program provides apprentices, including deepening their knowledge about and confidence in STEM.
Outcomes Evaluation	
URAP had positive impacts on apprentices' STEM knowledge and competencies.	• A majority of apprentices reported large or extreme gains in their knowledge of how professionals work on real problems in STEM; what everyday research work is like in STEM; a STEM topic or field in depth; the research processes, ethics, and rules for conduct in STEM; and research conducted in a STEM topic or field. These impacts were identified across all apprentice groups.
	• Many 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.
URAP had positive impacts on apprentices' 21st Century Skills.	• A large majority of 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 positively impacted apprentices' confidence and identity in STEM, as well as their interest in future STEM engagement.	• Many apprentices reported a large or extreme gain in feeling responsible for a STEM project or activity (88%), confidence to do well in future STEM courses (79%), ability to build academic or professional credentials in STEM (76%), preparedness for more challenging STEM activities (73%), feeling like a STEM professional (73%), feeling like part of a STEM community (73%) and trying out new ideas or procedures on their own in a STEM project (73%).
	• Apprentices also reported on the 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 (82%), to talk with friends or family about STEM (72%), and to help with a community service project related to STEM (69%).
URAP succeeded in raising apprentices' education aspirations, but did not	• After participating in URAP, 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 beyond a Bachelor's degree (79% before URAP, 91% after).

change their career aspirations.	• Apprentices were asked to indicate what kind of work they expected to be doing at age 30, and the data were coded as STEM-related or non-STEM-related. Although many apprentices indicated interest in a STEM-related career, there was not a statistically significant difference from before URAP to after. This result is likely due to the requirement for students to demonstrate interest in STEM in order to be selected for the program.
URAP apprentices are largely unaware of AEOP initiatives, but apprentices show substantial interest in future AEOP opportunities.	• About three-quarters of apprentices indicated that URAP made them more aware of other AEOPs (74%), and credited URAP with increasing their interest in participating in other programs (76%).
URAP raised apprentice awareness and appreciation of DoD STEM research and careers, as well as their interest in pursuing a STEM career with the DoD.	• A majority of apprentices reported that they had a greater awareness (62%) and appreciation (68%) of DoD STEM research and careers. In addition, 59% indicated that URAP raised their interest in pursuing a STEM career with the DoD.

Recommendations

1. AEOP objectives include expanding participation of historically underrepresented and underserved populations. Similar to past years, 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 underrepresented populations of students depends upon the diversity of the universities or colleges in which recruitment takes place. Indications are that many URAP apprentices are informally selected by mentors and subsequently sent to the AEOP application site as a mere formality. Guidance ensuring that "connected" applicants (e.g., those with family, family friends, or school-based connections to the site) are not disproportionately advantaged over qualified but "un-vetted" candidates who apply through the AEOP website is likely to help in recruitment efforts. 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.

2. Given the goal of exposing apprentices to other AEOP initiatives and encouraging continued participation (including as a mentor or volunteer) in programs which are available, URAP may want to work with sites to increase both mentors' and apprentices' exposure to AEOP. Evaluation data suggests that URAP apprentices and mentors were largely unaware of other AEOP initiatives and that URAP served as an entry point into the AEOP for students who have not yet been exposed the Army STEM outreach. Yet, substantial apprentice interest exists in participating in AEOPs moving forward. This interest could be cultivated with more attention by ARO and mentors

during URAP program activities. Continued guidance by ARO is needed to educate mentors about AEOP opportunities nationwide. Adequate resources and guidance for using resources with apprentices should be provided to mentors such that that all apprentices leave URAP with an idea of their next steps in AEOP and/or the capability to serve as an AEOP ambassador.

3. Similarly, given the goal of exposing apprentices to Army/DoD STEM research and careers, the program may want to build in opportunities to provide this information to their apprentices. More than half of apprentices who completed the survey (68%) reported that they did not learn about any DoD STEM jobs/careers during URAP. 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 start the conversation about Army STEM careers and motivate further exploration beyond the resource itself. A repository of public, web-based and print resources (e.g., Army and directorate STEM career webpages, online magazines, federal application guidelines) could also be disseminated to each mentor and/or apprentice to help guide their exploration of Army/DoD STEM interests, careers, and available positions.

4. Additional 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 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[26]) and response burden can affect participation.[27] In particular, consideration should be given to whether the parallel nature of the apprentice and mentor questionnaires is necessary, with items being asked only of the most appropriate data source.

[26] 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.

[27] When asked about potential improvements to URAP, one apprentice wrote "This survey is the worst part about URAP -- please shorten it for the sake of future URAP undergraduates."

Appendices

Appendix A

FY14 URAP Evaluation Plan

Questionnaires

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

1. AEOP Youth Questionnaire to be completed by students (apprentices); and
2. AEOP Mentor Questionnaire to be completed by University S&Es and/or other laboratory personnel that supervise, guide, or support apprentices during their URAP research activities.

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

The questionnaires have been revised for FY14 to align with:

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

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

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

Online Focus Groups

Purpose:
As per the approved FY14 AEOP APP, the external evaluation of URAP conducted by VT includes two or three online focus groups across all sites:

- one or two 45 minute focus group with 6-8 apprentices each; and
- one 45-minute focus group with 6-8 mentors.

Focus groups provide VT evaluation team with first-hand opportunities to speak with apprentices and their mentors. The information gleaned from these focus groups help us in illustrating and more deeply understanding the findings of other data collected (from questionnaires). In total, VT's findings are used to highlight program successes and inform program changes so that the AEOPs can be even better in the future. *Although VT will coordinate the online focus groups, we encourage ARO to alert ALL participants to the possibility that they may be invited by VT evaluators to join an online focus and to encourage their participation.*

Site and Participant Selection:
VT will purposefully sample from URAP participants using site-based enrollment data provided by ARO (site name, apprentice and mentor participant names, and basic demographic data). VT will "invite" sample to participate via email, and will require that each RSVP by a designated date (prior to the scheduled focus group), so that an alternate may be identified in the event an invited participant declines to participate.

Through our purposeful sampling, we are attempting to assemble a diverse group of focus group participants who can provide information about a range of experiences possible in the URAP. Ideally, each apprentice focus group will be inclusive of

- male and female students (equal representation if possible),
- range of grade levels of students,
- range of race/ethnicities of students served by the program, and
- range of STEM content studied/researched.

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

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

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

Appendix B

FY14 URAP Apprentice Questionnaire and Data Summaries

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.

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

❍ Yes, I agree to participate in this survey
❍ No, I do not wish to participate in this survey **If selected, respondent will be directed to the end of the survey**

Q2. Please provide your personal information below:

First Name: _____
Last Name: _____

Q3. What is your email address? (optional)

Email: _____

Q4. 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)

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

Q5. What is your gender?

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

Q6. What is your race or ethnicity?

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

Q7. Where was the URAP program located? (Select ONE)

- ❍ Alabama State University
- ❍ Arizona State University
- ❍ University of California - Berkeley
- ❍ University of California - Irvine
- ❍ University of California - Merced
- ❍ University of California - Riverside
- ❍ University of California - Santa Barbara
- ❍ Indiana University
- ❍ University of Notre Dame
- ❍ Louisiana State University
- ❍ Bowie State University
- ❍ Northeastern University
- ❍ Oakland University
- ❍ University of Michigan - Ann Arbor
- ❍ Mississippi State University
- ❍ University of Missouri
- ❍ Princeton University
- ❍ Polytechnic University of New York
- ❍ St. John's University - New York
- ❍ North Carolina A&T
- ❍ Ohio State University
- ❍ Oklahoma State University
- ❍ University of the Incarnate Word
- ❍ University of North Texas
- ❍ Hampton University
- ❍ California State University
- ❍ University of Texas

Other, (specify): _____

Q8. 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
Learn about new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍

Q9. How often did you do each of the following in URAP this year?

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

Q10. 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
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍
Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍

Q11. How often did you do each of the following in URAP this year?

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

Q12. 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
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍
Build (or simulate) something	❍	❍	❍	❍	❍

Q13. How often did you do each of the following in URAP this year?

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

Q14. Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during URAP:

	Not at all	A little	Somewhat	Very much
Army Research Office website	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat)	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍
Invited speakers or “career” events	❍	❍	❍	❍
Participation in URAP	❍	❍	❍	❍

Q15. Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during URAP:

	Not at all	A little	Somewhat	Very much
Army Research Office website	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat)	❍	❍	❍	❍
My mentor(s)	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍
Participation in URAP	❍	❍	❍	❍

Q16. How SATISFIED were you with each of the following URAP program features?

	Did Not Experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Other administrative tasks	❍	❍	❍	❍	❍
Communications from the Army Research Office	❍	❍	❍	❍	❍
Communications with [program site]	❍	❍	❍	❍	❍
Location(s) of program activities	❍	❍	❍	❍	❍
Availability of program topics or fields that interest you	❍	❍	❍	❍	❍
Instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍

Q17. Which of the following best describes your primary research mentor?

❍ I did not have a research mentor
❍ Teacher
❍ Coach
❍ Parent
❍ Club or activity leader (School club, Boy/Girls Scouts)
❍ STEM researcher (industry, university, or DoD/government employee.)
❍ Other (specify) _____

Q18. Which of the following statements best reflects the input you had into your project initially?

❍ 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

Q19. Which of the following statements best reflects the availability of your mentor?

❍ 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

Q20. Which of the following statements best reflects your working as part of a group or team?

❍ 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

Q21. How SATISFIED were you with each of the following:

	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	❍	❍	❍	❍	❍

Q22. Which of the following statements apply to your research experience? (choose 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

Q23. 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 in URAP:

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

Q24. Which category best describes the focus of your URAP experience?

❍ Science
❍ Technology
❍ Engineering
❍ Mathematics

Q25. 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
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q26. AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "science" in Q25**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Asking questions based on observations of real-world phenomena	❍	❍	❍	❍	❍
Asking a question (about a phenomenon) that can be answered with one or more investigations	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to answer a question	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable, in order to understand relationships between variables	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed explanation (for a phenomenon) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	❍	❍	❍	❍	❍

Q26 CONTINUED. AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "science" in Q25**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve an explanation	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their explanations	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your explanations of phenomena	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically)	❍	❍	❍	❍	❍

Q27. AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas? ****Only presented to respondents who selected "technology", "engineering", or "mathematics" in Q25****

	No gain	A little gain	Some gain	Large gain	Extreme gain
Identifying real-world problems based on social, technological, or environmental issues	❍	❍	❍	❍	❍
Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	❍	❍	❍	❍	❍
Making a model that represents the key features or functions of a solution to a problem	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to test if a solution functions as intended	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	❍	❍	❍	❍	❍

Q27 CONTINUED. AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas? **Only presented to respondents who selected "technology", "engineering", or "mathematics" in Q25**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Using computer-based models to investigate cause and effect relationships of a simulated solution	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution functions as intended	❍	❍	❍	❍	❍
Displaying numeric data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed solution (for a problem) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed 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	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their solutions	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how a solution meets design criteria	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best solution to a problem	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically)	❍	❍	❍	❍	❍

Q28. 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
Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍
Sticking with a task until it is complete	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Patience for the slow pace of research	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Sense of contributing to a body of knowledge	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and my personal values	❍	❍	❍	❍	❍

Q29. 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
Interest in a new STEM topic or field	❍	❍	❍	❍	❍
Clarifying a STEM career path	❍	❍	❍	❍	❍
Sense of accomplishing something in STEM	❍	❍	❍	❍	❍
Building academic or professional credentials in STEM	❍	❍	❍	❍	❍
Feeling prepared for more challenging STEM activities	❍	❍	❍	❍	❍
Confidence to do well in future STEM courses	❍	❍	❍	❍	❍
Confidence to contribute to STEM	❍	❍	❍	❍	❍
Thinking creatively about a STEM project or activity	❍	❍	❍	❍	❍
Trying out new ideas or procedures on my own in a STEM project or activity	❍	❍	❍	❍	❍
Feeling responsible for a STEM project or activity	❍	❍	❍	❍	❍
Feeling like a STEM professional	❍	❍	❍	❍	❍
Feeling like part of a STEM community	❍	❍	❍	❍	❍

Q30. 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
Visit a science museum or zoo	❍	❍	❍	❍	❍
Watch or read non-fiction STEM	❍	❍	❍	❍	❍
Look up STEM information at a library or on the internet	❍	❍	❍	❍	❍
Tinker with a mechanical or electrical device	❍	❍	❍	❍	❍
Work on solving mathematical or scientific puzzles	❍	❍	❍	❍	❍
Design a computer program or website	❍	❍	❍	❍	❍
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	❍	❍	❍	❍	❍
Talk with friends or family about STEM	❍	❍	❍	❍	❍
Mentor or teach other students about STEM	❍	❍	❍	❍	❍
Help with a community service project that relates to STEM	❍	❍	❍	❍	❍
Participate in a STEM club, student association, or professional organization	❍	❍	❍	❍	❍
Participate in STEM camp, fair, or competition	❍	❍	❍	❍	❍
Take an elective (not required) STEM class	❍	❍	❍	❍	❍
Work on a STEM project or experiment in a university or professional setting	❍	❍	❍	❍	❍
Receive an award or special recognition for STEM accomplishments	❍	❍	❍	❍	❍

Q31. How far did you want to go in school BEFORE participating in URAP?

❍ Graduate from high school
❍ Go to a trade or vocational school
❍ Go to college for a little while
❍ Finish college (get a Bachelor's degree)
❍ Get more education after college
❍ Get a master's degree
❍ Get a Ph.D.
❍ Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)
❍ Get a combined M.D. / Ph.D.
❍ Get another professional degree (law, business, etc.)

Q32. How far do you want to go in school AFTER participating in URAP?

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

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

Q33. 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)

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

Q34. 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 AFTER URAP)

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

Q35. When you are 30, to what extent do you expect to use your STEM knowledge, skills, and/or abilities in your work?

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

Q36. How many times have you participated in any of the following Army Educational Outreach Programs (AEOPs)? If you have heard of an AEOP but never participated select "Never". If you have not heard of an AEOP select "Never heard of it".

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCybermission	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q37. How interested are you in participating in the following programs in the future?

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

Q38. How many jobs/careers in science, technology, engineering, or math (STEM) did you learn about during URAP?

❍ None
❍ 1
❍ 2
❍ 3
❍ 4
❍ 5 or more

Q39. How many Department of Defense (DoD) STEM jobs/careers did you learn about during URAP?

❍ None
❍ 1
❍ 2
❍ 3
❍ 4
❍ 5 or more

Q40. Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
DoD researchers advance science and engineering fields	❍	❍	❍	❍	❍
DoD researchers develop new, cutting edge technologies	❍	❍	❍	❍	❍

DoD researchers support non-defense related advancements in science and technology	❍	❍	❍	❍	❍
DoD researchers solve real-world problems	❍	❍	❍	❍	❍
DoD research is valuable to society	❍	❍	❍	❍	❍

Q41. Which of the following statements describe you after participating in URAP?

	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 attending college	❍	❍	❍	❍
I am more interested in earning a STEM degree in college	❍	❍	❍	❍
I am more interested in pursuing a STEM career	❍	❍	❍	❍
I am more aware of DoD STEM research and careers	❍	❍	❍	❍
I have a greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
I am more interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q42. What are the three most important ways that you have benefited from URAP?

Benefit #1:

Benefit #2:

Benefit #3:

Q43. What are the three ways that URAP should be improved for future participants?

Improvement #1:

Improvement #2:

Improvement #3:

Q44. Tell us about your overall satisfaction with your URAP experience.

URAP Youth Data Summary

So that we can determine how diverse students respond to participation in AEOP programs, please tell us about yourself and your school. What grade will you start in the fall? (select one) (Avg. = 15.57, SD = 1.12)		
	Freq.	**%**
11th	0	0%
12th	1	3%
College freshman (13)	1	3%
College sophomore (14)	3	8%
College junior (15)	7	19%
College senior (16)	18	50%
Graduate program (17)	5	14%
Other, (specify)	0	0%
Choose not to report	1	3%
Total	**36**	**100%**

What is your gender?		
	Freq.	**%**
Male	26	72%
Female	10	28%
Choose not to report	0	0%
Total	**36**	**100%**

What is your race or ethnicity?		
	Freq.	**%**
Hispanic or Latino	1	3%
Asian	8	22%
Black or African American	4	11%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	20	56%
Other race or ethnicity, (specify):	1	3%
Choose not to report	2	6%
Total	**36**	**100%**

Note. Other = "Armenian".

Where was the URAP program located? (Select ONE)

	Freq.	%		Freq.	%
Alabama State University	2	6%	Mississippi State University	1	3%
Arizona State University	1	3%	University of Missouri	1	3%
University of California - Berkeley	1	3%	Princeton University	1	3%
University of California - Irvine	1	3%	Polytechnic University of New York	2	6%
University of California - Merced	1	3%	St. John's University - New York	1	3%
University of California - Riverside	0	0%	North Carolina A&T	0	0%
University of California - Santa Barbara	4	11%	Ohio State University	1	3%
Indiana University	0	0%	Oklahoma State University	0	0%
University of Notre Dame	2	6%	University of the Incarnate Word	2	6%
Louisiana State University	1	3%	University of North Texas	2	6%
Bowie State University	1	3%	Hampton University	2	6%
Northeastern University	1	3%	California State University	2	6%
Oakland University	1	3%	University of Texas	2	6%
University of Michigan - Ann Arbor	1	3%	Other, (specify):	1	3%
			Total	35	100%

Note. Other = "California State University, Northridge".

How often do you do each of the following in STEM classes at school this year?

	1	2	3	4	5	n	Avg.	SD
Learn about new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	1 (3%)	8 (23%)	10 (29%)	16 (46%)	35	**4.17**	0.89
Apply STEM knowledge to real life situations	2 (6%)	0 (0%)	8 (23%)	18 (51%)	7 (20%)	35	**3.80**	0.96
Learn about cutting-edge STEM research	1 (3%)	7 (20%)	12 (34%)	9 (26%)	6 (17%)	35	**3.34**	1.08
Learn about different STEM careers	2 (6%)	5 (14%)	17 (49%)	6 (17%)	5 (14%)	35	**3.20**	1.05
Interact with STEM professionals	2 (6%)	7 (20%)	9 (26%)	9 (26%)	8 (23%)	35	**3.40**	1.22

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

How often do you do each of the following in URAP this year?

	1	2	3	4	5	n	Avg.	SD
Learn about new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	0 (0%)	5 (14%)	18 (51%)	12 (34%)	35	**4.20**	0.68
Apply STEM knowledge to real life situations	0 (0%)	2 (6%)	4 (11%)	12 (34%)	17 (49%)	35	**4.26**	0.89

Learn about cutting-edge STEM research	0 (0%)	2 (6%)	6 (17%)	16 (46%)	11 (31%)	35	**4.03**	0.86
Learn about different STEM careers	3 (9%)	4 (11%)	17 (49%)	7 (20%)	4 (11%)	35	**3.14**	1.06
Interact with STEM professionals	1 (3%)	0 (0%)	5 (14%)	13 (37%)	16 (46%)	35	**4.23**	0.91

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

How often do you do each of the following in STEM classes at school this year?

	1	2	3	4	5	n	Avg.	SD
Practice using laboratory or field techniques, procedures, and tools	0 (0%)	2 (6%)	20 (57%)	9 (26%)	4 (11%)	35	**3.43**	0.78
Participate in hands-on STEM activities	2 (6%)	5 (14%)	12 (34%)	13 (37%)	3 (9%)	35	**3.29**	1.02
Work as part of a team	0 (0%)	2 (6%)	15 (43%)	12 (34%)	6 (17%)	35	**3.63**	0.84
Communicate with other students about STEM	1 (3%)	2 (6%)	4 (11%)	17 (49%)	11 (31%)	35	**4.00**	0.97

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

How often do you do each of the following in URAP this year?

	1	2	3	4	5	n	Avg.	SD
Practice using laboratory or field techniques, procedures, and tools	1 (3%)	1 (3%)	3 (9%)	8 (23%)	22 (63%)	35	**4.40**	0.98
Participate in hands-on STEM activities	0 (0%)	1 (3%)	4 (11%)	9 (26%)	21 (60%)	35	**4.43**	0.81
Work as part of a team	1 (3%)	0 (0%)	5 (14%)	10 (29%)	19 (54%)	35	**4.31**	0.93
Communicate with other students about STEM	0 (0%)	0 (0%)	3 (9%)	11 (31%)	21 (60%)	35	**4.51**	0.66

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

How often do you do each of the following in STEM classes at school this year?

	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	2 (6%)	3 (9%)	12 (34%)	15 (43%)	3 (9%)	35	**3.40**	0.98
Design an investigation	4 (11%)	7 (20%)	17 (49%)	6 (17%)	1 (3%)	35	**2.80**	0.96
Carry out an investigation	3 (9%)	5 (14%)	15 (43%)	11 (31%)	1 (3%)	35	**3.06**	0.97
Analyze and interpret data or information	1 (3%)	0 (0%)	15 (43%)	15 (43%)	4 (11%)	35	**3.60**	0.81
Draw conclusions from an investigation	3 (9%)	2 (6%)	13 (37%)	13 (37%)	4 (11%)	35	**3.37**	1.06
Come up with creative explanations or solutions	1 (3%)	5 (14%)	10 (29%)	15 (43%)	4 (11%)	35	**3.46**	0.98
Build (or simulate) something	2 (6%)	9 (26%)	12 (34%)	11 (31%)	1 (3%)	35	**3.00**	0.97

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

How often do you do each of the following in URAP this year?								
	1	2	3	4	5	n	Avg.	SD
Pose questions or problems to investigate	1 (3%)	2 (6%)	4 (11%)	11 (31%)	17 (49%)	35	**4.17**	1.04
Design an investigation	1 (3%)	1 (3%)	9 (26%)	14 (40%)	10 (29%)	35	**3.89**	0.96
Carry out an investigation	1 (3%)	1 (3%)	5 (14%)	12 (34%)	16 (46%)	35	**4.17**	0.98
Analyze and interpret data or information	0 (0%)	3 (9%)	3 (9%)	12 (34%)	17 (49%)	35	**4.23**	0.94
Draw conclusions from an investigation	0 (0%)	1 (3%)	3 (9%)	16 (46%)	15 (43%)	35	**4.29**	0.75
Come up with creative explanations or solutions	1 (3%)	1 (3%)	6 (17%)	15 (43%)	12 (34%)	35	**4.03**	0.95
Build (or simulate) something	0 (0%)	1 (3%)	5 (14%)	13 (37%)	16 (46%)	35	**4.26**	0.82

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

Rate how the following items impacted your awareness of Army Educational Outreach Programs (AEOPs) during URAP:								
	0	1	2	3	4	n	Avg.	SD
Army Research Office website	13 (37%)	3 (9%)	8 (23%)	8 (23%)	3 (9%)	35	**2.50**	0.91
Army Educational Outreach Program (AEOP) website	11 (31%)	2 (6%)	10 (29%)	7 (20%)	5 (14%)	35	**2.63**	0.92
AEOP social media	22 (63%)	8 (23%)	4 (11%)	1 (3%)	0 (0%)	35	**1.46**	0.66
AEOP brochure	22 (63%)	6 (17%)	5 (14%)	1 (3%)	1 (3%)	35	**1.77**	0.93
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat)	8 (24%)	2 (6%)	9 (26%)	10 (29%)	5 (15%)	34	**2.69**	0.88
My mentor(s)	1 (3%)	0 (0%)	3 (9%)	10 (29%)	21 (60%)	35	**3.53**	0.66
Invited speakers or "career" events	13 (37%)	7 (20%)	9 (26%)	5 (14%)	1 (3%)	35	**2.00**	0.87
Participation in URAP	0 (0%)	1 (3%)	3 (9%)	6 (17%)	25 (71%)	35	**3.57**	0.78

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

Rate how the following items impacted your awareness of Department of Defense (DoD) STEM careers during URAP:								
	0	1	2	3	4	n	Avg.	SD
Army Research Office website	12 (34%)	9 (26%)	7 (20%)	4 (11%)	3 (9%)	35	**2.04**	1.07
Army Educational Outreach Program (AEOP) website	11 (31%)	7 (20%)	9 (26%)	6 (17%)	2 (6%)	35	**2.13**	0.95
AEOP social media	22 (63%)	7 (20%)	5 (14%)	1 (3%)	0 (0%)	35	**1.54**	0.66
AEOP brochure	21 (60%)	6 (17%)	6 (17%)	2 (6%)	0 (0%)	35	**1.71**	0.73
AEOP instructional supplies (Rite in the Rain notebook, Lab Coat)	12 (34%)	6 (17%)	10 (29%)	5 (14%)	2 (6%)	35	**2.13**	0.92

My mentor(s)	5 (14%)	6 (17%)	9 (26%)	5 (14%)	10 (29%)	35	**2.63**	1.16
Invited speakers or "career" events	15 (43%)	10 (29%)	6 (17%)	4 (11%)	0 (0%)	35	**1.70**	0.80
Participation in URAP	5 (14%)	5 (14%)	9 (26%)	6 (17%)	10 (29%)	35	**2.70**	1.12

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

How SATISFIED were you with each of the following URAP program features?

	0	1	2	3	4	n	Avg.	SD
Application or registration process	0 (0%)	0 (0%)	2 (6%)	14 (40%)	19 (54%)	35	**3.49**	0.61
Other administrative tasks	2 (6%)	0 (0%)	7 (20%)	12 (34%)	14 (40%)	35	**3.21**	0.78
Communications from Army Research Office	4 (12%)	0 (0%)	4 (12%)	13 (38%)	13 (38%)	34	**3.30**	0.70
Communications from [URAP site]	3 (9%)	0 (0%)	6 (17%)	6 (17%)	20 (57%)	35	**3.44**	0.80
Location(s) of program activities	1 (3%)	1 (3%)	2 (6%)	7 (20%)	24 (69%)	35	**3.59**	0.74
Availability of program topics or fields that interest you	0 (0%)	1 (3%)	3 (9%)	6 (17%)	25 (71%)	35	**3.57**	0.78
Instruction or mentorship during program activities	0 (0%)	0 (0%)	1 (3%)	4 (11%)	30 (86%)	35	**3.83**	0.45
Participation stipends (payment)	0 (0%)	2 (6%)	1 (3%)	10 (29%)	22 (63%)	35	**3.49**	0.82
Research abstract preparation requirements	0 (0%)	0 (0%)	3 (9%)	10 (29%)	22 (63%)	35	**3.54**	0.66

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

Which of the following best describes your primary research mentor?

	Freq.	%
I did not have a research mentor	0	0%
Teacher	10	29%
Coach	2	6%
Parent	0	0%
Club or activity leader (School club, Boy/Girls Scouts)	0	0%
STEM researcher (university, industry, or DoD/government employee)	20	57%
Other (specify)	3	9%
Total	**35**	**100%**

Note. Other = "Professor" (n = 2), and "teacher's assistant".

Which of the following statements best reflects the input you had into your project initially?

	Freq.	%

I did not have a project	0	0%
I was assigned a project by my mentor	12	34%
I worked with my mentor to design a project	9	26%
I had a choice among various projects suggested by my mentor	4	11%
I worked with my mentor and members of a research team to design a project	10	29%
I designed the entire project on my own	0	0%
Total	**35**	**100%**

Which of the following statements best reflects the availability of your mentor?		
	Freq.	**%**
I did not have a mentor	0	0%
The mentor was never available	0	0%
The mentor was available less than half of the time	0	0%
The mentor was available about half of the time of my project	2	6%
The mentor was available more than half of the time	4	11%
The mentor was always available	29	83%
Total	**35**	**100%**

Which of the following statements best reflects your working as part of a group or team?		
	Freq.	**%**
I worked alone (or alone with my research mentor)	0	0%
I worked with others in a shared laboratory or other space, but we work on different projects	14	40%
I worked alone on my project and I met with others regularly for general reporting or discussion	4	11%
I worked alone on a project that was closely connected with projects of others in my group	7	20%
I work with a group who all worked on the same project	10	29%
Total	**35**	**100%**

How SATISFIED were you with each of the following?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
My working relationship with my mentor	0 (0%)	0 (0%)	1 (3%)	3 (9%)	31 (89%)	35	**3.86**	0.43

My working relationship with the group or team	0 (0%)	0 (0%)	1 (3%)	3 (9%)	31 (89%)	35	**3.86**	0.43
The amount of time I spent doing meaningful research	0 (0%)	0 (0%)	1 (3%)	9 (26%)	25 (71%)	35	**3.69**	0.53
The amount of time I spent with my research mentor	0 (0%)	0 (0%)	1 (3%)	4 (11%)	30 (86%)	35	**3.83**	0.45
The research experience overall	0 (0%)	0 (0%)	0 (0%)	5 (14%)	30 (86%)	35	**3.86**	0.36

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

Which of the following statements apply to your research experience? (choose all that apply) (n = 35)

	Freq.	%			Freq.	%
I presented a talk or poster to other students or faculty	10	29%		I will present a talk or poster to other students or faculty	20	57%
I presented a talk or poster at a professional symposium or conference	4	11%		I will present a talk or poster at a professional symposium or conference	14	40%
I attended a symposium or conference	10	29%		I will attend a symposium or conference	12	34%
I wrote or co-wrote a paper that was/will be published in a research journal	3	9%		I will write or co-write a paper that was/will be published in a research journal	12	34%
I wrote or co-wrote a technical paper or patent	2	6%		I will write or co-write a technical paper or patent	7	20%
				I won an award or scholarship based on my research	2	6%

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 the roles STEM play in my everyday life	35	22	63%	13	37%
Helped me understand how STEM can help me improve my community	35	24	69%	11	31%
Used teaching/mentoring activities that addressed my learning style	35	29	83%	6	17%
Provided me with extra support when I needed it	35	34	97%	1	3%
Encouraged me to exchange ideas with others whose backgrounds or viewpoints are different from mine	35	32	91%	3	9%
Allowed me to work on a collaborative project as a member of a team	35	31	89%	4	11%

Helped me practice a variety of STEM skills with supervision	35	32	91%	3	9%
Gave me constructive feedback to improve my STEM knowledge, skills, or abilities	35	33	94%	2	6%
Gave me guidance about educational pathways that would prepare me for a STEM career	35	27	77%	8	23%
Recommended Army Educational Outreach Programs that match my interests	35	15	43%	20	57%
Discussed STEM career opportunities with DoD or other government agencies	35	12	34%	23	66%

Which category best describes the focus of your URAP experience?

	Freq.	%
Science	22	63%
Technology	3	9%
Engineering	8	23%
Mathematics	2	6%
Total	**35**	**100%**

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

	1	2	3	4	5	n	Avg.	SD
Knowledge of a STEM topic or field in depth	1 (3%)	0 (0%)	3 (9%)	17 (49%)	14 (40%)	35	**4.23**	0.84
Knowledge of research conducted in a STEM topic or field	1 (3%)	0 (0%)	1 (3%)	12 (34%)	21 (60%)	35	**4.49**	0.82
Knowledge of research processes, ethics, and rules for conduct in STEM	1 (3%)	2 (6%)	4 (11%)	15 (43%)	13 (37%)	35	**4.06**	1.00
Knowledge of how professionals work on real problems in STEM	1 (3%)	0 (0%)	2 (6%)	14 (40%)	18 (51%)	35	**4.37**	0.84
Knowledge of what everyday research work is like in STEM	1 (3%)	0 (0%)	1 (3%)	10 (29%)	23 (66%)	35	**4.54**	0.82

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

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

	1	2	3	4	5	n	Avg.	SD
Asking questions based on observations of real-world phenomena	0 (0%)	3 (14%)	4 (18%)	11 (50%)	4 (18%)	22	**3.73**	0.94
Asking a question (about a phenomenon) that can be answered with one or more investigations	0 (0%)	1 (5%)	5 (23%)	13 (59%)	3 (14%)	22	**3.82**	0.73

Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	0 (0%)	0 (0%)	7 (32%)	9 (41%)	6 (27%)	22	**3.95**	0.79
Making a model to represent the key features and functions of an observed phenomenon	1 (5%)	4 (18%)	8 (36%)	4 (18%)	5 (23%)	22	**3.36**	1.18
Deciding what type of data to collect in order to answer a question	0 (0%)	1 (5%)	3 (14%)	10 (45%)	8 (36%)	22	**4.14**	0.83
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	0 (0%)	1 (5%)	5 (23%)	8 (36%)	8 (36%)	22	**4.05**	0.90
Identifying the limitations of data collected in an investigation	0 (0%)	1 (5%)	5 (23%)	12 (55%)	4 (18%)	22	**3.86**	0.77
Carrying out procedures for an investigation and recording data accurately	0 (0%)	0 (0%)	5 (23%)	10 (45%)	7 (32%)	22	**4.09**	0.75
Testing how changing one variable affects another variable, in order to understand relationships between variables	1 (5%)	0 (0%)	10 (45%)	7 (32%)	4 (18%)	22	**3.59**	0.96
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	7 (32%)	2 (9%)	3 (14%)	6 (27%)	4 (18%)	22	**2.91**	1.57
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	0 (0%)	4 (18%)	5 (23%)	8 (36%)	5 (23%)	22	**3.64**	1.05
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	0 (0%)	3 (14%)	4 (18%)	10 (45%)	5 (23%)	22	**3.77**	0.97
Using mathematics or computers to analyze numeric data	2 (9%)	4 (18%)	5 (23%)	7 (32%)	4 (18%)	22	**3.32**	1.25
Supporting a proposed explanation (for a phenomenon) with data from investigations	0 (0%)	2 (9%)	5 (23%)	11 (50%)	4 (18%)	22	**3.77**	0.87
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	1 (5%)	7 (32%)	9 (41%)	5 (23%)	22	**3.82**	0.85
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	0 (0%)	0 (0%)	8 (36%)	11 (50%)	3 (14%)	22	**3.77**	0.69
Using data or interpretations from other researchers or investigations to improve an explanation	0 (0%)	3 (14%)	5 (23%)	9 (41%)	5 (23%)	22	**3.73**	0.98
Asking questions to understand the data and interpretations others use to support their explanations	0 (0%)	0 (0%)	6 (27%)	11 (50%)	5 (23%)	22	**3.95**	0.72
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	0 (0%)	3 (14%)	7 (32%)	7 (32%)	5 (23%)	22	**3.64**	1.00

Deciding what additional data or information may be needed to find the best explanation for a phenomenon	0 (0%)	0 (0%)	10 (45%)	5 (23%)	7 (32%)	22	**3.86**	0.89
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	2 (9%)	6 (27%)	5 (23%)	9 (41%)	22	**3.95**	1.05
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	1 (5%)	9 (41%)	7 (32%)	5 (23%)	22	**3.73**	0.88
Integrating information from multiple sources to support your explanations of phenomena	0 (0%)	4 (18%)	6 (27%)	7 (32%)	5 (23%)	22	**3.59**	1.05
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	1 (5%)	2 (9%)	5 (23%)	8 (36%)	6 (27%)	22	**3.73**	1.12

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

AS A RESULT OF YOUR URAP EXPERIENCE, how much did you GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Identifying real-world problems based on social, technological, or environmental issues	0 (0%)	1 (8%)	3 (23%)	6 (46%)	3 (23%)	13	**3.85**	0.90
Defining a problem that can be solved by developing a new or improved object, process, or system	0 (0%)	0 (0%)	2 (15%)	4 (31%)	7 (54%)	13	**4.38**	0.77
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	0 (0%)	0 (0%)	1 (8%)	7 (54%)	5 (38%)	13	**4.31**	0.63
Making a model that represents the key features or functions of a solution to a problem	0 (0%)	1 (8%)	1 (8%)	6 (46%)	5 (38%)	13	**4.15**	0.90
Deciding what type of data to collect in order to test if a solution functions as intended	0 (0%)	2 (15%)	1 (8%)	4 (31%)	6 (46%)	13	**4.08**	1.12
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	0 (0%)	0 (0%)	2 (15%)	5 (38%)	6 (46%)	13	**4.31**	0.75
Identifying the limitations of the data collected in an investigation	0 (0%)	1 (8%)	2 (15%)	7 (54%)	3 (23%)	13	**3.92**	0.86
Carrying out procedures for an investigation and recording data accurately	0 (0%)	2 (15%)	2 (15%)	4 (31%)	5 (38%)	13	**3.92**	1.12
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	1 (8%)	0 (0%)	2 (15%)	7 (54%)	3 (23%)	13	**3.85**	1.07

Using computer-based models to investigate cause and effect relationships of a simulated solution	0 (0%)	3 (23%)	2 (15%)	2 (15%)	6 (46%)	13	**3.85**	1.28
Considering alternative interpretations of data when deciding if a solution functions as intended	0 (0%)	2 (15%)	4 (31%)	2 (15%)	5 (38%)	13	**3.77**	1.17
Displaying numeric data in charts or graphs to identify patterns and relationships	0 (0%)	2 (17%)	3 (25%)	1 (8%)	6 (50%)	12	**3.92**	1.24
Using mathematics or computers to analyze numeric data	1 (8%)	1 (8%)	4 (31%)	2 (15%)	5 (38%)	13	**3.69**	1.32
Supporting a proposed solution (for a problem) with data from investigations	0 (0%)	2 (15%)	4 (31%)	1 (8%)	6 (46%)	13	**3.85**	1.21
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	1 (8%)	3 (23%)	3 (23%)	6 (46%)	13	**4.08**	1.04
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0 (0%)	1 (8%)	4 (31%)	1 (8%)	7 (54%)	13	**4.08**	1.12
Using data or interpretations from other researchers or investigations to improve a solution	0 (0%)	1 (8%)	4 (31%)	2 (15%)	6 (46%)	13	**4.00**	1.08
Asking questions to understand the data and interpretations others use to support their solutions	0 (0%)	1 (8%)	3 (23%)	1 (8%)	8 (62%)	13	**4.23**	1.09
Using data from investigations to defend an argument that conveys how a solution meets design criteria	0 (0%)	1 (8%)	6 (46%)	1 (8%)	5 (38%)	13	**3.77**	1.09
Deciding what additional data or information may be needed to find the best solution to a problem	0 (0%)	1 (8%)	3 (23%)	5 (38%)	4 (31%)	13	**3.92**	0.95
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	1 (8%)	2 (15%)	3 (23%)	7 (54%)	13	**4.23**	1.01
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	0 (0%)	3 (23%)	5 (38%)	5 (38%)	13	**4.15**	0.80
Integrating information from multiple sources to support your solution to a problem	0 (0%)	0 (0%)	3 (23%)	5 (38%)	5 (38%)	13	**4.15**	0.80
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	0 (0%)	1 (8%)	4 (31%)	2 (15%)	6 (46%)	13	**4.00**	1.08

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

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

	1	2	3	4	5	n	Avg.	SD
Learning to work independently	0 (0%)	1 (3%)	5 (14%)	20 (57%)	9 (26%)	35	**4.06**	0.73
Setting goals and reflecting on performance	0 (0%)	1 (3%)	6 (17%)	17 (49%)	11 (31%)	35	**4.09**	0.78
Sticking with a task until it is complete	1 (3%)	1 (3%)	3 (9%)	16 (46%)	14 (40%)	35	**4.17**	0.92
Making changes when things do not go as planned	1 (3%)	2 (6%)	2 (6%)	13 (37%)	17 (49%)	35	**4.23**	1.00
Patience for the slow pace of research	0 (0%)	1 (3%)	2 (6%)	10 (29%)	22 (63%)	35	**4.51**	0.74
Working collaboratively with a team	0 (0%)	4 (11%)	5 (14%)	13 (37%)	13 (37%)	35	**4.00**	1.00
Communicating effectively with others	0 (0%)	1 (3%)	9 (26%)	12 (34%)	13 (37%)	35	**4.06**	0.87
Including others' perspectives when making decisions	0 (0%)	4 (11%)	7 (20%)	14 (40%)	10 (29%)	35	**3.86**	0.97
Sense of being part of a learning community	0 (0%)	1 (3%)	7 (20%)	15 (43%)	12 (34%)	35	**4.09**	0.82
Sense of contributing to a body of knowledge	1 (3%)	1 (3%)	8 (23%)	14 (40%)	11 (31%)	35	**3.94**	0.97
Building relationships with professionals in a field	0 (0%)	2 (6%)	6 (17%)	11 (31%)	16 (46%)	35	**4.17**	0.92
Connecting a topic or field and my personal values	3 (9%)	2 (6%)	10 (29%)	9 (26%)	11 (31%)	35	**3.66**	1.24

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

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 or field	0 (0%)	4 (12%)	8 (24%)	12 (35%)	10 (29%)	34	**3.82**	1.00
Clarifying a STEM career path	4 (12%)	1 (3%)	12 (35%)	9 (26%)	8 (24%)	34	**3.47**	1.24
Sense of accomplishing something in STEM	1 (3%)	2 (6%)	9 (26%)	12 (35%)	10 (29%)	34	**3.82**	1.03
Building academic or professional credentials in STEM	0 (0%)	2 (6%)	6 (18%)	16 (47%)	10 (29%)	34	**4.00**	0.85
Feeling prepared for more challenging STEM activities	0 (0%)	2 (6%)	7 (21%)	14 (41%)	11 (32%)	34	**4.00**	0.89
Confidence to do well in future STEM courses	0 (0%)	2 (6%)	5 (15%)	14 (41%)	13 (38%)	34	**4.12**	0.88
Confidence to contribute to STEM	0 (0%)	1 (3%)	9 (26%)	13 (38%)	11 (32%)	34	**4.00**	0.85
Thinking creatively about a STEM project or activity	0 (0%)	2 (6%)	8 (24%)	9 (26%)	15 (44%)	34	**4.09**	0.97
Trying out new ideas or procedures on my own in a STEM project or activity	1 (3%)	2 (6%)	6 (18%)	12 (35%)	13 (38%)	34	**4.00**	1.04
Feeling responsible for a STEM project or activity	0 (0%)	2 (6%)	2 (6%)	13 (38%)	17 (50%)	34	**4.32**	0.84
Feeling like a STEM professional	0 (0%)	2 (6%)	7 (21%)	13 (38%)	12 (35%)	34	**4.03**	0.90
Feeling like part of a STEM community	0 (0%)	1 (3%)	8 (24%)	11 (32%)	14 (41%)	34	**4.12**	0.88

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

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?								
	1	2	3	4	5	n	Avg.	SD
Visit a science museum or zoo	0 (0%)	2 (6%)	19 (54%)	9 (26%)	5 (14%)	35	**3.49**	0.82
Watch or read non-fiction STEM	0 (0%)	1 (3%)	18 (51%)	6 (17%)	10 (29%)	35	**3.71**	0.93
Look up STEM information at a library or on the internet	0 (0%)	0 (0%)	12 (35%)	12 (35%)	10 (29%)	34	**3.94**	0.81
Tinker with a mechanical or electrical device	0 (0%)	0 (0%)	14 (40%)	12 (34%)	9 (26%)	35	**3.86**	0.81
Work on solving mathematical or scientific puzzles	0 (0%)	0 (0%)	12 (34%)	14 (40%)	9 (26%)	35	**3.91**	0.78
Design a computer program or website	0 (0%)	0 (0%)	21 (60%)	9 (26%)	5 (14%)	35	**3.54**	0.74
Observe things in nature (plant growth, animal behavior, stars or planets, etc.)	0 (0%)	0 (0%)	15 (43%)	13 (37%)	7 (20%)	35	**3.77**	0.77
Talk with friends or family about STEM	0 (0%)	1 (3%)	9 (26%)	16 (46%)	9 (26%)	35	**3.94**	0.80
Mentor or teach other students about STEM	0 (0%)	0 (0%)	14 (40%)	12 (34%)	9 (26%)	35	**3.86**	0.81
Help with a community service project that relates to STEM	0 (0%)	0 (0%)	11 (31%)	17 (49%)	7 (20%)	35	**3.89**	0.72
Participate in a STEM club, student association, or professional organization	0 (0%)	0 (0%)	13 (37%)	15 (43%)	7 (20%)	35	**3.83**	0.75
Participate in STEM camp, fair, or competition	0 (0%)	0 (0%)	15 (43%)	14 (40%)	6 (17%)	35	**3.74**	0.74
Take an elective (not required) STEM class	0 (0%)	0 (0%)	15 (43%)	10 (29%)	10 (29%)	35	**3.86**	0.85
Work on a STEM project or experiment in a university or professional setting	0 (0%)	0 (0%)	6 (17%)	18 (51%)	11 (31%)	35	**4.14**	0.69
Receive an award or special recognition for STEM accomplishments	0 (0%)	0 (0%)	12 (34%)	15 (43%)	8 (23%)	35	**3.89**	0.76

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

How far did you want to go in school BEFORE participating in URAP?		
	Freq.	%
Graduate from high school	1	3%
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)	6	18%
Get more education after college	3	9%
Get a master's degree	7	21%
Get a Ph.D.	10	29%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	5	15%

Get a combined M.D. / Ph.D.	1	3%
Get another professional degree (law, business, etc.)	1	3%
Total	**34**	**100%**

How far did you want to go in school AFTER participating in URAP?		
	Freq.	**%**
Graduate from high school	0	0%
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)	3	9%
Get more education after college	4	12%
Get a master's degree	7	21%
Get a Ph.D.	12	35%
Get a medical-related degree (M.D.), veterinary degree (D.V.M), or dental degree (D.D.S)	3	9%
Get a combined M.D. / Ph.D.	4	12%
Get another professional degree (law, business, etc.)	1	3%
Total	**34**	**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.**	**%**
Undecided	3	9%		Teaching, non-STEM	0	0%
Science (no specific subject)	1	3%		Medicine (doctor, dentist, veterinarian, etc.)	5	15%
Physical science (physics, chemistry, astronomy, materials science, etc.)	2	6%		Health (nursing, pharmacy, technician, etc.)	0	0%
Biological science	4	12%		Social science (psychologist, sociologist, etc.)	0	0%
Earth, atmospheric or oceanic science	0	0%		Business	0	0%
Agricultural science	0	0%		Law	0	0%
Environmental science	0	0%		English/language arts	0	0%
Computer science	1	3%		Farming	0	0%
Technology	0	0%		Military, police, or security	0	0%
Engineering	14	41%		Art (writing, dancing, painting, etc.)	0	0%
Mathematics or statistics	0	0%		Skilled trade (carpenter, electrician, plumber, etc.)	0	0%

Teaching, STEM	1	3%		Other, (specify):	3	9%
				Total	34	100%

Note. Other = "Computer Science/Electrical Engineering", "forensics", and "work for NASA".

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%		Teaching, non-STEM	0	0%
Science (no specific subject)	1	3%		Medicine (doctor, dentist, veterinarian, etc.)	6	18%
Physical science (physics, chemistry, astronomy, materials science, etc.)	4	12%		Health (nursing, pharmacy, technician, etc.)	1	3%
Biological science	4	12%		Social science (psychologist, sociologist, etc.)	0	0%
Earth, atmospheric or oceanic science	0	0%		Business	0	0%
Agricultural science	0	0%		Law	0	0%
Environmental science	1	3%		English/language arts	0	0%
Computer science	0	0%		Farming	0	0%
Technology	1	3%		Military, police, or security	0	0%
Engineering	11	32%		Art (writing, dancing, painting, etc.)	0	0%
Mathematics or statistics	0	0%		Skilled trade (carpenter, electrician, plumber, etc.)	0	0%
Teaching, STEM	1	3%		Other, (specify):	3	9%
				Total	34	100%

Note. Other = "Computer Science/Electrical Engineering", "forensic toxicology", and "work for NASA".

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

	Freq.	%
not at all	0	0%
less than 25% of the time	0	0%
26% to 50% of the time	1	3%
51% to 75% of the time	7	21%
76% to 100% of the time	26	76%
Total	34	100%

How many times have you participated in any of the following Army Educational Outreach Programs? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."								
	0	1	2	3	4	n	Avg.	SD
Camp Invention	22 (65%)	12 (35%)	0 (0%)	0 (0%)	0 (0%)	34	**1.00**	0.00
eCYBERMISSION	22 (65%)	12 (35%)	0 (0%)	0 (0%)	0 (0%)	34	**1.00**	0.00
Junior Solar Sprint (JSS)	22 (65%)	12 (35%)	0 (0%)	0 (0%)	0 (0%)	34	**1.00**	0.00
West Point Bridge Design Contest (WPBDC)	21 (62%)	13 (38%)	0 (0%)	0 (0%)	0 (0%)	34	**1.00**	0.00
Junior Science & Humanities Symposium (JSHS)	20 (59%)	13 (38%)	1 (3%)	0 (0%)	0 (0%)	34	**1.07**	0.27
Gains in the Education of Mathematics and Science (GEMS)	22 (65%)	11 (32%)	1 (3%)	0 (0%)	0 (0%)	34	**1.08**	0.29
GEMS Near Peers	22 (65%)	11 (32%)	0 (0%)	1 (3%)	0 (0%)	34	**1.17**	0.58
UNITE	22 (65%)	12 (35%)	0 (0%)	0 (0%)	0 (0%)	34	**1.00**	0.00
Science & Engineering Apprenticeship Program (SEAP)	20 (59%)	12 (35%)	1 (3%)	1 (3%)	0 (0%)	34	**1.21**	0.58
Research & Engineering Apprenticeship Program (REAP)	17 (52%)	14 (42%)	2 (6%)	0 (0%)	0 (0%)	33	**1.13**	0.34
High School Apprenticeship Program (HSAP)	17 (50%)	15 (44%)	1 (3%)	1 (3%)	0 (0%)	34	**1.18**	0.53
College Qualified Leaders (CQL)	22 (65%)	10 (29%)	1 (3%)	0 (0%)	1 (3%)	34	**1.33**	0.89
Undergraduate Research Apprenticeship Program (URAP)	2 (6%)	8 (24%)	21 (62%)	1 (3%)	2 (6%)	34	**1.91**	0.73
Science Mathematics, and Research for Transformation (SMART) College Scholarship	16 (47%)	16 (47%)	1 (3%)	0 (0%)	1 (3%)	34	**1.22**	0.73
National Defense Science & Engineering Graduate (NDSEG) Fellowship	20 (59%)	13 (38%)	0 (0%)	1 (3%)	0 (0%)	34	**1.14**	0.53

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

How interested are you in participating in the following programs in the future?							
	1	2	3	4	n	Avg.	SD
Camp Invention	22 (67%)	6 (18%)	4 (12%)	1 (3%)	33	**1.52**	0.83
eCYBERMISSION	23 (70%)	6 (18%)	3 (9%)	1 (3%)	33	**1.45**	0.79
Junior Solar Sprint (JSS)	24 (73%)	5 (15%)	3 (9%)	1 (3%)	33	**1.42**	0.79
West Point Bridge Design Contest (WPBDC)	22 (71%)	4 (13%)	5 (16%)	0 (0%)	31	**1.45**	0.77
Junior Science & Humanities Symposium (JSHS)	23 (70%)	4 (12%)	5 (15%)	1 (3%)	33	**1.52**	0.87
Gains in the Education of Mathematics and Science (GEMS)	17 (52%)	8 (24%)	5 (15%)	3 (9%)	33	**1.82**	1.01
GEMS Near Peers	22 (67%)	7 (21%)	3 (9%)	1 (3%)	33	**1.48**	0.80
UNITE	23 (72%)	5 (16%)	3 (9%)	1 (3%)	32	**1.44**	0.80
Science & Engineering Apprenticeship Program (SEAP)	11 (32%)	5 (15%)	11 (32%)	7 (21%)	34	**2.41**	1.16

Research & Engineering Apprenticeship Program (REAP)	11 (32%)	7 (21%)	6 (18%)	10 (29%)	34	**2.44**	1.24
High School Apprenticeship Program (URAP)	27 (82%)	3 (9%)	2 (6%)	1 (3%)	33	**1.30**	0.73
College Qualified Leaders (CQL)	15 (45%)	5 (15%)	8 (24%)	5 (15%)	33	**2.09**	1.16
Undergraduate Research Apprenticeship Program (URAP)	7 (21%)	3 (9%)	7 (21%)	17 (50%)	34	**3.00**	1.21
Science Mathematics, and Research for Transformation (SMART) College Scholarship	10 (29%)	5 (15%)	7 (21%)	12 (35%)	34	**2.62**	1.26
National Defense Science & Engineering Graduate (NDSEG) Fellowship	9 (26%)	5 (15%)	12 (35%)	8 (24%)	34	**2.56**	1.13

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

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

	Freq.	%
None	6	18%
1	5	15%
2	6	18%
3	8	24%
4	2	6%
5 or more	7	21%
Total	**34**	**100%**

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

	Freq.	%
None	23	68%
1	2	6%
2	4	12%
3	3	9%
4	1	3%
5 or more	1	3%
Total	**34**	**100%**

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	1 (3%)	0 (0%)	8 (24%)	15 (44%)	10 (29%)	34	**3.97**	0.90
DoD researchers develop new, cutting edge technologies	1 (3%)	0 (0%)	7 (21%)	15 (44%)	11 (32%)	34	**4.03**	0.90
DoD researchers support non-defense related advancements in science and technology	0 (0%)	1 (3%)	13 (38%)	12 (35%)	8 (24%)	34	**3.79**	0.84
DoD researchers solve real-world problems	1 (3%)	0 (0%)	8 (24%)	14 (41%)	11 (32%)	34	**4.00**	0.92
DoD research is valuable to society	1 (3%)	0 (0%)	9 (26%)	11 (32%)	13 (38%)	34	**4.03**	0.97

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

Which of the following statements describe you after participating in URAP?							
	1	2	3	4	n	Avg.	SD
I am more confident in my STEM knowledge, skills, and abilities	0 (0%)	2 (6%)	23 (68%)	9 (26%)	34	**3.21**	0.54
I am more interested in participating in STEM activities outside of school requirements	2 (6%)	5 (15%)	21 (62%)	6 (18%)	34	**2.91**	0.75
I am more aware of other AEOPs	9 (26%)	0 (0%)	19 (56%)	6 (18%)	34	**2.65**	1.07
I am more interested in participating in other AEOPs	5 (15%)	3 (9%)	17 (50%)	9 (26%)	34	**2.88**	0.98
I am more interested in taking STEM classes in school	3 (9%)	10 (29%)	14 (41%)	7 (21%)	34	**2.74**	0.90
I am more interested in attending college	6 (18%)	13 (38%)	9 (26%)	6 (18%)	34	**2.44**	0.99
I am more interested in earning a STEM degree in college	3 (9%)	15 (44%)	8 (24%)	8 (24%)	34	**2.62**	0.95
I am more interested in pursuing a STEM career	2 (6%)	12 (35%)	14 (41%)	6 (18%)	34	**2.71**	0.84
I am more aware of DoD STEM research and careers	12 (35%)	1 (3%)	14 (41%)	7 (21%)	34	**2.47**	1.19
I have a greater appreciation of DoD STEM research and careers	11 (32%)	0 (0%)	16 (47%)	7 (21%)	34	**2.56**	1.16
I am more interested in pursuing a STEM career with the DoD	12 (35%)	2 (6%)	14 (41%)	6 (18%)	34	**2.41**	1.16

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".

Data from URAP registration/application records

How did you learn about URAP? (n = 60)						
	Freq.	%			Freq.	%
ARL website	0	0%		Extended family member (grandparents, aunts, uncles, cousins)	0	0%
Program or AEOP website	2	3%		Friend of the family	1	2%
Facebook, Twitter, Pinterest, or other social media	0	0%		Teacher or professor	43	72%
School or university newsletter, email, or website	12	20%		Guidance counselor	1	2%
News story or other media coverage	0	0%		Mentor from URAP	10	17%
Past participant of URAP	0	0%		Someone who works at an Army laboratory	3	5%
Friend	2	3%		Someone who works with the Department of Defense	0	0%
Immediate family member (mother, father, siblings)	0	0%		Choose not to report	1	2%
				Other, (specify):	1	2%

Note. Other = "PI, Elaine Li, UT Austin".

Data from URAP registration/application records

How motivating were the following factors in your decision to participate in URAP?								
	0	1	2	3	4	n	Avg.	SD
Teacher or professor encouragement	1 (2%)	1 (2%)	1 (2%)	13 (22%)	44 (73%)	60	**3.69**	0.59
The program mentor(s)	4 (7%)	1 (2%)	2 (3%)	6 (10%)	47 (78%)	60	**3.77**	0.60
Building college application or résumé	3 (5%)	3 (5%)	1 (2%)	18 (30%)	35 (58%)	60	**3.49**	0.78
Networking opportunities	1 (2%)	0 (0%)	1 (2%)	28 (47%)	30 (50%)	60	**3.49**	0.54
Interest in science, technology, engineering, or mathematics (STEM)	0 (0%)	0 (0%)	0 (0%)	2 (3%)	58 (97%)	60	**3.97**	0.18
Interest in STEM careers with the Army	8 (13%)	2 (3%)	8 (13%)	23 (38%)	19 (32%)	60	**3.13**	0.82
Having fun	1 (2%)	0 (0%)	6 (10%)	16 (27%)	37 (62%)	60	**3.53**	0.68
Earning stipend or award during summer	0 (0%)	1 (2%)	9 (15%)	22 (37%)	28 (47%)	60	**3.28**	0.78
Opportunity to do something with friends	4 (7%)	4 (7%)	17 (28%)	20 (33%)	15 (25%)	60	**2.82**	0.92
Opportunity to use advanced laboratory technology	2 (3%)	0 (0%)	0 (0%)	6 (10%)	52 (87%)	60	**3.90**	0.31
Desire to expand laboratory or research skills	0 (0%)	0 (0%)	0 (0%)	1 (2%)	59 (98%)	60	**3.98**	0.13
Learning in ways that are not possible in school	2 (3%)	0 (0%)	0 (0%)	5 (8%)	53 (88%)	60	**3.91**	0.28
Serving the community or country	4 (7%)	2 (3%)	1 (2%)	20 (33%)	33 (55%)	60	**3.50**	0.71
Parent encouragement	0 (0%)	2 (3%)	5 (8%)	27 (45%)	26 (43%)	60	**3.28**	0.76

Exploring a unique work environment	0 (0%)	0 (0%)	2 (3%)	8 (13%)	50 (83%)	60	**3.80**	0.48
Other, (specify)	1 (2%)	1 (2%)	1 (2%)	13 (22%)	44 (73%)	60	**3.69**	0.59

Note. Response scale: 0 = "Did not experience", 1 = "Not at all motivating", 2 = "Not too motivating," 3 = "Somewhat motivating", 4 = "Very motivating". Other = "Learning and Service!", "my desire to learn more about scientific techniques", "the thrill of doing something so exciting putting my skills to the test", "a rare opportunity to work in a clean room", "Building a bright future", "Application of biochemical principles to research, contribution to biochemical research", "finding out what I want to do with science", "To learn new things to teach my nieces.", "My desire to learn and apply what I learn in a real laboratory setting that could prepare me for a future career.", "The strong emphasis on undergraduate research at my institution.", "I have considered being a military contractor, so I'd like to work with them to get some experience.", "Exploring new advancements for mankind", "I want to use my summer to learn and expand my horizons, and I feel that HSAP/URAP is my best opportunity to do that.", "PI encouragement", and "expand knowledge and current skill set".

Appendix C

FY14 URAP Mentor Questionnaire and Data Summaries

2014 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

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

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

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

Q2 Please provide your personal information below: (required)

First Name _____
Last Name _____

Q3 Please provide your email address: (optional)

Email _____

Q4 What is your gender?

❍ Male
❍ Female
❍ Choose not to report

Q5 What is your race or ethnicity?

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

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

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

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

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

Q8 Which of the following best describes your primary area of research?

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

Q9 Where was the URAP program located?

- ❍ Alabama State University
- ❍ Arizona State University
- ❍ University of California - Berkeley
- ❍ University of California - Irvine
- ❍ University of California - Merced

- ❍ University of California - Riverside
- ❍ University of California - Santa Barbara
- ❍ Indiana University
- ❍ University of Notre Dame
- ❍ Louisiana State University
- ❍ Bowie State University
- ❍ Northeastern University
- ❍ Oakland University
- ❍ University of Michigan - Ann Arbor
- ❍ Mississippi State University
- ❍ University of Missouri
- ❍ Princeton University
- ❍ Polytechnic University of New York
- ❍ St. John's University - New York
- ❍ North Carolina A&T
- ❍ Ohio State University
- ❍ Oklahoma State University
- ❍ University of the Incarnate Word
- ❍ University of North Texas
- ❍ Hampton University
- ❍ California State University
- ❍ University of Texas
- ❍ Other, (specify): _____

Q10 Which of the following BEST describes your role during URAP?

- ❍ Research Mentor
- ❍ Research Team Member but not a Principal Investigator (PI)
- ❍ Other, (specify) _____

Q11 How many URAP students did you work with this year?

Q12 How did you learn about URAP? (Check all that apply)

- ❑ Army Research Office website
- ❑ Army Educational Outreach Program (AEOP) website
- ❑ Facebook, Twitter, Pinterest, or other social media
- ❑ State or national educator conference
- ❑ STEM conference
- ❑ School, university, or professional organization newsletter, email or website
- ❑ A news story or other media coverage
- ❑ Past URAP participant
- ❑ A student
- ❑ A colleague
- ❑ A supervisor or superior
- ❑ URAP event or site host/director
- ❑ Workplace communications

- ❑ Someone who works at an Army laboratory
- ❑ Someone who works with the Department of Defense
- ❑ Other, (specify): _____

Q13 How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs (AEOPs) in any capacity? If you have heard of an AEOP but never participated select "Never." If you have not heard of an AEOP select "Never heard of it."

	Never	Once	Twice	Three or more times	Never heard of it
Camp Invention	❍	❍	❍	❍	❍
eCYBERMISSION	❍	❍	❍	❍	❍
Junior Solar Sprint (JSS)	❍	❍	❍	❍	❍
West Point Bridge Design Contest (WPBDC)	❍	❍	❍	❍	❍
Junior Science & Humanities Symposium (JSHS)	❍	❍	❍	❍	❍
Gains in the Education of Mathematics and Science (GEMS)	❍	❍	❍	❍	❍
GEMS Near Peers	❍	❍	❍	❍	❍
UNITE	❍	❍	❍	❍	❍
Science & Engineering Apprenticeship Program (SEAP)	❍	❍	❍	❍	❍
Research & Engineering Apprenticeship Program (REAP)	❍	❍	❍	❍	❍
High School Apprenticeship Program (HSAP)	❍	❍	❍	❍	❍
College Qualified Leaders (CQL)	❍	❍	❍	❍	❍
Undergraduate Research Apprenticeship Program (URAP)	❍	❍	❍	❍	❍
Science Mathematics, and Research for Transformation (SMART) College Scholarship	❍	❍	❍	❍	❍
National Defense Science & Engineering Graduate (NDSEG) Fellowship	❍	❍	❍	❍	❍

Q14 Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply)

- ❑ Applications from Army Research Office 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)
- ❑ Career fair(s)
- ❑ Education conference(s) or event(s)
- ❑ STEM conference(s) or event(s)
- ❑ Organization(s) serving underserved or underrepresented populations
- ❑ Student contacted mentor
- ❑ I do not know how student(s) was recruited for apprenticeship

❑ Other, Specify: _____

Q15 How SATISFIED were you with each of the following URAP features?

	Did not experience	Not at all	A little	Somewhat	Very much
Application or registration process	❍	❍	❍	❍	❍
Other administrative tasks	❍	❍	❍	❍	❍
Communications from the Army Research Office	❍	❍	❍	❍	❍
Communications from [URAP site]	❍	❍	❍	❍	❍
Support for instruction or mentorship during program activities	❍	❍	❍	❍	❍
Participation stipends (payment)	❍	❍	❍	❍	❍
Research abstract preparation requirements	❍	❍	❍	❍	❍

Q16 The list below describes instructional and mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in URAP.

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

Q17 The list below describes instructional and mentoring strategies that are effective ways to support the diverse needs of students as learners. From the list below, please indicate which strategies you used when working with your student(s) in URAP.

	Yes - I used this strategy	No - I did not use this strategy
Finding out about students' learning styles at the beginning of the program	❍	❍

Interacting with all students in the same way regardless of their gender or race and ethnicity	❍	❍
Using gender neutral language	❍	❍
Using diverse teaching/mentoring activities to address a broad spectrum of students	❍	❍
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	❍	❍
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	❍	❍
Directing students to other individuals or programs if I can only provide limited support	❍	❍
Other, (specify):	❍	❍

Q18 The list below describes instructional and mentoring strategies that are effective ways to support students development of collaboration and interpersonal skills. From the list below, please indicate which strategies you used when working with your student(s) in URAP.

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

Q19 The list below describes instructional and mentoring strategies that are effective ways to support students' engagement in "authentic" STEM activities. From the list below, please indicate which strategies you used when working with your student(s) in URAP.

	Yes - I used this strategy	No - I did not use this strategy
Teaching (or assigning readings) about specific STEM subject matter	❍	❍
Having students access and critically review technical texts or media to support their work	❍	❍

Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	❍	❍
Helping students practice STEM skills with supervision	❍	❍
Giving constructive feedback to improve students' STEM competencies	❍	❍
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	❍	❍
Encouraging students to seek support from other team members	❍	❍
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	❍	❍
Other, (specify):	❍	❍

Q20 The list below describes instructional and mentoring strategies that are effective ways to support students' STEM educational and career pathways. The list also includes items that reflect AEOP and Army priorities. From the list below, please indicate which strategies you used when working with your student(s) in URAP.

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

Q21 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
Army Research Office website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍
Program administrator or site coordinators	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in URAP	❍	❍	❍	❍	❍

Q22 Which of the following AEOPs did YOU EXPLICITLY DISCUSS with your student(s) during URAP? (check ALL that apply)

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

Q23 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
Army Research Office website	❍	❍	❍	❍	❍
Army Educational Outreach Program (AEOP) website	❍	❍	❍	❍	❍
AEOP social media	❍	❍	❍	❍	❍
AEOP brochure and/or presentation	❍	❍	❍	❍	❍
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	❍	❍	❍	❍	❍
Program administrator or site coordinator	❍	❍	❍	❍	❍
Invited speakers or "career" events	❍	❍	❍	❍	❍
Participation in URAP	❍	❍	❍	❍	❍

Q24 Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:

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

Q25 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
Learn new science, technology, engineering, or mathematics (STEM) topics	❍	❍	❍	❍	❍
Apply STEM knowledge to real life situations	❍	❍	❍	❍	❍
Learn about cutting-edge STEM research	❍	❍	❍	❍	❍
Learn about different STEM careers	❍	❍	❍	❍	❍
Interact with STEM professionals	❍	❍	❍	❍	❍
Practice using laboratory or field techniques, procedures, and tools	❍	❍	❍	❍	❍
Participate in hands-on STEM activities	❍	❍	❍	❍	❍

Work as part of a team	❍	❍	❍	❍	❍
Communicate with other students about STEM	❍	❍	❍	❍	❍
Pose questions or problems to investigate	❍	❍	❍	❍	❍
Design an investigation	❍	❍	❍	❍	❍
Carry out an investigation	❍	❍	❍	❍	❍
Analyze and interpret data or information	❍	❍	❍	❍	❍
Draw conclusions from an investigation	❍	❍	❍	❍	❍
Come up with creative explanations or solutions	❍	❍	❍	❍	❍

Q26 Which category best describes the focus of your student(s)' URAP experience?

❍ Science
❍ Technology
❍ Engineering
❍ Mathematics

Q27 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
Knowledge of a STEM topic or field in depth	❍	❍	❍	❍	❍
Knowledge of research conducted in a STEM topic or field	❍	❍	❍	❍	❍
Knowledge of research processes, ethics, and rules for conduct in STEM	❍	❍	❍	❍	❍
Knowledge of how professionals work on real problems in STEM	❍	❍	❍	❍	❍
Knowledge of what everyday research work is like in STEM	❍	❍	❍	❍	❍

Q28 AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to respondents who selected "science" in Q26**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Asking questions based on observations of real-world phenomena	❍	❍	❍	❍	❍
Asking a question (about a phenomenon) that can be answered with one or more investigations	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	❍	❍	❍	❍	❍
Making a model to represent the key features and functions of an observed phenomenon	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to answer a question	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of data collected in an investigation	❍	❍	❍	❍	❍

Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable, in order to understand relationships between variables	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	❍	❍	❍	❍	❍
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed explanation (for a phenomenon) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed 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	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve an explanation	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their explanations	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your explanations of phenomena	❍	❍	❍	❍	❍
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	❍	❍	❍	❍	❍

Q29 AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas? **Only presented to respondents who selected "technology", "engineering", or "mathematics" in Q26**

	No gain	A little gain	Some gain	Large gain	Extreme gain
Identifying real-world problems based on social, technological, or environmental issues	❍	❍	❍	❍	❍
Defining a problem that can be solved by developing a new or improved object, process, or system	❍	❍	❍	❍	❍
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	❍	❍	❍	❍	❍

Making a model that represents the key features or functions of a solution to a problem	❍	❍	❍	❍	❍
Deciding what type of data to collect in order to test if a solution functions as intended	❍	❍	❍	❍	❍
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	❍	❍	❍	❍	❍
Identifying the limitations of the data collected in an investigation	❍	❍	❍	❍	❍
Carrying out procedures for an investigation and recording data accurately	❍	❍	❍	❍	❍
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	❍	❍	❍	❍	❍
Using computer-based models to investigate cause and effect relationships of a simulated solution	❍	❍	❍	❍	❍
Considering alternative interpretations of data when deciding if a solution functions as intended	❍	❍	❍	❍	❍
Displaying numeric data in charts or graphs to identify patterns and relationships	❍	❍	❍	❍	❍
Using mathematics or computers to analyze numeric data	❍	❍	❍	❍	❍
Supporting a proposed solution (for a problem) with data from investigations	❍	❍	❍	❍	❍
Supporting a proposed 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	❍	❍	❍	❍	❍
Using data or interpretations from other researchers or investigations to improve a solution	❍	❍	❍	❍	❍
Asking questions to understand the data and interpretations others use to support their solutions	❍	❍	❍	❍	❍
Using data from investigations to defend an argument that conveys how a solution meets design criteria	❍	❍	❍	❍	❍
Deciding what additional data or information may be needed to find the best solution to a problem	❍	❍	❍	❍	❍
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	❍	❍	❍	❍	❍
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	❍	❍	❍	❍	❍
Integrating information from multiple sources to support your solution to a problem	❍	❍	❍	❍	❍
Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	❍	❍	❍	❍	❍

Q30 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
Learning to work independently	❍	❍	❍	❍	❍
Setting goals and reflecting on performance	❍	❍	❍	❍	❍

Sticking with a task until it is completed	❍	❍	❍	❍	❍
Making changes when things do not go as planned	❍	❍	❍	❍	❍
Patience for the slow pace of research	❍	❍	❍	❍	❍
Working collaboratively with a team	❍	❍	❍	❍	❍
Communicating effectively with others	❍	❍	❍	❍	❍
Including others' perspectives when making decisions	❍	❍	❍	❍	❍
Sense of being part of a learning community	❍	❍	❍	❍	❍
Sense of contributing to a body of knowledge	❍	❍	❍	❍	❍
Building relationships with professionals in a field	❍	❍	❍	❍	❍
Connecting a topic or field and their personal values	❍	❍	❍	❍	❍

Q31 Which of the following statements describe YOUR STUDENT(S) after participating in the URAP program?

	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 attending college	❍	❍	❍	❍
More interested in earning a STEM degree in college	❍	❍	❍	❍
More interested in pursuing a STEM career	❍	❍	❍	❍
More aware of Department of Defense (DoD) STEM research and careers	❍	❍	❍	❍
Greater appreciation of DoD STEM research and careers	❍	❍	❍	❍
More interested in pursuing a STEM career with the DoD	❍	❍	❍	❍

Q32 What are the three most important strengths of URAP?

Strength #1

Strength #2

Strength #3

Q33 What are the three ways URAP should be improved for future participants?

Improvement #1

Improvement #2

Improvement #3

Q34 Tell us about your overall satisfaction with your URAP experience.

URAP Mentor Data Summary

What is your gender?		
	Freq.	%
Male	11	69%
Female	5	31%
Choose not to report	0	0%
Total	16	100%

What is your race or ethnicity?		
	Freq.	%
Hispanic or Latino	1	6%
Asian	9	56%
Black or African American	0	0%
Native American or Alaska Native	0	0%
Native Hawaiian or Other Pacific Islander	0	0%
White	6	38%
Other race or ethnicity, (specify):	0	0%
Choose not to report	0	0%
Total	16	100%

Which of the following BEST describes your current occupation? (select ONE)		
	Freq.	%
Teacher	1	6%
Other school staff	0	0%
University educator	11	69%
Scientist, Engineer, or Mathematician in training (undergraduate or graduate student, etc.)	2	13%
Scientist, Engineer, or Mathematics professional	2	13%
Other, (specify):	0	0%
Total	16	100%

Which of the following BEST describes your organization? (select ONE)		
	Freq.	%
No organization	0	0%

School or district (K-12)	0	0%
State educational agency	0	0%
Institution of higher education (vocational school, junior college, college, or university)	16	100%
Industry	0	0%
Department of Defense or other government agency	0	0%
Non-profit	0	0%
Other, (specify):	0	0%
Total	16	100%

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

	Freq.	%			Freq.	%
Physical science (physics, chemistry, astronomy, materials science)	6	38%		Technology	0	0%
Biological science	4	25%		Engineering	4	25%
Earth, atmospheric, or oceanic science	0	0%		Mathematics or statistics	0	0%
Agricultural science	0	0%		Medical, health, or behavioral science	1	6%
Environmental science	0	0%		Social science (psychology, sociology, anthropology, etc.)	0	0%
Computer science	1	6%		Other, (specify)	0	0%
				Total	16	100%

Where was the URAP program located? (Select ONE)

	Freq.	%			Freq.	%
Alabama State University	1	6%		Mississippi State University	0	0%
Arizona State University	2	13%		University of Missouri	1	6%
University of California - Berkeley	0	0%		Princeton University	0	0%
University of California - Irvine	0	0%		Polytechnic University of New York	2	13%
University of California - Merced	1	6%		St. John's University - New York	1	6%

University of California - Riverside	0	0%		North Carolina A&T	1	6%
University of California - Santa Barbara	1	6%		Ohio State University	0	0%
Indiana University	0	0%		Oklahoma State University	1	6%
University of Notre Dame	0	0%		University of the Incarnate Word	1	6%
Louisiana State University	0	0%		University of North Texas	1	6%
Bowie State University	0	0%		Hampton University	0	0%
Northeastern University	0	0%		California State University	1	6%
Oakland University	1	6%		University of Texas	0	0%
University of Michigan - Ann Arbor	1	6%		Other, (specify):	0	0%
				Total	**16**	**100%**

Which of the following BEST describes your role during URAP?

	Freq.	%
Research Mentor	14	88%
Research Team Member but not a Principal Investigator (PI)	1	6%
Other, (specify)	1	6%
Total	16	100%

Note. Other = "Program Coordinator".

How many URAP students did you work with this year?

# of Students	Freq.	%
1	2	13%
2	12	80%
3	0	0%
4	0	0%
5	0	0%
6	1	7%
Total	15	100%

How did you learn about URAP? (Check all that apply) (n = 16)						
	Freq.	%			Freq.	%
Army Research Office website	5	31%		A student	0	0%
Army Educational Outreach Program (AEOP) website	1	6%		A colleague	0	0%
Facebook, Twitter, Pinterest, or other social media	0	0%		A supervisor or superior	1	6%
State or national educator conference	0	0%		URAP site host/director	1	6%
STEM conference	0	0%		Workplace communications	0	0%
School, university, or professional organization newsletter, email, or website	3	19%		Someone who works at an Army laboratory	0	0%
A news story or other media coverage	0	0%		Someone who works with the Department of Defense	3	19%
Past URAP participant	5	31%		Other, (specify):	1	6%

Note. Other = "ARO Program Manager".

How many times have YOU PARTICIPATED in any of the following Army Educational Outreach Programs in any capacity? If you have not heard of an AEOP, select "Never heard of it." If you have heard of an AEOP but never participated, select "Never."								
	0	1	2	3	4	n	Avg.	SD
Camp Invention	8 (53%)	7 (47%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
eCYBERMISSION	8 (53%)	7 (47%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
Junior Solar Sprint (JSS)	7 (47%)	8 (53%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
West Point Bridge Design Contest (WPBDC)	8 (53%)	7 (47%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
Junior Science & Humanities Symposium (JSHS)	8 (53%)	7 (47%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
Gains in the Education of Mathematics and Science (GEMS)	7 (47%)	8 (53%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
GEMS Near Peers	7 (47%)	8 (53%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
UNITE	8 (53%)	7 (47%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
Science & Engineering Apprenticeship Program (SEAP)	5 (33%)	9 (60%)	0 (0%)	0 (0%)	1 (7%)	15	**1.30**	0.95
Research & Engineering Apprenticeship Program (REAP)	4 (27%)	9 (60%)	1 (7%)	0 (0%)	1 (7%)	15	**1.36**	0.92
High School Apprenticeship Program (HSAP)	1 (7%)	12 (80%)	1 (7%)	0 (0%)	1 (7%)	15	**1.29**	0.83
College Qualified Leaders (CQL)	5 (33%)	10 (67%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00
Undergraduate Research Apprenticeship Program (URAP)	0 (0%)	2 (13%)	5 (31%)	7 (44%)	2 (13%)	16	**2.56**	0.89
Science Mathematics, and Research for Transformation (SMART) College Scholarship	3 (20%)	12 (80%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00

National Defense Science & Engineering Graduate (NDSEG) Fellowship	3 (20%)	12 (80%)	0 (0%)	0 (0%)	0 (0%)	15	**1.00**	0.00

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

Which of the following were used for the purpose of recruiting your student(s) for apprenticeships? (select ALL that apply) (n = 15)

	Freq.	%			Freq.	%
Applications from Army Research Office or the AEOP	5	33%		Communication(s) generated by a university or faculty (newsletter, email blast, website)	5	33%
Personal acquaintance(s) (friend, family, neighbor, etc.)	4	27%		Career fair(s)	0	0%
Colleague(s) in my workplace	10	67%		Education conference(s) or event(s)	1	7%
K-12 school teacher(s) outside of my workplace	1	7%		STEM conference(s) or event(s)	1	7%
University faculty outside of my workplace	2	13%		Organization(s) serving underserved or underrepresented populations	0	0%
Informational materials sent to K-12 schools or Universities outside of my workplace	0	0%		Student contacted mentor	5	33%
Communication(s) generated by a K-12 school or teacher (newsletter, email blast, website)	0	0%		I do not know how student(s) was recruited for apprenticeship	0	0%
				Other, Specify:	1	7%

Note. Other = "I advertised at my university and interviewed potential candidates!".

How SATISFIED were you with each of the following URAP program features?

	0	1	2	3	4	n	Avg.	SD
Application or registration process	1 (6%)	0 (0%)	0 (0%)	7 (44%)	8 (50%)	16	**3.53**	0.52
Other administrative tasks	4 (25%)	0 (0%)	1 (6%)	2 (13%)	9 (56%)	16	**3.67**	0.65
Communications from Army Research Office	0 (0%)	1 (6%)	1 (6%)	4 (25%)	10 (63%)	16	**3.44**	0.89
Communications from [URAP site]	2 (13%)	0 (0%)	1 (6%)	7 (44%)	6 (38%)	16	**3.36**	0.63
Support for instruction or mentorship during program activities	1 (6%)	1 (6%)	1 (6%)	4 (25%)	9 (56%)	16	**3.40**	0.91
Participation stipends (payment)	0 (0%)	1 (6%)	0 (0%)	7 (44%)	8 (50%)	16	**3.38**	0.81
Research abstract preparation requirements	1 (6%)	0 (0%)	0 (0%)	6 (38%)	9 (56%)	16	**3.60**	0.51

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

The list below describes mentoring strategies that are effective ways to establish the relevance of learning activities for students. From the list below, please indicate which strategies you used when working with your student(s) in URAP.					
		Yes – I used this strategy		No – I did not use this strategy	
	n	Freq.	%	Freq.	%
Finding out about students' backgrounds and interests at the beginning of the program	16	16	100%	0	0%
Giving students real-life problems to investigate or solve	16	15	94%	1	6%
Asking students to relate outside events or activities to topics covered in the program	16	9	56%	7	44%
Selecting readings or activities that relate to students' backgrounds	16	11	69%	5	31%
Encouraging students to suggest new readings, activities, or projects	16	12	75%	4	25%
Making explicit provisions for students who wish to carry out independent studies	16	15	94%	1	6%
Helping students become aware of the roles STEM plays in their everyday lives	16	11	69%	5	31%
Helping students understand how STEM can help them improve their communities	15	7	47%	8	53%
Other, (specify):	5	2	40%	3	60%

Note. Other = "1) Link research study to courses 2) Link research study to skeptical-realistic real-world thinking", and "hands on experiences".

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.	%
Finding out about students' learning styles at the beginning of the program	15	9	60%	6	40%
Interacting with all students in the same way regardless of their gender or race and ethnicity	15	14	93%	1	7%
Using gender neutral language	15	14	93%	1	7%
Using diverse teaching/mentoring activities to address a broad spectrum of students	15	12	80%	3	20%
Integrating ideas from the literature on pedagogical activities for women and underrepresented students	15	6	40%	9	60%
Providing extra readings, activities, or other support for students who lack essential background knowledge or skills	15	14	93%	1	7%
Directing students to other individuals or programs if I can only provide limited support	15	12	80%	3	20%
Other, (specify):	2	0	0%	2	100%

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 students tell others about their backgrounds and interests	16	12	75%	4	25%
Having students explain difficult ideas to others	16	16	100%	0	0%
Having students exchange ideas with others whose backgrounds or viewpoints are different from their own	16	9	56%	7	44%
Having students participate in giving and receiving feedback	16	15	94%	1	6%
Having students work on collaborative activities or projects as a member of a team	16	16	100%	0	0%
Having students listen to the ideas of others with an open mind	16	15	94%	1	6%
Having students pay attention to the feelings of all team members	16	13	81%	3	19%
Having students develop ways to resolve conflict and reach agreement among the team	16	10	63%	6	38%
Other, (specify):	3	0	0%	3	100%

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	15	13	87%	2	13%
Having students access and critically review technical texts or media to support their work	15	13	87%	2	13%
Demonstrating the use of laboratory or field techniques, procedures, and tools students are expected to use	15	15	100%	0	0%
Helping students practice STEM skills with supervision	15	14	93%	1	7%
Giving constructive feedback to improve students' STEM competencies	15	15	100%	0	0%
Allowing students to work independently as appropriate for their self-management abilities and STEM competencies	15	15	100%	0	0%
Encouraging students to seek support from other team members	15	15	100%	0	0%
Encouraging opportunities in which students could learn from others (team projects, team meetings, journal clubs)	15	15	100%	0	0%
Other, (specify):	2	0	0%	2	100%

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 about students' educational and career interests	16	15	94%	1	6%
Recommending extracurricular programs that align with students' educational goals	16	10	63%	6	38%
Recommending Army Educational Outreach Programs that align with students' educational goals	16	7	44%	9	56%
Providing guidance about educational pathways that would prepare students for a STEM career	16	13	81%	3	19%
Sharing personal experiences, attitudes, and values pertaining to STEM	15	12	80%	3	20%
Discussing STEM career opportunities with the DoD or other government agencies	15	8	53%	7	47%
Discussing STEM career opportunities outside of the DoD or other government agencies (private industry, academia)	15	11	73%	4	27%
Discussing non-technical aspects of a STEM career (economic, political, ethical, and/or social issues)	15	5	33%	10	67%
Highlighting under-representation of women and racial and ethnic minority populations in STEM and/or their contributions in STEM	15	5	33%	10	67%
Recommending student and professional organizations in STEM	15	8	53%	7	47%
Helping students build effective STEM networks	15	8	53%	7	47%
Critically reviewing students' résumé, application, or interview preparations	15	13	87%	2	13%
Other, (specify):	2	0	0%	2	100%

How USEFUL were each of the following in your efforts to expose student(s) to Army Educational Outreach Programs (AEOPs) during URAP?								
	0	**1**	**2**	**3**	**4**	**n**	**Avg.**	**SD**
Army Research Office website	6 (43%)	0 (0%)	2 (14%)	3 (21%)	3 (21%)	14	**3.13**	0.83
Army Educational Outreach Program (AEOP) website	5 (36%)	0 (0%)	2 (14%)	3 (21%)	4 (29%)	14	**3.22**	0.83
AEOP social media	10 (71%)	0 (0%)	2 (14%)	0 (0%)	2 (14%)	14	**3.00**	1.15
AEOP brochure	8 (57%)	0 (0%)	1 (7%)	1 (7%)	4 (29%)	14	**3.50**	0.84
AEOP instructional supplies (Rite in the Rain notebook, Lab coats, etc.)	4 (29%)	0 (0%)	2 (14%)	4 (29%)	4 (29%)	14	**3.20**	0.79
Program administrator or site coordinator	6 (43%)	0 (0%)	2 (14%)	1 (7%)	5 (36%)	14	**3.38**	0.92
Invited speakers or "career" events	12 (86%)	0 (0%)	1 (7%)	0 (0%)	1 (7%)	14	**3.00**	1.41
Participation in URAP	0 (0%)	0 (0%)	2 (14%)	1 (7%)	11 (79%)	14	**3.64**	0.74

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

Which of the following AEOPs did you EXPLICITLY DISCUSS with your student(s) during 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?								
	0	1	2	3	4	n	Avg.	SD
Army Research Office website	6 (40%)	0 (0%)	1 (7%)	5 (33%)	3 (20%)	15	**3.22**	0.67
Army Educational Outreach Program (AEOP) website	6 (40%)	0 (0%)	3 (20%)	2 (13%)	4 (27%)	15	**3.11**	0.93
AEOP social media	11 (79%)	0 (0%)	2 (14%)	0 (0%)	1 (7%)	14	**2.67**	1.15
AEOP brochure	8 (57%)	0 (0%)	2 (14%)	1 (7%)	3 (21%)	14	**3.17**	0.98
AEOP instructional supplies (Rite in the Rain notebook, Lab coats)	6 (43%)	0 (0%)	3 (21%)	1 (7%)	4 (29%)	14	**3.13**	0.99
Program administrator or site coordinator	8 (53%)	0 (0%)	1 (7%)	1 (7%)	5 (33%)	15	**3.57**	0.79
Invited speakers or "career" events	11 (79%)	0 (0%)	1 (7%)	0 (0%)	2 (14%)	14	**3.33**	1.15
Participation in URAP	1 (7%)	0 (0%)	2 (13%)	3 (20%)	9 (60%)	15	**3.50**	0.76

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

Rate how much you agree or disagree with each of the following statements about Department of Defense (DoD) researchers and research:								
	1	2	3	4	5	n	Avg.	SD
DoD researchers advance science and engineering fields	0 (0%)	0 (0%)	1 (7%)	3 (20%)	11 (73%)	15	**4.67**	0.62
DoD researchers develop new, cutting edge technologies	0 (0%)	0 (0%)	1 (7%)	2 (13%)	12 (80%)	15	**4.73**	0.59
DoD researchers support non-defense related advancements in science and technology	0 (0%)	0 (0%)	2 (13%)	3 (20%)	10 (67%)	15	**4.53**	0.74
DoD researchers solve real-world problems	0 (0%)	0 (0%)	1 (7%)	2 (13%)	12 (80%)	15	**4.73**	0.59
DoD research is valuable to society	0 (0%)	0 (0%)	1 (7%)	2 (13%)	12 (80%)	15	**4.73**	0.59

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

How often did YOUR STUDENT(S) have opportunities do each of the following in URAP?								
	1	2	3	4	5	n	Avg.	SD
Learn new science, technology, engineering, or mathematics (STEM) topics	0 (0%)	0 (0%)	1 (6%)	6 (38%)	9 (56%)	16	**4.50**	0.63
Apply STEM knowledge to real life situations	1 (6%)	2 (13%)	2 (13%)	6 (38%)	5 (31%)	16	**3.75**	1.24
Learn about cutting-edge STEM research	1 (6%)	1 (6%)	3 (19%)	3 (19%)	8 (50%)	16	**4.00**	1.26
Learn about different STEM careers	1 (6%)	3 (19%)	6 (38%)	4 (25%)	2 (13%)	16	**3.19**	1.11
Interact with STEM professionals	2 (13%)	0 (0%)	2 (13%)	4 (25%)	8 (50%)	16	**4.00**	1.37

Practice using laboratory or field techniques, procedures, and tools	1 (6%)	0 (0%)	1 (6%)	6 (38%)	8 (50%)	16	**4.25**	1.06
Participate in hands-on STEM activities	1 (6%)	0 (0%)	2 (13%)	3 (19%)	10 (63%)	16	**4.31**	1.14
Work as part of a team	0 (0%)	0 (0%)	1 (6%)	0 (0%)	15 (94%)	16	**4.88**	0.50
Communicate with other students about STEM	0 (0%)	0 (0%)	2 (14%)	2 (14%)	10 (71%)	14	**4.57**	0.76
Pose questions or problems to investigate	0 (0%)	0 (0%)	2 (13%)	4 (27%)	9 (60%)	15	**4.47**	0.74
Design an investigation	0 (0%)	1 (7%)	5 (33%)	2 (13%)	7 (47%)	15	**4.00**	1.07
Carry out an investigation	0 (0%)	0 (0%)	2 (13%)	3 (20%)	10 (67%)	15	**4.53**	0.74
Analyze and interpret data or information	0 (0%)	0 (0%)	4 (27%)	4 (27%)	7 (47%)	15	**4.20**	0.86
Draw conclusions from an investigation	0 (0%)	1 (7%)	3 (20%)	5 (33%)	6 (40%)	15	**4.07**	0.96
Come up with creative explanations or solutions	0 (0%)	1 (7%)	4 (27%)	5 (33%)	5 (33%)	15	**3.93**	0.96

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	9	9 (56%)
Technology	2	2 (13%)
Engineering	4	4 (25%)
Mathematics	1	1 (6%)
Total	16	100%

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Knowledge of a STEM topic or field in depth	0 (0%)	0 (0%)	1 (6%)	8 (50%)	7 (44%)	16	**4.38**	0.62
Knowledge of research conducted in a STEM topic or field	0 (0%)	0 (0%)	2 (13%)	6 (38%)	8 (50%)	16	**4.38**	0.72
Knowledge of research processes, ethics, and rules for conduct in STEM	0 (0%)	1 (6%)	1 (6%)	6 (38%)	8 (50%)	16	**4.31**	0.87
Knowledge of how professionals work on real problems in STEM	0 (0%)	1 (6%)	1 (6%)	8 (50%)	6 (38%)	16	**4.19**	0.83
Knowledge of what everyday research work is like in STEM	0 (0%)	1 (6%)	0 (0%)	6 (38%)	9 (56%)	16	**4.44**	0.81

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

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	2	3	4	5	n	Avg.	SD
Asking questions based on observations of real-world phenomena	0 (0%)	0 (0%)	4 (44%)	4 (44%)	1 (11%)	9	**3.67**	0.71
Asking a question (about a phenomenon) that can be answered with one or more investigations	0 (0%)	0 (0%)	4 (44%)	4 (44%)	1 (11%)	9	**3.67**	0.71
Applying knowledge, logic, and creativity to propose explanations that can be tested with investigations	0 (0%)	0 (0%)	3 (33%)	5 (56%)	1 (11%)	9	**3.78**	0.67
Making a model to represent the key features and functions of an observed phenomenon	0 (0%)	1 (11%)	5 (56%)	3 (33%)	0 (0%)	9	**3.22**	0.67
Deciding what type of data to collect in order to answer a question	0 (0%)	1 (11%)	2 (22%)	3 (33%)	3 (33%)	9	**3.89**	1.05
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	0 (0%)	2 (22%)	2 (22%)	3 (33%)	2 (22%)	9	**3.56**	1.13
Identifying the limitations of data collected in an investigation	0 (0%)	0 (0%)	4 (44%)	3 (33%)	2 (22%)	9	**3.78**	0.83
Carrying out procedures for an investigation and recording data accurately	0 (0%)	0 (0%)	1 (11%)	4 (44%)	4 (44%)	9	**4.33**	0.71
Testing how changing one variable affects another variable, in order to understand relationships between variables	0 (0%)	0 (0%)	2 (22%)	5 (56%)	2 (22%)	9	**4.00**	0.71
Using computer-based models to investigate cause and effect relationships of a simulated phenomenon	5 (56%)	2 (22%)	0 (0%)	2 (22%)	0 (0%)	9	**1.89**	1.27
Considering alternative interpretations of data when deciding on the best explanation for a phenomenon	0 (0%)	0 (0%)	4 (44%)	3 (33%)	2 (22%)	9	**3.78**	0.83
Displaying numeric data from an investigation in charts or graphs to identify patterns and relationships	0 (0%)	1 (11%)	4 (44%)	2 (22%)	2 (22%)	9	**3.56**	1.01
Using mathematics or computers to analyze numeric data	1 (11%)	3 (33%)	2 (22%)	2 (22%)	1 (11%)	9	**2.89**	1.27
Supporting a proposed explanation (for a phenomenon) with data from investigations	0 (0%)	0 (0%)	5 (56%)	2 (22%)	2 (22%)	9	**3.67**	0.87
Supporting a proposed explanation with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	0 (0%)	4 (44%)	3 (33%)	2 (22%)	9	**3.78**	0.83
Identifying the strengths and limitations of explanations in terms of how well they describe or predict observations	1 (11%)	1 (11%)	4 (44%)	3 (33%)	0 (0%)	9	**3.00**	1.00

Using data or interpretations from other researchers or investigations to improve an explanation	1 (11%)	1 (11%)	5 (56%)	1 (11%)	1 (11%)	9	**3.00**	1.12
Asking questions to understand the data and interpretations others use to support their explanations	1 (11%)	1 (11%)	2 (22%)	3 (33%)	2 (22%)	9	**3.44**	1.33
Using data from investigations to defend an argument that conveys how an explanation describes an observed phenomenon	1 (11%)	0 (0%)	5 (56%)	3 (33%)	0 (0%)	9	**3.11**	0.93
Deciding what additional data or information may be needed to find the best explanation for a phenomenon	0 (0%)	2 (22%)	4 (44%)	2 (22%)	1 (11%)	9	**3.22**	0.97
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	3 (33%)	3 (33%)	1 (11%)	2 (22%)	9	**3.22**	1.20
Identifying the strengths and limitation of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	3 (33%)	4 (44%)	2 (22%)	0 (0%)	9	**2.89**	0.78
Integrating information from multiple sources to support your explanations of phenomena	0 (0%)	2 (22%)	5 (56%)	1 (11%)	1 (11%)	9	**3.11**	0.93
Communicating information about your investigations and explanations in different formats (orally, written, graphically, mathematically, etc.)	0 (0%)	0 (0%)	4 (44%)	4 (44%)	1 (11%)	9	**3.67**	0.71

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

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Identifying real-world problems based on social, technological, or environmental issues	1 (14%)	0 (0%)	2 (29%)	4 (57%)	0 (0%)	7	**3.29**	1.11
Defining a problem that can be solved by developing a new or improved object, process, or system	0 (0%)	0 (0%)	0 (0%)	7 (100%)	0 (0%)	7	**4.00**	0.00
Applying knowledge, logic, and creativity to propose solutions that can be tested with investigations	0 (0%)	0 (0%)	1 (14%)	5 (71%)	1 (14%)	7	**4.00**	0.58
Making a model that represents the key features or functions of a solution to a problem	0 (0%)	0 (0%)	0 (0%)	7 (100%)	0 (0%)	7	**4.00**	0.00
Deciding what type of data to collect in order to test if a solution functions as intended	0 (0%)	0 (0%)	1 (14%)	5 (71%)	1 (14%)	7	**4.00**	0.58
Designing procedures for investigations, including selecting methods and tools that are appropriate for the data to be collected	0 (0%)	0 (0%)	1 (14%)	5 (71%)	1 (14%)	7	**4.00**	0.58

Identifying the limitations of the data collected in an investigation	0 (0%)	1 (14%)	1 (14%)	5 (71%)	0 (0%)	7	**3.57**	0.79
Carrying out procedures for an investigation and recording data accurately	0 (0%)	0 (0%)	1 (14%)	5 (71%)	1 (14%)	7	**4.00**	0.58
Testing how changing one variable affects another variable in order to determine a solution's failure points or to improve its performance	0 (0%)	1 (14%)	1 (14%)	4 (57%)	1 (14%)	7	**3.71**	0.95
Using computer-based models to investigate cause and effect relationships of a simulated solution	0 (0%)	0 (0%)	0 (0%)	6 (86%)	1 (14%)	7	**4.14**	0.38
Considering alternative interpretations of data when deciding if a solution functions as intended	0 (0%)	0 (0%)	1 (14%)	5 (71%)	1 (14%)	7	**4.00**	0.58
Displaying numeric data in charts or graphs to identify patterns and relationships	0 (0%)	0 (0%)	0 (0%)	5 (83%)	1 (17%)	6	**4.17**	0.41
Using mathematics or computers to analyze numeric data	0 (0%)	0 (0%)	1 (17%)	4 (67%)	1 (17%)	6	**4.00**	0.63
Supporting a proposed solution (for a problem) with data from investigations	0 (0%)	0 (0%)	1 (17%)	3 (50%)	2 (33%)	6	**4.17**	0.75
Supporting a proposed solution with relevant scientific, mathematical, and/or engineering knowledge	0 (0%)	0 (0%)	1 (17%)	3 (50%)	2 (33%)	6	**4.17**	0.75
Identifying the strengths and limitations of solutions in terms of how well they meet design criteria	0 (0%)	1 (17%)	1 (17%)	3 (50%)	1 (17%)	6	**3.67**	1.03
Using data or interpretations from other researchers or investigations to improve a solution	0 (0%)	0 (0%)	1 (17%)	3 (50%)	2 (33%)	6	**4.17**	0.75
Asking questions to understand the data and interpretations others use to support their solutions	0 (0%)	0 (0%)	0 (0%)	5 (83%)	1 (17%)	6	**4.17**	0.41
Using data from investigations to defend an argument that conveys how a solution meets design criteria	0 (0%)	0 (0%)	4 (67%)	2 (33%)	0 (0%)	6	**3.33**	0.52
Deciding what additional data or information may be needed to find the best solution to a problem	0 (0%)	0 (0%)	2 (33%)	3 (50%)	1 (17%)	6	**3.83**	0.75
Reading technical or scientific texts, or using other media, to learn about the natural or designed worlds	0 (0%)	0 (0%)	2 (33%)	3 (50%)	1 (17%)	6	**3.83**	0.75
Identifying the strengths and limitations of data, interpretations, or arguments presented in technical or scientific texts	0 (0%)	0 (0%)	1 (17%)	5 (83%)	0 (0%)	6	**3.83**	0.41
Integrating information from multiple sources to support your solution to a problem	0 (0%)	0 (0%)	3 (50%)	2 (33%)	1 (17%)	6	**3.67**	0.82

Communicating information about your design processes and/or solutions in different formats (orally, written, graphically, mathematically, etc.)	0 (0%)	0 (0%)	1 (17%)	5 (83%)	0 (0%)	6	**3.83**	0.41

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

AS A RESULT OF THE URAP EXPERIENCE, how much did your student(s) GAIN (on average) in the following areas?								
	1	**2**	**3**	**4**	**5**	**n**	**Avg.**	**SD**
Learning to work independently	0 (0%)	0 (0%)	3 (19%)	8 (50%)	5 (31%)	16	**4.13**	0.72
Setting goals and reflecting on performance	0 (0%)	1 (6%)	5 (31%)	7 (44%)	3 (19%)	16	**3.75**	0.86
Sticking with a task until it is complete	0 (0%)	0 (0%)	4 (25%)	9 (56%)	3 (19%)	16	**3.94**	0.68
Making changes when things do not go as planned	0 (0%)	0 (0%)	4 (25%)	8 (50%)	4 (25%)	16	**4.00**	0.73
Patience for the slow pace of research	0 (0%)	1 (6%)	3 (19%)	9 (56%)	3 (19%)	16	**3.88**	0.81
Working collaboratively with a team	0 (0%)	0 (0%)	2 (13%)	7 (44%)	7 (44%)	16	**4.31**	0.70
Communicating effectively with others	0 (0%)	0 (0%)	3 (19%)	9 (56%)	4 (25%)	16	**4.06**	0.68
Including others' perspectives when making decisions	0 (0%)	1 (6%)	3 (19%)	7 (44%)	5 (31%)	16	**4.00**	0.89
Sense of being part of a learning community	0 (0%)	0 (0%)	3 (19%)	7 (44%)	6 (38%)	16	**4.19**	0.75
Sense of contributing to a body of knowledge	0 (0%)	0 (0%)	2 (13%)	9 (56%)	5 (31%)	16	**4.19**	0.66
Building relationships with professionals in a field	1 (6%)	1 (6%)	2 (13%)	8 (50%)	4 (25%)	16	**3.81**	1.11
Connecting a topic or field and their personal values	2 (13%)	0 (0%)	3 (19%)	7 (44%)	4 (25%)	16	**3.69**	1.25

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

Which of the following statements describe YOUR STUDENT(S) after participating in the URAP program?							
	1	**2**	**3**	**4**	**n**	**Avg.**	**SD**
More confident in STEM knowledge, skills, and abilities	0 (0%)	0 (0%)	12 (80%)	3 (20%)	15	**3.20**	0.41
More interested in participating in STEM activities outside of school requirements	1 (7%)	2 (13%)	9 (60%)	3 (20%)	15	**2.93**	0.80
More aware of other AEOPs	4 (27%)	1 (7%)	8 (53%)	2 (13%)	15	**2.53**	1.06
More interested in participating in other AEOPs	2 (14%)	1 (7%)	6 (43%)	5 (36%)	14	**3.00**	1.04
More interested in taking STEM classes in school	2 (13%)	5 (33%)	5 (33%)	3 (20%)	15	**2.60**	0.99
More interested in attending college	3 (20%)	6 (40%)	4 (27%)	2 (13%)	15	**2.33**	0.98
More interested in earning a STEM degree in college	2 (13%)	5 (33%)	7 (47%)	1 (7%)	15	**2.47**	0.83
More interested in pursuing a STEM career	2 (13%)	3 (20%)	8 (53%)	2 (13%)	15	**2.67**	0.90
More aware of Department of Defense (DoD) STEM research and careers	3 (20%)	1 (7%)	7 (47%)	4 (27%)	15	**2.80**	1.08
Greater appreciation of DoD STEM research and careers	3 (20%)	1 (7%)	7 (47%)	4 (27%)	15	**2.80**	1.08
More interested in pursuing a STEM career with the DoD	5 (33%)	1 (7%)	6 (40%)	3 (20%)	15	**2.47**	1.19

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

FY14 URAP Apprentice Focus Group Protocol

2014 Army Educational Outreach Program

Student Focus Group

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

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

Key Questions

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

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

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

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

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

Ending questions:

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

Appendix E

FY14 URAP Mentor Focus Group Protocol

2014 Army Educational Outreach Program
Adult Focus Group

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

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

Key Questions

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

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

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

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

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

Ending questions:

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