

## **Increasing Minority Student Applications to STEM Graduate Programs: Lessons Learned and Outlook for a New Program**

### **Mr. Kingsley Nwosu Jr, Virginia Polytechnic Institute and State University**

Kingsley Nwosu is a Computer Science Master's of Engineering student at the Virginia Polytechnic Institute and State University's (Virginia Tech) College of Engineering. He received his Bachelors of Science degree in Computer Science from Saint Leo University. Nwosu attends Virginia Tech as a full GEM fellow, and serves as a graduate student for the Virginia Tech College of Engineering. He has also served as a Graduate Teaching Assistant and a Graduate Research Assistant.

### **Dr. Tremayne O'Brian Waller, Virginia Polytechnic Institute and State University**

Dr. Tremayne O. Waller (Ph.D., Virginia Tech) is the Director of Graduate Student Programs at Virginia Tech in the Center for the Enhancement of Engineering Diversity (CEED). Dr. Waller is responsible for developing and implementing evidence-based strategic priorities for recruiting and retention of underrepresented students in College of Engineering graduate programs. He is working with faculty, staff and students to implement a strategic plan for graduate student success. Dr. Waller was the Interim Director for the Office of Academic Diversity Initiatives (OADI) and Director/Lecturer of the McNair Scholars Program at Cornell University. He has also worked as the Associate Director of Advising and Diversity in the College of Architecture, Art, and Planning and Diversity Programs in Engineering (DPE) at Cornell University. He completed his Ph.D. in Curriculum and Instruction from Virginia Tech.

### **Mandy J Wright, Fields Wright Consulting**

Mandy Wright has a background in the service and hospitality industry, along with 15 years' experience teaching high school and college language arts, composition, communication. Of those 15 years, she spent 2012 to 2019 at Virginia Tech, teaching, coordinating, and assessing professional and technical communication instruction within three different engineering departments (MSE, ESM/BEAM, and CEE); and developing and founding the civil engineering communication program.

Mandy holds master's degrees in rhetoric and English education from the University of Dayton, and completed 42 hours of PhD coursework and research in Rhetoric and Writing at Virginia Tech, with a focus on technical communication in engineering education. In 2010, she wrote her MA thesis on personal statements in application to graduate programs, and since has served as a panelist, speaker, workshop instructor, and writing coach to hundreds of successful graduate school applicants and graduates across the nation.

In 2019, she returned to Ohio and served a year as Education Director for a small Dayton, Ohio-based non-profit, where she helped the organization earn its accreditation in the fall, and then spent the first half of 2020 in remote learning and advocacy for the teenage foster youth who lived in its group home.

She has since moved on to positions as data analyst, content developer, and team supervisor for Merriman River Group, an elections consulting firm; and in logistics for Formula Ink, which provides agile-based training and support for entrepreneurs and corporations. She also provides strategic communication and coaching services across multiple sectors.

Mandy currently resides in Satellite Beach, Florida with her partner, Jonathan, and their "Brady Bunch" of five black cats.

### **Dr. Mike Ekoniak, Youngstown State University - Rayen School of Engineering**

Mike Ekoniak is an Assistant Professor at Youngstown State University's Rayen School of Engineering, where he teaches in the First-Year Engineering Program. His scholarship interests include innovative pedagogies to prepare engineering graduates for critical practice in a diverse and constantly-evolving society, engineering culture and identity, and the relationship between engineering and capitalism. Mike holds bachelor's and master's degrees in Computer Engineering from Kettering University and Virginia Tech, where he also completed his PhD in Engineering Education.



*Increasing Minority  
Student Applications to  
STEM Graduate Programs:*

*Lessons Learned and Outlook  
for a New Program*

Good afternoon, and thank you for joining us today as we discuss our lessons learned and outlook for a new program developed to increase underrepresented minority student applications to STEM graduate programs, called A Step to the Doctorate. (To the reviewers: The final version of this PowerPoint would/will include photos from the program; participants signed a photo waiver.)

## Overview



- Who We Are
- Introduction
  - About Virginia Tech Center for Enhancement of Engineering Diversity
  - Objectives and Goals of CEED and A Step to the Doctorate Program
- Background
- Program Descriptions – 2020 & 2021
- Program Participant Feedback & Reflections
  - GESES Survey Questionnaire
  - Exit Survey
  - Reflections & Discussion
- Next Steps
- References

Our intentions in joining the conversation here at CoNECD include describing the first two incarnations of the program, delivered in 2020 and 2021, and discussing the results of our exit survey on program effectiveness. We will examine these results as related to participant demographic data, scores on the Graduate Education Self-Efficacy Scale, and our own reflections. As we continue to develop the program in light of our goals, reflections, and participant feedback, we are also seeking opportunities to expand the conversation to peer programs in order to develop, locate, and implement tools for analysis and assessment and to find and share narratives and analysis of successes and challenges to these programs and their participating students, practitioners, researchers, and institutions. Our vision also includes to work with our peers in these ways to identify potential best practices for programs like A Step to the Doctorate, with an audience beyond engineering education, in student services and administration, in mind as well. But first, we will introduce ourselves and the center through which the program operates.



## Who We Are

**Tremayne “Trey” Waller, PhD**

Director of Graduate Student Programs  
College of Engineering, Virginia Tech

**Mike Ekoniak III, PhD**

Assistant Professor  
Rayen School of Engineering,  
Youngstown State University

**Kingsley Nwosu, MEng**

Data Platform Engineer  
Oak Ridge National Laboratory

**Mandy J. Wright, MA, MEd**

Co-Director | Content Strategy  
Fields Wright Communication  
Consulting

Individual introductions of those present and their roles.



*Goals and Objectives of CEED and  
A Step to the Doctorate Program*

A Step to the Doctorate is programming offered by the Center for Enhancement of Engineering Diversity, or CEED ("seed") at Virginia Tech, a center for diversity and outreach located within the dean's office of the College of Engineering, under the direction of the Associate Dean of Equity and Engagement.

**CEED**

Virginia Tech  
Center for  
Enhancement  
of Engineering  
Diversity

<https://eng.vt.edu/ceed.html>

Mission: "The Center for the Enhancement of Engineering Diversity (CEED) at Virginia Tech is dedicated to enriching the engineering profession through increased diversity. Our programs are targeted to current engineering students at Virginia Tech, prospective students, and the Commonwealth of Virginia's pre-college community."

(CEED 2019-2020 Annual Report)

The mission of CEED reflects this; according to the 2019-2020 CEED Annual Report, "The Center for the Enhancement of Engineering Diversity (CEED) at Virginia Tech is dedicated to enriching the engineering profession through increased diversity. Our programs are targeted to current engineering students at Virginia Tech, prospective students, and the Commonwealth of Virginia's pre-college community." The CEED website and Annual Report also introduce the center, "Since 1992, the Center for the Enhancement of Engineering Diversity (CEED) has provided encouragement and support to engineering students, focusing on the under-represented population. Our office recognizes that Virginia Tech students are among the best and brightest, and assists them in achieving excellence."

**CEED**

Virginia Tech  
Center for  
Enhancement  
of Engineering  
Diversity

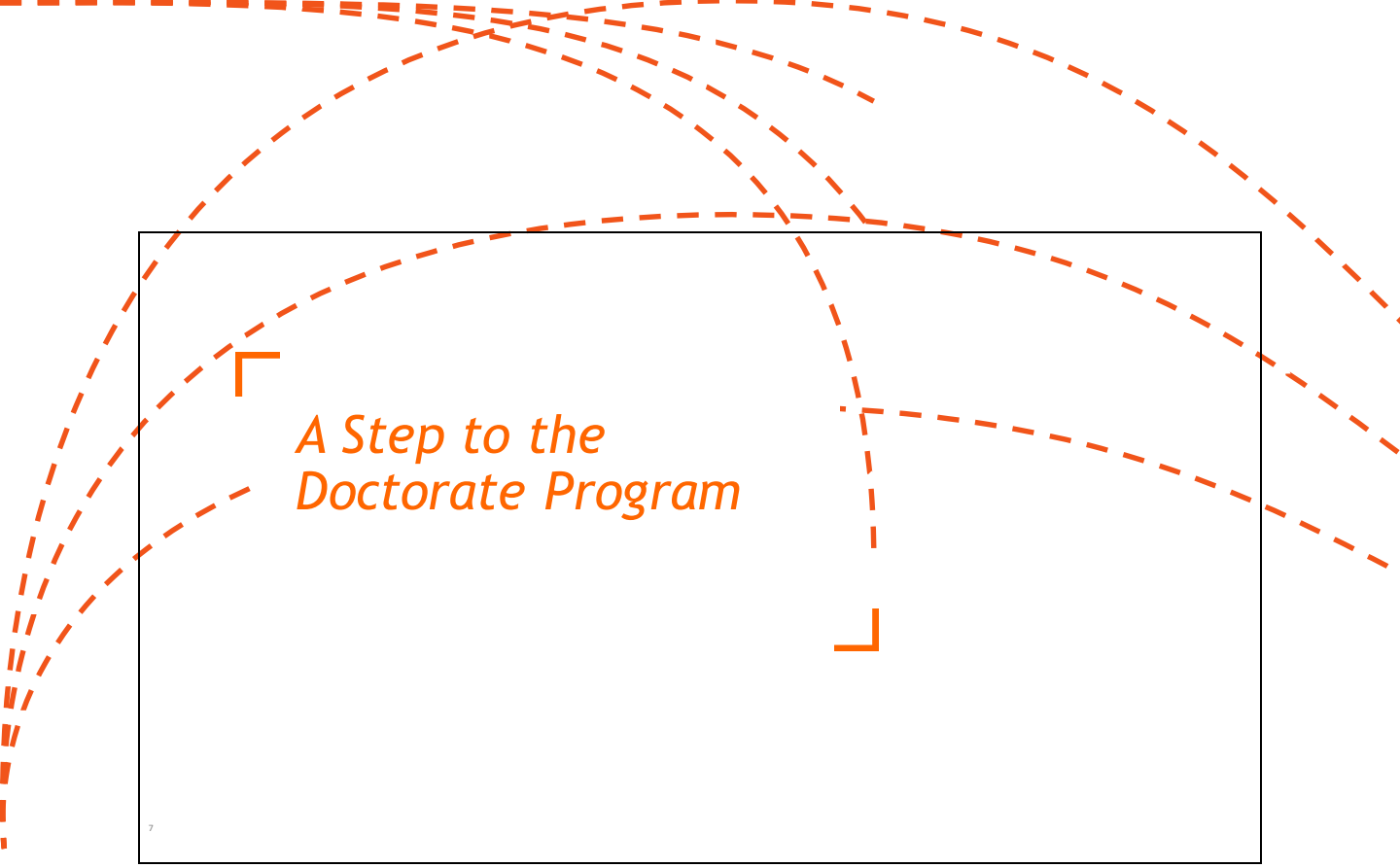
(<https://eng.vt.edu/ceed.html>)

- Outreach Programs
- Undergraduate Programs
- Graduate Programs

CEED's programming includes 10 outreach programs for K through 12 students. Seven of these programs were highlighted as major initiatives in the CEED Annual Report 2019-2020; these programs focus on students from a variety of underrepresented backgrounds, including in-school programs for students in the rural Appalachian region where Blacksburg and Virginia Tech are located, residential and day camps on Virginia Tech campus, and TechGirls, a STEM exchange program for girls ages 15 to 17 from the Middle East, North Africa, and Central Asia. The report also highlights undergraduate programs that include the Student Transition Engineering Program, or STEP, which is a five week program that includes credit-bearing courses in chemistry, math, and engineering fundamentals; along with professional, social, and academic programming to support the transition from high school to college. Hypatia and Galileo are Integrated Living and Learning Communities for first year women and men in engineering, respectively. CEED also provides peer mentoring and an academic recovery program called Jump Start to serve students with diverse academic needs. In addition to major initiatives and other K12 and undergraduate programming and outreach, two CEED graduate programs focus on mentoring for first year graduate students. The New Horizon Graduate Scholars are nominated by their departments and this program is focused on providing professional development, research, and networking opportunities with a goal of encouraging cross-disciplinary connections.

One commitment of New Horizon Scholars is to provide peer mentorship as part of the VTEEM program, helping mentor other first year engineering graduate students through the transition into graduate work.





Now we will take a look at A Step to the Doctorate itself.

## A Step to the Doctorate Program

<https://eng.vt.edu/ceed/about-ceed.html>

### Selected CEED Objectives and Goals

- to increase the diversity of students who apply to, enroll, and graduate from the College of Engineering at VT;
- to increase the awareness of engineering and other technical fields as an exciting and rewarding career path to a diverse population;  
*[and in particular]*
- to provide academic, professional and personal support programs.

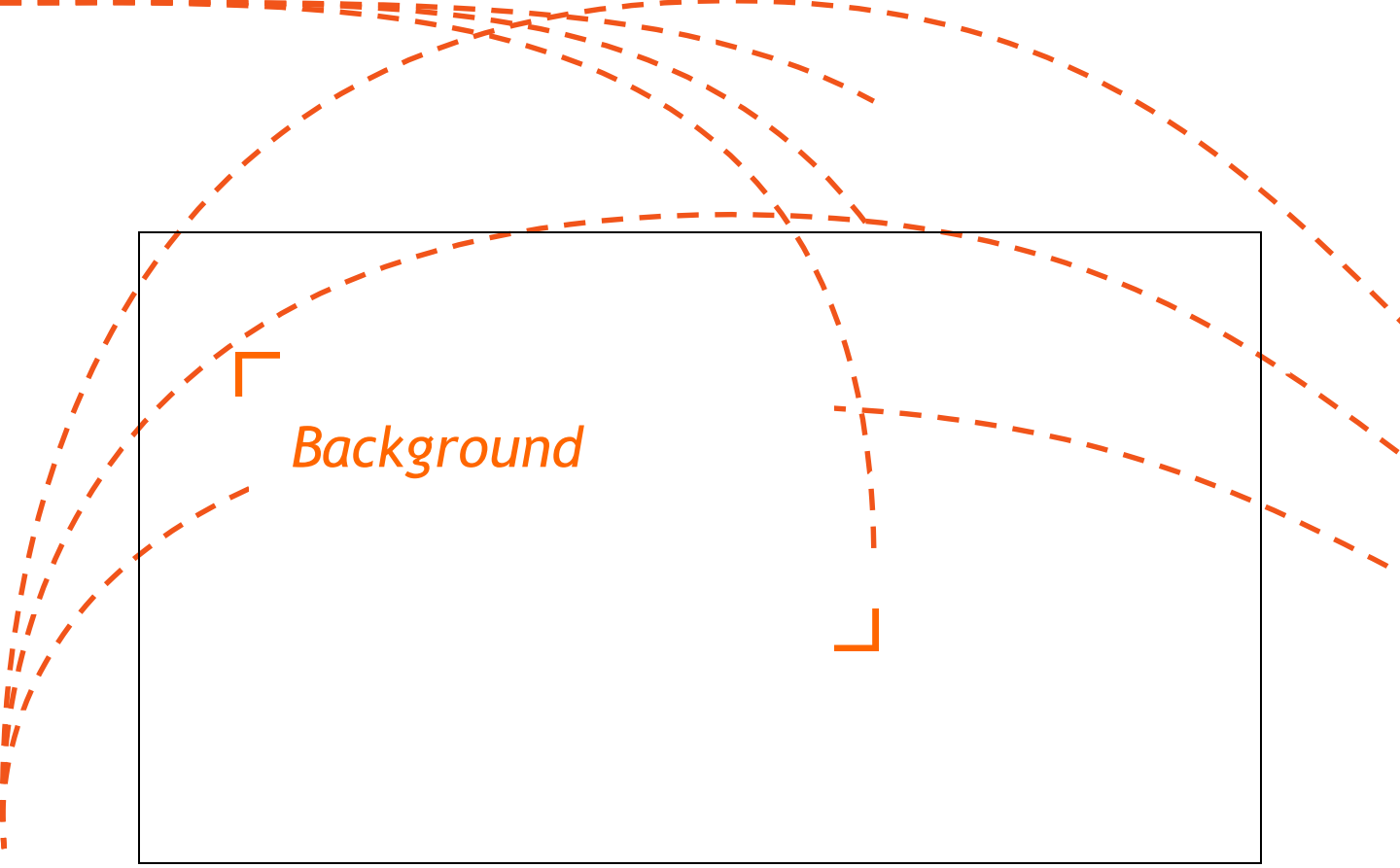
From our quick overview, you can see that CEED takes a multi-pronged approach to its mission and welcomes new ideas from its leadership and constituents to bridge gaps in this programming and to connect and engage students, faculty and professionals, and the community. A Step to the Doctorate was created in response to one of the gaps identified in existing programming, bridging between undergraduate and graduate programs. The program aims to support the mission of CEED and selected CEED objectives and goals, namely "to increase the diversity of students who apply to, enroll, and graduate from the College of Engineering at VT; to increase the awareness of engineering and other technical fields as an exciting and rewarding career path to a diverse population; *[and in particular]* to provide academic, professional and personal support programs."

## *A Step to the Doctorate Program*


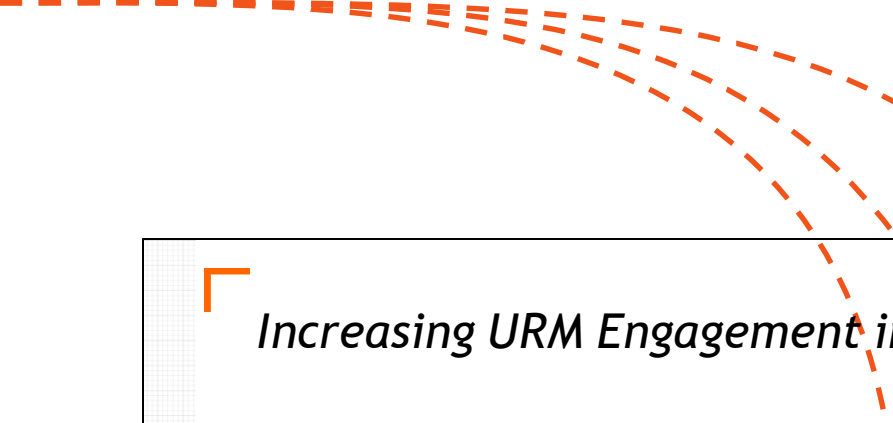
### Additional Objectives of *A Step to the Doctorate*:

- to provide exposure to graduate school
- to help participants prepare for graduate applications

Additional stated objectives of *A Step to the Doctorate* program at its outset included to provide exposure to graduate school and to help participants prepare for graduate applications.



We will describe both the 2020 and 2021 versions of the program after we very briefly discuss scholarship related to it.




## *Increasing URM Engagement in STEM*

- Gaps in attainment of URMs vs. peers (Hurtado et al., 2010)
- Focus in industry & academia on STEM labor force (Le, Mourikes, & Roy, 2020)
- Diversity vs. *equity* in STEM (Covington, Chavis, & Perry, 2017; Griffin, 2019)

11

Despite advances in bridging the divide, significant gaps remain between the attainment of underrepresented minority students in STEM and that of their white and Asian peers (Hurtado et al., 2010). While industry and academia continue to lament this disparity (Myers & Pavel, 2011; Okhana, Zhou, & Gao, 2020) and focus on growing the number of URMs in the STEM labor force (Le, Mourikes, & Roy, 2020), scholars in engineering education have critiqued the pipeline analogy and sought to also bring nuance to the discussion of increasing *equity* in STEM (Covington, Chavis, & Perry, 2017; Griffin, 2019).



## *Peer Programs in the Literature*

- Program effectiveness (Hurtado et al., 2010; Lam et al., 2003; Maton et al., 2000)
- Retention and graduation (Brothers & Knox, 2013; Cole & Espinoza, 2008; Lane, 2016; Stolle-McAllister et al., 2010)
- Identifying with STEM and academia (Carlone & Johnson, 2007; Johnson et al., 2007; Miller et al., 2017; Austin, 2002; Palmer et al., 2013)
- Faculty mentoring (Fifolt et al., 2014; Hurtado et al., 2011)

A Step to the Doctorate Institute is among several programs developed in the past two decades seeking to increase engagement of URM students in STEM and higher education. Scholarship on these programs has focused on program effectiveness (Hurtado et al., 2010; Lam et al., 2003; Maton et al., 2000) and impact on retention and graduation (Brothers & Knox, 2013; Cole & Espinoza, 2008; Lane, 2016; Stolle-McAllister et al., 2010). Research also links student success to career identity perception (Carlone & Johnson, 2007; Johnson et al., 2007; Miller et al., 2017) and socialization to academia and STEM (Austin, 2002), including the effects of attending minority serving institutions (Palmer et al., 2013). Faculty mentoring is also a factor in student success and transition to professions in STEM (Fifolt et al., 2014; Hurtado et al., 2011).



*Program Description:  
A Step to the Doctorate*

To address CEED objectives and goals set out for the program, and to address needs we have identified related to underrepresented minorities' educational attainment in STEM fields, A Step to the Doctorate was created.

## Population Served by A Step to the Doctorate: Virginia Tech/COE Undergraduate Demographics

Fall 2020

### Gender

#### Engineering / University

Male: 7,291 / 17,037

Female: 2,049 / 12,902

Not reported: 18 / 81

Total: 9,358 / 30,020

### Location

#### Engineering / University

In-state: 5,613 / 21,141

Out-of-state: 3,745 / 8,579

Total: 9,358 / 30,020

### Race/Ethnicity

#### Engineering / University

American Indian or Alaskan Native: 10 / 36

Asian: 1,297 / 3,325

Black or African American: 380 / 1,458

Hispanics of any race: 716 / 2,318

Native Hawaiian or Pacific Islander: 11 / 35

White: 5,331 / 18,834

Two or more races: 451 / 1,516

Not reported: 249 / 759

Nonresident alien: 913 / 1,739

Total: 9,358 / 30,020

14

<https://eng.vt.edu/about/rankings-and-figures/undergraduate-enrollment-by-gender-and-ethnicity.html>

In order to provide background on the population served by A Step to the Doctorate, this 2020 data provided by the College of Engineering at Virginia Tech compares the undergraduate population of the College to the overall university population on several demographic data points. Minority students in all the categories identified here made up 37.3 percent of the total student population overall and 43% of undergraduates in the college, for reference. Black or African American students comprised about 4.1% of the college population, tagging but trailing 4.8% of the overall student population. Hispanic students of any race comprised about 7.7% of both engineering undergraduates and the total student population. Students who self-identified as two or more races comprised about 4.0 and 5.0 percent of these populations, respectively; and the total number of American Indian, Alaskan Native, Native Hawaiian, and Pacific Islander students are 21 \*students\* in the college and 61 \*students\* at Virginia Tech.



## Population Served by A Step to the Doctorate: Virginia Tech/COE Graduate Demographics (2020)

Race/Ethnicity	Engineering			University		
	Masters	Doctors	Total	Masters	Doc- tors	Total
American Indian or Alaskan	0	2	2	3	5	8
Native						
Asian	59	52	111	254	112	366
Black or African American	20	41	61	166	178	344
Hispanic of any race	32	36	68	203	114	317
Native Hawaiian or Pacific Islander	0	0	0	0	0	0
White	397	349	746	1964	1152	3116
Two or more races	17	24	41	108	61	169
Not reported	18	12	30	167	42	209
Nonresident alien	367	746	1113	537	1266	1803
Total	910	1262	2172	3402	2930	6332

	Masters	Doctors	Total	Percent- age
<b>Underrepresented Minority</b>	60	88	148	7%
BSE	41	27	68	3%
Total	101	115	216	10%

Engineering				
Gender	Masters	Doctors	Total	Percent- age
Female	205	326	531	24%
Male	705	932	1637	75%
Not reported	0	4	4	0%
Total	910	1262	2172	

15

<https://eng.vt.edu/about/rankings-and-figures/graduate-enrollment-by-gender-and-ethnicity.html>

Since we are talking about the transition to graduate programs and a dearth of underrepresented minority students in engineering, let's also look at some similar 2020 data for graduate students in the College of Engineering. While the data is not presented in the same fashion, we see that underrepresented minority students comprise 10% of the graduate student population.



## *Population Served by A Step to the Doctorate: Recruitment*

- Students enrolled in the COE
- Self-identified at enrollment as an underrepresented minority in STEM
- With GPA 2.8+
- Sent nomination email by the Associate Dean for Equity and Engagement
- Applied at a link and completed GESES survey
- All who applied were accepted to participate

16

Students who recruited for the A Step to the Doctorate program were nominated according to the following overall criteria and process: The Dean's office drew a list of students who had self-identified at enrollment as a member of a minority group that is underrepresented in STEM and had a GPA of at least 2.8. On the next slide we will see a couple of differences in the details of student nominations from the 2020 to 2021 cohorts. The students who were nominated to participate in the program were sent an invitation email by the office of the Associate Dean for Equity and Engagement, which included a link to apply and complete a survey on the Graduate Education Self-Efficacy Scale, which was developed and validated by Eric G. Williams in his 2004 dissertation study of McNair Scholars at Virginia Tech. All of the students who completed these steps in each year was accepted to participate in the program.

## Population Served by A Step to the Doctorate: Participants

### 2020

- Capped at 12 students
- Seniors by credits
- Actual: Juniors and Seniors by graduation dates
- 246 nominated
- 11\* applied & participated
- 10 responded to survey

### 2021

- Capped at 20 students
- Juniors by credits
- Actual: Sophomores, Juniors, and Seniors by graduation dates
- 244 nominated
- 12\* applied & participated
- XX responded to survey

17

There were some differences in the recruitment in each year, in response to our reflections and to student feedback. With a plan to grow the program from the start, the participant cap for the program was 12 students in 2020 and 20 students in 2021. In 2020, the program was held in September of students' and students whose total credits made them seniors were nominated. With an eye to recruiting more students who needed the help the program offered and to provide more guidance and resources through the graduate applications process to those students, the 2021 program began in March and students whose credits earned made them juniors were nominated for the program. The students who joined the program in both years have included those with a spread of of expected graduation dates across several semesters. \*The asterisks on the slide next to the numbers of participants denote that the final number of participants reflects some deviation from the recruitment strategy described on the previous slide: Each year, one student requested to join the program who had learned about it by word of mouth. In each case this was a highly motivated student with a slightly lower overall GPA than required but great holistic potential fit for graduate education (e.g. one is going into his second semester as a NASA intern & has a higher in-major GPA/evidence of improvement); also in 2021 there was a student from an HBCU who attended the HBCU Summit at Virginia Tech and approached the director of A Step to the Doctorate, indicated that she planned to

apply to Virginia Tech. Because a medium term goal/dream of growing the program to include students from nearby HBCUs had already been discussed, he invited her to join the 2021 program after the start date as well, to "beta test" that idea in a way.

## Program Design 2020

### Weekend 1 Bootcamp

- Welcome & intro to program & grad student mentors
- "Why graduate school?"
- Role of grad coordinators
- Young faculty panel
- GEM & other funding
- Intro to personal statements
- Resume presentation

### Weekend 2 Bootcamp

- Personal statements workshop
- Graduate student panel

18

In 2020 A Step to the Doctorate Institute consisted primarily of two 6-hour “bootcamps” on consecutive Saturdays in September, delivered online via Zoom due to COVID-19 related precautions. Presentations by VT faculty, professional staff, and graduate students centered on the graduate experience with a focus on underrepresented minorities in STEM. The Associate Dean of Equity and Engagement and the Director of Graduate Programs welcomed the students to the program and gave an overview, including introducing students to their assigned graduate mentors. Following introductions, a faculty mentor who is a former McNair scholar gave a presentation on graduate school that ranged from explaining her academic and career trajectory to giving and advice and considerations for the entire process from how to decide whether to complete graduate work through every detail. The graduate coordinator for the Department of Civil and Environmental Engineering talked about the role of graduate coordinators in their departments and programs in the Virginia Tech College of Engineering, and encouraged the participants to talk with theirs early and often throughout the applications process and graduate school. A young faculty panel Q&A with two Black and Hispanic male faculty members followed a break for lunch, then the program director's discussion of the GEM fellowship and other funding opportunities. In the afternoon, the personal statement workshop coordinator gave a presentation and short workshop introducing personal

statements, and then an advisor from Career and Professional Development services gave a presentation on resumes. With the idea that the program was bootcamp style, we assigned them to complete a draft of their personal statement and conduct some program and funding research in the week between. On the second Saturday, the second personal statements workshop progressed, although not quite as originally intended, as only a couple of students had written much, and these were not at all complete. Having a sense that this might be the case, the instructor had gathered some sample successful statements from faculty and graduate students affiliated with the program, and much time was provided for writing and discussing the sample essays that were provided by those faculty and graduate student mentors. Several of the graduate student mentors held a Q&A panel on the second Saturday, as well.



## *Program Design 2020: Ongoing Programming*

- Resources posted in A Step Canvas site
- Participation in GEM Grad Lab
- Graduate student mentors
- Personal statement writing conferences and grad school research support (individual)

19

During and after the two Saturday bootcamps, a variety of program resources were posted to a Canvas site for A Step to the Doctorate. Canvas was chosen among options for gathering resources because it is the standard course management site for Virginia Tech, and therefore we decided that students would not need to learn or navigate a new platform to locate their course materials. Materials included slides from the bootcamp presentations, videos of the bootcamp Zoom meetings, links to graduate school applications and funding resources, and writing resources for writing personal statements and general resources for research and writing in graduate school. Programming after the Saturday bootcamps included participation in the GEM Grad Lab, which is put on by The National GEM Consortium to promote their fellowship program. According to their website "The mission of The National GEM Consortium is to enhance the value of the nation's human capital by increasing the participation of underrepresented groups (African Americans, American Indians, and Hispanic Americans) at the master's and doctoral levels in engineering and science." The writing coordinator provided ongoing individual graduate school applications research coaching and support, and one on one writing conferences, providing feedback and support on personal statements. Volunteer graduate student mentors



## *Program Design 2021: Changes and Adaptations at the Outset*

- Program ran March through September
- Boot camp in March:
  - Welcome and introduction
  - "Why grad school?"
  - Young faculty panel
  - Grad student/2020 participant panel
  - Funding presentation
  - Intro to personal statements & writing workshops
- Ongoing programming
- Closing Institute in September


20

After receiving feedback on the interest and usefulness of the programming on the 2020 exit survey, as well as through individual and anecdotal feedback and reflections, the following changes were made to the overall program design in 2021. In addition to recruiting students and beginning the program in March, the initial bootcamp contained a distilled version of the 2020 bootcamps. The Associate Dean and the Director provided a welcome, and the former McNair scholar gave a presentation on graduate school. The young faculty panel Q&A was retained and another faculty member joined the others for that hour. Graduate student mentors were not part of the program in 2021, but a graduate panel Q&A involving former participants in A Step to the Doctorate, now CEED Graduate Assistants, was added to the program. The Director gave a funding presentation that highlighted a number of funding sources, including the NSF GRFP and the GEM Fellowship; and the program included an introduction to personal statements and writing workshops. The plan was for monthly writing workshops that broke down the personal statement into small chunks directed by questions such as "What do you plan to study? What kind of research interests you?" And "Who are you? What is your story?" With peer review, revision plans, and ultimately pulling the writing together into a polished statement; with a day long closing institute in September.





## ***Program Design 2021: Adapting and Changing Mid-Stream***

- GRE scholarships
  - GEM Grad Lab
  - NSF GRFP workshop
  - Graduate school research & personal statements workshops
    - Monthly asynchronous group workshops
    - By mid-summer, completely asynchronous, individual & small group
  - Graduate school research, personal statements, and resume conferences and support (individual)
  - Closing Institute > Fall meeting/debrief/goal setting
- 



*Program Participant  
Feedback & Reflections*



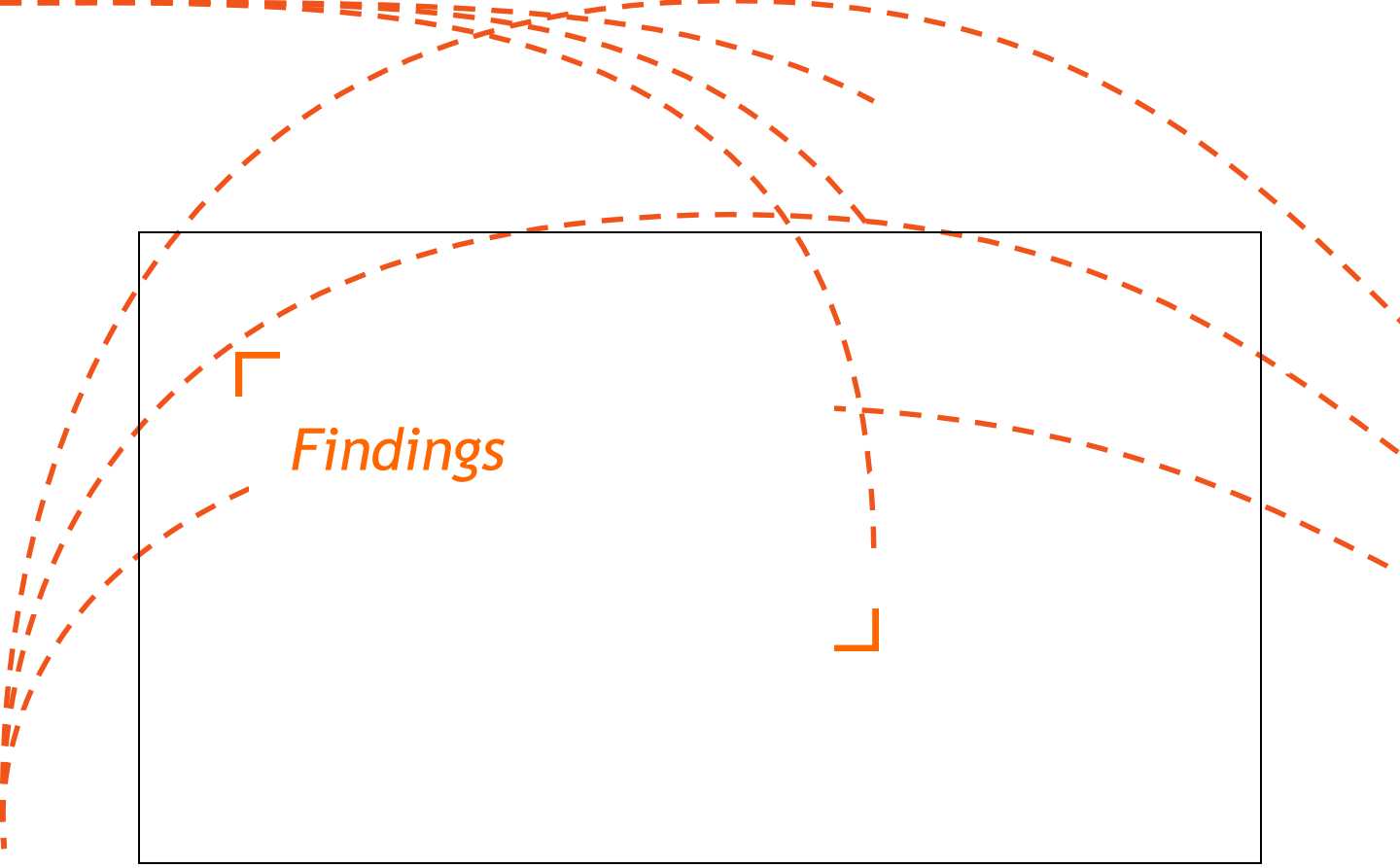
## *A Step to the Doctorate Exit Survey*

We developed a survey instrument with multiple aims:

- assessing the institute,
- identifying opportunities to improve the program from the perspective of its participants,
- better understanding students' goals for applying to graduate school in STEM fields, and
- collecting demographic information related to known obstacles to URMs' access and acculturation to graduate school

23

We developed a [survey instrument](#) with multiple aims, including to assess the institute, to identify opportunities to improve the program from the perspective of its participants, and to better understand students' goals for applying to graduate school in STEM fields. The survey also poses demographic questions related to known obstacles to URMs' access and acculturation to graduate school.





## 2020 Participant Demographics

- 7 identified as Black or African-American
- 1 identified as Afro-Latino
- One participant was a first-generation college student

25

N=10 of 11 participants (91% response rate)

From our demographics-based survey questions, we found that 7 (87%) of the participants identify as Black and 1 (12%) of the participants identify as Afro-Latino. Also, 1 (12%) of the students are first-generation college students and (75%) of the respondents stated that they have a challenging time financing their education. The students have yet to reply to the exit survey for 2021, so this data is forthcoming.



## *Academic & Professional Development*

- Warm relationships with academic advisors
- Noted challenges with restricted in-person meetings
- Uncertainty about post-graduation plans
- Proximity to family was a factor in graduate school decision making
- Funding was not a primary decision factor

Several questions inquired about the academic and professional development of the respondents. All the participants reported enjoying warm relationships with their academic advisors despite the inability to meet in person. Several respondents were uncertain about their plans after graduation. The participants weighed the graduate curriculum and proximity to their families when applying to graduate school, while funding was not seen as important.



## *Mentoring and Relationships*

- Participants viewed most program activities favorably
- Connections with mentors and administrators were viewed as most beneficial
- Funding less of a concern than anticipated

27

Participants reported that connections and experiences they had with the mentors and administrators were the most beneficial aspect of the program. The program activities enjoyed mostly favorable reviews, though students showed less interest in funding than the practitioner-researchers had expected. When asked for suggestions for the future of the program, participants suggested more activities focused on their specific graduate program interests and graduate applications activities, and improving the scheduling and logistics of the program.



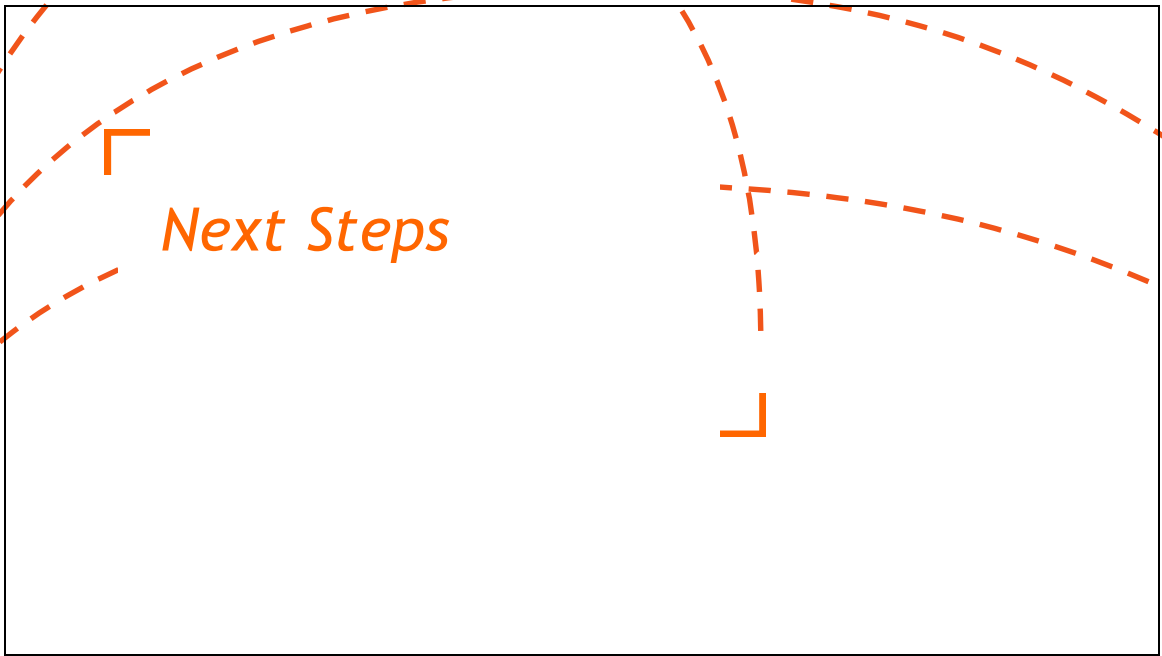
## *Further Discussion*

- Survey methodology was a limitation in capturing the breadth of participant experiences
- 2021 cohort will include a closing meeting (focus group) to supplement exit survey data

28

The 2021 program is ending with a focus group in order to collect more robust exploratory data than is possible with the exit survey alone?







## *Reflections, Musings, & Discussion*

- (How) does parental degree attainment affect student applications to research-based graduate programs?
- How can we better reach and serve first-generation college students?
- Differences between first-generation college students and first-generation graduate students?
- How can we also serve indigenous students, women from MENA and Central Asian countries, and rural Appalachian students? (targeted by some CEED Outreach Programs)

## *A Step to the Doctorate: Future Projects*

### **Funding & Expanding**

- Locate potential funding sources
- Partner with HBCUs, HACUs, and/or Native-Serving Institutions
- Develop program through best practices/assessment
- Apply for grants

### **Research & Networking**

- Literature review and "deep dive" into peer programs
- Best practices
- Analysis, assessment, theory generating
- Edited collection on peer programs?



## References

- Austin, A. E. (2002). Preparing the next generation of faculty: Graduate school as socialization to the academic career. *The Journal of Higher Education*, 73(1), 94–122.
- Brothers, E. L., & Knox, B. (2013). Best Practices in Retention Of Underrepresented Minorities In Science, Technology, Engineering, And Mathematics (Stem) In The Tennessee Louis Stokes Alliance For Minority Participation (Tennessee LSAMP). *Journal of Intercultural Disciplines*, 11, 71-84.
- Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187–1218.
- Cole, D., & Espinoza, A. (2008). Examining the Academic Success of Latino Students in Science Technology Engineering and Mathematics (STEM) Majors. *Journal of College Student Development*, 49(4), 285–300.
- Covington, M., Chavis, T., & Perry, A. (2017). A scholar-practitioner perspective to promoting minority success in STEM. *Journal for Multicultural Education* 11(2), 149-159.



## References

- Fifolt, M., Engler, J., & Abbott, G. (2014). Bridging STEM Professions for McNair Scholars through Faculty Mentoring and Academic Preparation. American Association of Collegiate Registrars and Admissions Officers.
- Griffin, K. A. (2019). Institutional barriers, strategies, and benefits to increasing the representation of Women and Men of Color in the Professoriate: Looking beyond the pipeline. *Higher Education: Handbook of Theory and Research: Volume 35*, 1-73.
- Hurtado, S., Eagan, M. K., Tran, M. C., Newman, C. B., Chang, M. J., & Velasco, P. (2011). "We Do Science Here": Underrepresented Students' Interactions with Faculty in Different College Contexts. *Journal of Social Issues*, 67(3), 553–579.
- Hurtado, S., Newman, C. B., Tran, M. C., & Chang, M. J. (2010). Improving the rate of success for underrepresented racial minorities in STEM fields: Insights from a national project. *New Directions for Institutional Research*, 2010(148), 5–15.
- Johnson, D. R., Soldner, M., Leonard, J. B., Alvarez, P., Inkelas, K. K., Rowan-Kenyon, H. T., & Longerbeam, S. D. (2007). Examining Sense of Belonging Among First-Year Undergraduates from Different Racial/Ethnic Groups. *Journal of College Student Development*, 48(5), 525–542.



## References

- Lam, P. C., Ugweje, O., Mawasha, P. R., & Srivatsan, T. (2003). An Assessment Of The Effectiveness Of The McNair Program At The University Of Akron. *Journal of Women and Minorities in Science and Engineering*, 9(1), 103–117.
- Lane, T. B. (2016). Beyond Academic and Social Integration: Understanding the Impact of a STEM Enrichment Program on the Retention and Degree Attainment of Underrepresented Students. *CBE—Life Sciences Education*, 15(3).  
<https://doi.org/10.1187/cbe.16-01-0070>
- Le, B., Mourikes, D., & Roy, S. (2020). The Future of Work. Cornell Industrial and Labor Relations School Center for Advanced Human Resource Studies. White Paper.
- Maton, K. I., Hrabowski, F. A., & Schmitt, C. L. (2000). African American college students excelling in the sciences: College and postcollege outcomes in the Meyerhoff Scholars Program. *Journal of Research in Science Teaching*, 37(7), 629–654.
- Miller, B., Tsugawa-Nieves, M. A., Chestnut, J. N., Cass, C., & Kirn, A. (2017). The influence of perceived identity fit on engineering doctoral student motivation and performance. In ASEE Annual Conference & Exposition.



## References

- Myers, C. B., & Pavel, D. M. (2011). Underrepresented students in STEM: The transition from undergraduate to graduate programs. *Journal of Diversity in Higher Education*, 4(2), 90-105.
- Okahana, H., Zhou, E., & Gao, J. (2020). Graduate enrollment and degrees: 2009 to 2019. Washington, DC: Council of Graduate Schools.
- Palmer, R. T., Maramba, D. C., & Gasman, M. (2013). *Fostering success of ethnic and racial minorities in STEM: The role of minority serving institutions*. Routledge.
- Stolle-McAllister, K., Sto. Domingo, M. R., & Carrillo, A. (2010). The Meyerhoff Way: How the Meyerhoff Scholarship Program Helps Black Students Succeed in the Sciences. *Journal of Science Education and Technology*, 20(1), 5–16.
- Virginia Tech Engineering. (2021, January 28). *About the Center for the Enhancement of Engineering Diversity--CEED*. <https://eng.vt.edu/ceed/about-ceed.html>.
- Williams, E. G. (2004). *Academic, research, and social self-efficacy among African American pre-McNair scholar participants and African American post-McNair scholar participants*. [Doctoral dissertation, Virginia Tech]. ProQuest Dissertations Publishing.



*Thank You*





*Additional Information:  
Exit Survey Questions*

**Instructions:**

Please fill out this survey interview honestly and as completely as possible. Your responses will help us assess A Step to the Doctorate Institute and identify areas of need and opportunities for the Institute to further support you and future participants.

**Section A.**

This section consists of personal response questions about your experience in A Step to the Doctorate Institute.

Before you attended, to what extent were you **INTERESTED** in learning the following by attending **A Step to the Doctorate Institute**? Click and drag the statements in order from highest to lowest.

- How to figure out what research I want to do
- How to find graduate programs
- How to get funding to attend grad school
- The differences between Master's and PhD study
- How to manage the applications process
- How to write a personal statement
- How to do the kind of writing I will be expected to do in grad school
- How to apply for scholarships and fellowships
- Requirements for the GEM Fellowship
- The difference between graduate study and getting a job in industry
- How to decide if graduate study is right for me

Please rate the following segments of **A Step to the Doctorate Institute Spring Bootcamp** on how **HELPFUL** or **USEFUL** you found them.

	Very Unhelpful	Somewhat Unhelpful	Neither Helpful nor Unhelpful	Somewhat Helpful	Very Helpful
What is graduate school presentation by Dr. Shernita Lee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Young faculty Q&A panel with Dr. Walter Lee, Dr. Rafael Patrick, and Dr. Freddy Paige	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Funding graduate education and intro to the GEM Fellowship by Dr. Trey Waller	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal statement presentations and writing workshop presentation with Ms. Mandy Wright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graduate student Q&A panel with A Step To Doctorate Scholars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GEM Grad Lab	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Canvas Resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rank the following segments of **A Step to the Doctorate Institute Spring Bootcamp** on level of **ENJOYABLE** or **INTERESTING** you found them. Click and drag the statements in order from highest to lowest.

- What is graduate school presentation by Dr. Shernita Lee
- Young faculty Q&A panel with Dr. Walter Lee, Dr. Rafael Patrick, and Dr. Freddy Paige
- Funding graduate education and intro to the GEM Fellowship by Dr. Trey Waller
- Personal statement presentations and writing workshop presentation with Ms. Mandy Wright
- Graduate student Q&A panel with 2020 A Step To Doctorate Scholars
- GEM Grad Lab
- Canvas Resources

Please rank the following segments of **A Step to the Doctorate Institute** Spring Bootcamp on level of **ENJOYABLE** or **INTERESTING** you found them. Click and drag the statements in order from highest to lowest.

- What is graduate school presentation by Dr. Shernita Lee
- Young faculty Q&A panel with Dr. Walter Lee, Dr. Rafael Patrick, and Dr. Freddy Paige
- Funding graduate education and intro to the GEM Fellowship by Dr. Trey Waller
- Personal statement presentations and writing workshop presentation with Ms. Mandy Wright
- Graduate student Q&A panel with 2020 A Step To Doctorate Scholars
- GEM Grad Lab
- Canvas Resources

What did you like **MOST** about **A Step to the Doctorate Institute Spring Bootcamp**? Please be specific with your response.

What did you like **LEAST** about **A Step to the Doctorate Institute Spring Bootcamp**? Please be specific with your response.

How **EFFECTIVE** were the following aspects of **A Step to the Doctorate Institute Spring Bootcamp** in helping you consider applying to Master's or PhD programs?

	Very Ineffective	Somewhat Ineffective	Neither Effective nor Ineffective	Somewhat Effective	Very Effective
What is graduate school presentation by Dr. Shernita Lee	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Young faculty Q&A panel with Dr. Walter Lee, Dr. Rafael Patrick, and Dr. Freddy Paige	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Funding graduate education and intro to the GEM Fellowship by Dr. Trey Waller	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal statement presentations and writing workshop presentation with Ms. Mandy Wright	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graduate student Q&A panel with A Step To Doctorate Scholars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GEM Grad Lab	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Canvas Resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What changes would you make to the curriculum/content of **A Step to the Doctorate Institute Spring Bootcamp** and **ongoing writing workshops and coaching** to help students consider pursuing a Master's or PhD? Please be specific.

What changes would you make to **A Step to the Doctorate Institute Spring Bootcamp** and **ongoing writing workshops and coaching** to help students locate graduate programs and/or complete their graduate school, scholarship, and fellowship applications? Please be specific.

What did you learn from the **GEM Grad Lab**? Feel free to write a bulleted list. Please be specific.

Please rank the following scheduling and logistics of **A Step to the Doctorate Institute** on their **EASE** or **CONVENIENCE** for you. Click and drag the statements in order from highest to lowest.

- Six-hour Spring Bootcamp on a Saturday in early March
- Asynchronous weekly research and writing workshop prompts
- March-September time span
- Fall Closing Meeting on a Saturday in early September
- Conducted online by Zoom
- Resources provided on Canvas
- Individual and small group writing conferences and discussions
- Slack group for discussion and reminders

**Section B.**

This section consists of personal response and informational questions about your undergraduate experience at Virginia Tech and your plans for after graduation.

Please respond on the scale to the following statements.

*"I believe that my undergraduate faculty, administrators, and graduate students generally":*

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
... liked me as much as they liked other students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... cared about my learning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... did not want me to do well in my courses.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... wanted me to succeed in my major.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... did not want to help me learn.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... wanted me to do my best.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... believed in "weeding out" unsuccessful students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... cared about me as a person.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... thought that mental health was important.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... thought that it was important to get to know me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... did not care about my feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... believed that I could succeed in my career.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How frequently do you meet with your undergraduate advisor?

- I have never met with my advisor
- Once
- Once per year
- Once per semester
- Monthly
- More than once per month

How often do you discuss graduate school with your undergraduate advisor or another faculty member?

- I have never discussed grad school with a faculty member or advisor
- Once
- Once per year
- Once per semester
- Monthly
- More than once per month

What do you plan to do after you graduate?

- To attend graduate school at Virginia Tech
- To attend graduate school elsewhere
- To get a job in a field related to my major
- To get a job in a field not related my major
- To travel and/or take a "gap year"
- To do mission work or join The Peace Corps, Teach for America, or a similar program
- Something else
- I don't know

What would you most **prefer** to do after you graduate?

- To attend graduate school at Virginia Tech
- To attend graduate school elsewhere
- To get a job in a field related to my major
- To get a job in a field not related my major
- To travel and/or take a "gap year"
- To do mission work or join The Peace Corps, Teach for America, or a similar program
- Something else
- I don't know

Please rank the extent to which the following items are **IMPORTANT** to your consideration of whether to attend graduate school. Click and drag the statements in order from highest to lowest.

- My GPA
- Deciding on a research project/agenda
- Being accepted to a top tier program
- Being accepted to a program near my family
- Being accepted to a program in my preferred geographic region
- Being accepted to a program at Virginia Tech
- Receiving funding through an assistantship
- Receiving funding through fellowships or scholarships
- Whether I want to attend school for additional years
- Whether I get the full time job that I want
- How the COVID-19 pandemic pans out in 2022 or beyond

If you plan to attend graduate school, do you intend to apply for the GEM Fellowship? Why or why not? Please provide any details that will help explain your response, including if you are uncertain.

If you plan to attend graduate school, do you intend to apply for the NSF GRFP? Why or why not? Please provide any details that will help explain your response, including if you are uncertain.

If you plan to attend graduate school, do you intend to apply for the GEM Fellowship? Why or why not? Please name and describe.

- Click to write Choice 1
- Click to write Choice 2
- Click to write Choice 3

How has the COVID-19 pandemic affected your plans for after you graduate? Please be specific.

Which of the following have you done to work on your personal statement(s) for graduate applications? (Select all that apply)

- Attended Mandy Wright's workshops for A Step to the Doctorate Institute
- Written rough draft(s)
- Had a conference/conferences with Mandy Wright
- Gotten feedback or help from a Writing Center tutor
- Gotten feedback from peer(s)
- Gotten feedback from graduate student(s)
- Gotten feedback from STEM faculty member(s)
- Gotten feedback from other mentor(s)
- Used resources on A Step to the Doctorate Canvas site
- Used resources on VT Career and Professional Development site
- Used other online or print resources
- Revised and/or edited my personal statement
- Had someone edit my personal statement

How much time have you spent on the graduate applications process—researching programs, writing personal and research statements, and filling out applications?

To what extent have you found the following helpful in writing your personal statement(s)? Click and drag the statements in the order from highest to lowest.

- Mandy Wright's workshops for A Step to the Doctorate Institute
- Conference(s) with Mandy Wright
- Feedback or help from a Writing Center tutor
- Feedback from peer(s)
- Feedback from graduate student(s)
- Gotten feedback from STEM faculty member(s)
- Gotten feedback from other mentor(s)
- Resources on A Step to the Doctorate Canvas site
- Resources on VT Career and Professional Development site
- Other online or print resources

What did you like **MOST** about the personal statements workshops and/or individual or small group conferences with Mandy Wright? Please be specific.

What did you like **LEAST** about the personal statement workshops and/or individual or small group conferences with Mandy Wright? Please be specific.

What changes would you make to the personal statements workshops and/or conferences to help you write your personal statement(s) for graduate school and scholarship/fellowship applications? Please be specific.