EAGER: Student Support in STEM: Developing and Validating a Survey Instrument for Assessing the Magnitude of Institutional Support Provided to Undergraduate Students at a College Level

Dr. Walter C. Lee, Virginia Tech

Dr. Walter Lee is an assistant professor in the Department of Engineering Education and the assistant director for research in the Center for the Enhancement of Engineering Diversity (CEED), both at Virginia Tech. His research interests include co-curricular support, student success and retention, and diversity. Lee received his Ph.D in engineering education from Virginia Tech, his M.S. in industrial & systems engineering from Virginia Tech, and his B.S. in industrial engineering from Clemson University.

Dr. David B. Knight, Virginia Tech

David Knight is Assistant Professor and Assistant Department Head for Graduate Programs in the Department of Engineering Education at Virginia Tech. He is also Director of International Engagement in Engineering Education and affiliate faculty with the Higher Education Program at Virginia Tech. His research tends to be at the macro-scale, focused on a systems-level perspective of how engineering education can become more effective, efficient, and inclusive.

Dr. Allison Godwin, Purdue University, West Lafayette (College of Engineering)

Allison Godwin, Ph.D. is an Assistant Professor of Engineering Education at Purdue University. Her research focuses what factors influence diverse students to choose engineering and stay in engineering through their careers and how different experiences within the practice and culture of engineering foster or hinder belongingness and identity development. Dr. Godwin graduated from Clemson University with a B.S. in Chemical Engineering and Ph.D. in Engineering and Science Education. Her research earned her a National Science Foundation CAREER Award focused on characterizing latent diversity, which includes diverse attitudes, mindsets, and approaches to learning, to understand engineering students' identity development. She is the recipient of a 2014 American Society for Engineering Education (ASEE) Educational Research and Methods Division Apprentice Faculty Grant. She has also been recognized for the synergy of research and teaching as an invited participant of the 2016 National Academy of Engineering Frontiers of Engineering Education Symposium and 2016 New Faculty Fellow for the Frontiers in Engineering Education Annual Conference. She also was an NSF Graduate Research Fellow for her work on female empowerment in engineering which won the National Association for Research in Science Teaching 2015 Outstanding Doctoral Research Award.

Dr. Lisa Ann Moyer, Virginia Tech

Lisa Moyer is currently a postdoctoral associate for Engineering Education at Virginia Tech. She received her PhD from VT in Integrative STEM Education. In her role as an educational consultant, her recent projects have included building professional development protocol for NASA's Out of School Learning Network, developing a master's degree program in Community Based Education and Leadership for Stevenson University, and helping Radford City Schools transition to more innovative teaching and learning practices. Lisa taught in public schools (gifted education, elementary and middle) for 17 years. An avid trail runner, she also co-owns a small outdoor adventure business.

Indhira María Hasbún, Virginia Tech

Indhira María Hasbún is a PhD student and Graduate Teaching Assistant in Engineering Education at Virginia Tech. She received her BS in Civil Engineering and ME in Environmental Engineering from Utah State University.

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Overview

The aim of this exploratory research is to develop and gather validity evidence for a survey instrument that can be used by college-level administrators and student-support practitioners to assess the magnitude of science, technology, engineering, and mathematics (STEM) students' perceived institutional support. Such an instrument is important because it will facilitate college-level administrators monitoring progress in this area, leading to the identification of opportunities for making STEM learning environments more supportive. The theoretical foundation for our instrument is the model of co-curricular support (MCCS), which was recently developed [1]. The MCCS is a student-retention model that demonstrates the breadth of assistance currently used to support undergraduate students in STEM, particularly those from underrepresented groups.

In total, the MCCS outlines six elements of institutional support (See Table 1). Our survey will transform student support in STEM by making it possible to assess each of these constructs. The benefit of looking at student support through this lens is that the MCCS provides a way to deconstruct student support and identify the underlying experiences. This multipronged approach is advantageous because, while specific interventions may not be transferable, students' experiences can transcend contexts within and across institutions. For example, instead of investigating the impact of peer mentoring programs—which are not often identical—this lens allows us to investigate the impact of the overall perception of interactions that students have with other students outside of the classroom.

Research Design& Rationale

The development of the survey instrument is being carried out following best practices as defined by DeVellis [2] and Gall, Gall & Borg [3]. We defined the construct of interest and target population, reviewed related instruments, developed a prototype of the survey instrument, evaluated the prototype for face and content validity from students and experts, revised and tested the instrument based on suggestions, and will collect data to determine test validity and reliability across four institutional contexts during the Spring 2018 semester. Because of the lack of theory investigating the effectiveness of institutional support for undergraduate students in STEM, we built the survey instrument based on findings from Lee's previous research that developed the MCCS [4]. Survey questions were originally developed using student responses to open-ended survey questions related to each element of institutional support. Below, we outline our progress-to-date on the survey development and plans for future deployment.

Table 1 - Elements of Institutional Support	
Construct	Definition
Academic Support	Institutional support geared towards disseminating information related to improving academic performance or circumstances, providing access to resources that support academic performance, monitoring academic performance or development, or contributing to the development of content-independent and content-dependent skills that contribute to academic performance.
Faculty-Interaction Support	Institutional support geared towards disseminating information related to interacting with faculty/staff, increasing the quantity of interactions students have with faculty/ staff, and helping students establish relationships with faculty or staff.
Extracurricular Support	Institutional support geared towards disseminating information related to improving or increasing extracurricular involvement and providing students with opportunities.
Peer-Interaction Support	Institutional support geared towards disseminating information related to students interacting with other students, increasing the quantity of interactions that students have with other students outside of the classroom, or grouping students based on some part of their identity or academic circumstances.
Professional-Development Support	Institutional support geared towards developing industry-independent skills that contribute to obtaining employment; disseminating information related to career opportunities via an undergraduate degree in STEM; providing work experiences that contribute to the professional development of students via employment; providing access to role models along different career trajectories; or developing industry independent skills that contribute to successful professional performance.
Additional Support	Institutional support geared towards acclimating students into the university environment; facilitating access to financial assistance; publically acknowledging the successes of students; or discussing life as an underrepresented student in STEM.

Survey Development

To date, a prototype survey has been developed and revised through three rounds of evaluation. Round 1 consisted of several focus groups with undergraduate science and engineering students. As students read the survey, they were asked to "think aloud" and discuss confusing questions and wording, redundancies, and unnecessary questions that related to their educational experiences. The survey was also distributed to institutional partners for feedback, which include administrators from sites that have agreed to distribute the survey after initial development. Revisions were made to the survey based on the student and institutional partner feedback. For Round 2, the revised survey was reviewed by undergraduate science and engineering students, this time individually as opposed to focus groups. As students completed the survey, they were instructed to focus on many of the same areas outlined in Round 1. The survey was again revised based on this information. The survey was then reviewed by graduate students in engineering education during Round 3. These students were chosen as they are not too far from their undergraduate experiences and also have some expertise in education research. Their comments prompted a third round of revisions. We display a subset of the preliminary questions in Table 2.

Table 2 - Sample survey items that comprise the MCCS Constructs	
Academic Support	I received helpful guidance planning the courses that are required to earn my degree
	I received advice on how to manage my time better
	I regularly met with a study group for my STEM courses.
Faculty-Interaction Support	Faculty members in my department were available to meet with me if needed
	I have a STEM faculty member whom I consider a role model
	I receive responses from faculty members in a timely manner
Extracurricular Support	I was aware of opportunities to be involved in activities outside of class
	I was encouraged to be an active member of the STEM community at my university
	I had enough time to balance schoolwork and out-of-class activities
Peer-Interaction Support	My faculty members encouraged me to make connections with my classmates
	I met STEM students with whom I could relate
	I regularly interacted with STEM students from different demographic groups (e.g., race, gender, etc.)
Professional-Development Support	I received assistance with preparing for career fairs
	I was encouraged to apply for internships, co-ops, or summer research fellowship programs.
	I was encouraged to participate in undergraduate research
Additional Support	I received the financial assistance that I needed to attend this university
	I was welcomed into the university when I arrived as a new student
	I believe my college was committed to addressing issues of prejudice and discrimination
Student Involvement	Which of the following have you done since becoming a student at your current institution? • Participated in an internship, co-op, or field/lab work • Participate in a summer bridge program • Conducted undergraduate research
Student Involvement cont.	During the current school year, how involved have you been in the following activities? • An out-of-class student design project/competition • A STEM-related fraternity or sorority (Theta Tau, Alpha Omega Epsilon, etc.) • Volunteering/outreach programs (service learning, EWB, etc.)

Future Work

Next, the refined survey instrument will be administered during spring 2018 to undergraduate students enrolled in STEM disciplines at Virginia Tech, Purdue University, and Clemson University. Though we anticipate the constructs from the theoretical framework to be valid from the piloting work, we will conduct exploratory factor analysis on this sample because this is the first large-scale deployment of this instrument. We will also examine discriminant and convergent validity of each construct through Cronbach's α and correlation analysis. To conduct a factor analysis on these items, we are aiming for a sample size of at least 500 students. We estimate a 25% response rate, so we will initially deploy the survey to over 2,000 students across the three institutions. We have budgeted for participant incentives for this step of our research, and our project partners will assist us in recruiting students within their respective colleges and expanding our sample population as necessary.

In addition to considering how students in the full sample responded to these items (i.e., RQ1 and RQ3), we will also use inferential statistics to explore differences across subpopulations. We will collect more inclusive data on student demographics as informed by the previous work of

senior personnel Godwin and colleagues [5]. These demographic items allow for more inclusive collection of race and ethnicity, gender identity, disability or ability status, sexual orientation, gender inclusive parent/guardians, first-generation college status, international status as well as engineering discipline, grade level, and self-reported GPA. While some demographic information will be collected in Pilot 1.0, due to length, the full list will not be included.

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