Exploring Faculty Perceptions of Students Characteristics at Hispanic Serving Institutions

Dr. Meagan R. Kendall, University of Texas, El Paso

An Assistant Professor at The University of Texas at El Paso, Dr. Meagan R. Kendall is helping develop a new Engineering Leadership Program to enable students to bridge the gap between traditional engineering education and what they will really experience in industry. With a background in both engineering education and design thinking, her research focuses on how Latinx students develop an identity as an engineer, methods for enhancing student motivation, and methods for involving students in curriculum development and teaching through Peer Designed Instruction.

Dr. Alexandra Coso Strong, Florida International University

As an assistant professor of engineering education at Florida International University, Dr. Alexandra Coso Strong works and teaches at the intersection of engineering education, faculty development, and complex systems design. Alexandra completed her doctorate in aerospace engineering at Georgia Tech in spring, 2014. Prior to attending Georgia Tech, Alexandra received a bachelor’s degree in aerospace engineering from MIT (2007) and a master’s degree in systems engineering from the University of Virginia (2010). Alexandra comes to FIU after completing a postdoctoral fellowship at Georgia Tech’s Center for the Enhancement of Teaching and Learning (CETL) and three years as a faculty member at Olin College of Engineering in Massachusetts. Alexandra’s research aims to improve the design of educational experiences for students by critically examining the work and learning environments of practitioners. Specifically, she focuses on (1) how to design and change educational and work systems through studies of practicing engineers and educators and (2) how to help students transition into, through and out of educational and work systems.

Dr. Ines Basalo, University of Miami

Dr. Basalo is an Assistant Professor in Practice in Mechanical and Aerospace Engineering at the University of Miami. Prior to joining the University of Miami in 2014, she worked as an adjunct professor at Columbia University and the Cooper Union in New York City. She received her PhD from Columbia University in 2006. Since 2015 Dr. Basalo has been actively involved in the University of Miami College of Engineering’s “Redefining Engineering Education” strategic plan on educational innovation.

Gemma Henderson, University of Miami

Gemma Henderson is a Senior Instructional Designer for the LIFE (Learning, Innovation and Faculty Engagement) team in Academic Technologies at the University of Miami (UM). Gemma partners with faculty members, academic units, and other university stakeholders to create innovative, effective, and meaningful learning experiences, through learner-centered pedagogies, differentiated teaching, and emerging educational technologies. Since Fall 2016, in partnership with the College of Engineering and the LIFE team, Gemma designed and supported faculty development workshops in active learning pedagogies, provided regular consultations and also joined the UM team at Olin College’s 2017 Collaboratory Summer Institute. Gemma is currently a post-graduate student in the MSc Digital Education program at the University of Edinburgh, challenging perspectives about education and technological change.
Exploring Faculty Perceptions of Students Characteristics at Hispanic Serving Institutions

Abstract
The creation of a diverse STEM workforce has been the target of multiple initiatives that seek to broaden the participation of underrepresented minorities. Hispanic/Latinx students represent a small fraction of undergraduate engineering students, and more than half obtain their undergraduate degrees from Hispanic Serving Institutions (HSIs). Focusing efforts at these institutions has the potential to increase significantly the representation of the Latinx population in engineering. This study is part of a broader effort to identify needs and successes at existing HSIs by actively engaging with engineering educators through the use of design thinking methodologies. This paper aims to further the understanding of how educators at HSIs perceive their undergraduate students, including their assets and needs. Thirty-six engineering educators from 13 HSIs in Arizona, Florida, New Mexico, and Texas attended one of two workshops in the spring of 2018. Participants engaged in individual and group activities that helped them reflect on their students and actively design an educational innovation for their institution, using information previously gathered through interviews with students. Qualitative analysis of the data across the thirty-six educators at both workshops identified differences between how instructors describe characteristics of Latinx engineering students across regions and instructor type. The overall findings provide a set of unique characteristics of students at HSIs that can serve as the foundation for future research and future educational efforts to increase the representation of Latinx students in engineering.

Keywords: Undergraduate, Faculty, Race/Ethnicity, Engineering

Motivation
The Latino and Latina population, Latinx for short, in the United States has continued to grow and with it has come an influx of Latinx engineering students. As the educator of 59% of Latinx engineers [1], Hispanic Serving Institutions (HSI) are responding to this growth and more successfully graduating engineers than non-HSIs [2]. Consequently, these institutions are at the forefront of innovating curriculum for Latinx engineers. Focusing efforts at these institutions has the potential to increase the representation of the Latinx population in engineering significantly.

Faculty play a critical role in supporting students’ self-efficacy and self-regulated learning behaviors [3]. For Latinx students, in particular, faculty support is a key factor in student retention [4]. Instructors support students by serving as role models, acting as mentors, and inspiring students. When educators maintain these relationships, particularly outside the classroom, they contribute to higher student satisfaction and persistence to graduation [5]. However, not all faculty at HSIs share their students’ Latinx ethnicity [6] and must find alternative means of developing relationships that support their students.

To achieve this level of support for Latinx students, engineering educators have a unique opportunity to apply their engineering design expertise to innovate the educational experience of their students. In Design Thinking, one key feature is the emphasis on user engagement and developing a deep understanding of a user’s needs, environment, and assets [7]. Educators, as educational designers, should first seek to understand the unique characteristics of the students in their programs. This process of developing a deeper understanding of one’s students can result in educational experiences that support
student learning by meeting students where they are [8] and connecting to themes, ideas, and topics that are relevant to the student and their desired career trajectory [9].

While the perception and understanding that faculty may have of their students, i.e., their biases, may or may not be accurate, it establishes a foundation from which the engineering education community can begin to identify potential discrepancies between what is perception and reality. Much like in assessing discrepancies between students’ level of prior knowledge and the expectations of instructors [10], both need to be identified to achieve positive and long-lasting advancements in curricular change [11]. Therefore, this study seeks to understand how educators at HSIs perceive their Latinx students by answering the following question: How do educators at HSIs describe their student’s characteristics, including assets, needs, and opportunities, that could be used to amplify current efforts at HSIs? Given the diversity of the Latinx student population, this paper also explores differences in the perceptions of educators from two different geographical regions of the United States. Further, as educational responsibilities and passions can vary with instructor role (e.g., tenured, tenure-track, lecturers, professional faculty), this study examines the differences in perspectives across instructor role. By understanding how engineering educators at HSIs describe their students, discrepancies can be identified which could lead to opportunities for affecting educational change, resulting in an improved educational experience at HSIs and other institutions educating Latinx engineers.

Methodology

Research project overview
This investigation is the result of a broader collaborative, multi-institutional mixed methods study examining the existing engineering education efforts and needs at Hispanic Serving Institutions. In response to the National Science Foundation’s (NSF) Dear Colleague Letter: Improving Undergraduate STEM Education in Hispanic Serving Institutions (HSIs), this broader project seeks to uncover the non-obvious needs and existing successes at HSIs that can be addressed and amplified in future NSF initiatives to improve undergraduate engineering education. To determine these non-obvious needs and opportunities, the project team convened multiple workshops with individuals not necessarily conducting engineering education research, but engaged in engineering education at both two- and four-year HSIs. During these Rethinking Engineering Education workshops, participants tested out three innovative approaches to supporting student learning that are independent of specific pedagogies or tools: Design Thinking, Intrinsic Motivation, and students as Empowered Agents. Leveraging these approaches through multiple educational design activities, participants generated ideas for educational reform and reflected on mechanisms for amplifying these ideas on their campuses. Ultimately, these approaches provided a lens through which participants could articulate the opportunities, success cases, and needs at HSIs.

Rethinking Engineering Education Workshops Overview
To gather non-obvious and diverse perspectives from engineering educators engaged in undergraduate education at HSIs, we adopted a participatory research design [12], collecting data at three faculty development workshops. The first two Rethinking Engineering Education Workshops were hosted during the spring of 2018 at the University of Texas at El Paso and the University of Miami, both of which are in the vicinity of other HSIs, to facilitate participation from educators who may not have the means to attend faculty development events. The final workshop was held at the 2018 American Society for Engineering
Education (ASEE) Annual Conference and Exposition. The first two workshops were framed to facilitate discussion, reflection, and development of educational innovation to capture insights about engineering educators within their own teaching and institutional context, rather than provide ready-made solutions. Based on these prototypes, participants reflected on existing interventions, assets, needs, or opportunities that exist at their institution for implementing their proposed innovation. The final workshop at ASEE was designed to provide an opportunity for dissemination of preliminary results and member-checking purposes. Additional information about the workshops can be found on the official workshop series’ website (http://eel.utep.edu/HSI/).

The locations of the first two workshops were intentionally selected to facilitate a comparison of different Latinx populations. The Texas workshop was hosted in a region whose Latinx population is predominantly of Mexican descent. The University of Texas at El Paso, the Texas host institution, has a Latinx student population of approximately 85%, and the surrounding community is 80% Latinx. The Florida workshop was selected for comparison of a more diverse Latinx population, including students of largely Cuban, Puerto Rican, Venezuelan, and Mexican descent. The University of Miami, the Florida host institution, has a Latinx student population of approximately 25%, and the surrounding community is 70% Latinx.

During the first two workshops, participants completed a series of design thinking-based activities to better understand their students and consequently design and prototype educational innovations to implement at their institution. Three guiding educational philosophies were adopted as a lens for both the research and workshop design: intrinsic motivation [13], students as empowered agents [14], and design thinking [7], [15]. Each of these lenses connects to positive learning outcomes and can be used in a variety of ways and contexts. They are areas of research in themselves with open questions for members of the engineering education research community.

**Participants**

The first two workshops applied voluntary and convenience sampling methods to engage engineering educators at HSIs. Participants were recruited via a call for applications posted to the workshop website and distributed via personal emails and appropriate ASEE engineering education listservs and newsletters. The selection criteria for the workshop, and consequently this study, included: completion of the workshop application, an institutionally assigned instructional role at an HSI, more than two years of teaching experience in engineering at their current institution, and willingness to participate and complete assigned activities.

Thirty-six participants from thirteen institutions from across the southern United States (from Arizona, Florida, New Mexico, and Texas) attended one of the two Rethinking Engineering Education Workshops. Five institutions were represented by the 18 participants at the Florida workshop and eight institutions by the 18 participants at the Texas workshop (Figure 1). Across both workshops, there were two private four-year institutions, eight public four-year institutions, and three two-year institutions. Of these institutions, all were considered Hispanic Serving Institutions based on having over 25% of their student body identifying as Latinx/Hispanic [16]. The Florida workshop had a larger number of private, 4-year institutions as compared to the Texas workshop, where all but one of the 18 participants were
The educators attending these workshops included a diverse set of engineering instructors. Across both workshops, 42% were tenured or tenure-track faculty, 44% were instructional faculty (professional and non-tenure track), and 17% were part-time lecturers, staff, or administrators with instructional responsibilities (Figure 2). Twenty-five percent of attendees identified as women (Figure 2) and 39% identified as Hispanic (the same at both workshops). On average, the educators reported 6.5 years of experience in their current position.

The follow-up workshop at ASEE also applied voluntary and convenience sampling methods to engage engineering educators from each workshop as well as five attendees at ASEE. Five participants from each workshop were provided with stipends to attend ASEE. To be eligible for the stipends, participants had to agree to attend ASEE and the workshop, have completed a majority of workshop activities, and not have attended ASEE previously. Participants were also selected for diversity of institution and faculty type.
**Data Collection and Management**

This study focuses on qualitative data collected during one of a series of design thinking exercises during the two-day workshops. The Assets and Challenges activity asked participants to respond to two questions: “What do students bring to your classroom each week?” and “What challenges do your students face in the classroom and outside the classroom?” The activity was grounded in a survey participants completed before the workshop. Each participant was asked to gather resources, reflect, and summarize their perspectives on institutional stakeholders (administration, students, and external partners and faculty) as part of the pre-workshop climate assessment survey. The purpose of the survey was to prepare participants to speak, with some confidence and supporting evidence, on behalf of stakeholders at their institution. Before the Assets and Challenges activity, participants were also introduced to the design-thinking lens and the importance of understanding student characteristics.

Participants recorded their responses in writing on a handout that was then deidentified and transcribed for analysis. Throughout the entire project, each participant completed, on average, a pre and post-workshop survey; eleven handouts during the workshop that were either completed individually, in dyads, or in small groups; and a follow-up survey in the fall semester of 2018.

**Data Analysis**

A thematic analysis [17] was conducted by categorizing each quote based on emergent themes within the higher-level categories of student assets and challenges, corresponding to the two prompts on the handout. Thematic analysis is an iterative analysis process that includes reading and rereading participant responses, developing categories to capture the key component(s) of the responses, and then combining, collapsing, and/or renaming categories based on examinations of the other responses [17]. In addition, each response was coded for workshop location (Texas or Florida) and educator type. Educator types include tenured, tenure-track, instructional faculty (professional and non-tenure track), and part-time lecturers, staff, and administrators with instructional responsibilities. After preliminary analysis by the research team, member checking [17] was completed with the ten participants from the first two workshops and the five new participants from the general ASEE population to confirm the wording of codes/themes.

**Limitations**

This exploratory study was not attempting to represent the perspectives of educators as evidence for what the characteristics of Latinx students are, rather it is intended to explain what the educators perceive. Future studies should explore the validity of each of the descriptors the educators provided. Given the number of HSIs in the regions of interest, the sample sizes in this study are small. However, this study was exploratory and sought to optimize the depth of interactions with a diverse set of institution and educator types over having a large sample size. Future studies should include additional participants and other stakeholders beyond educators, such as students or employers. In addition, 50% of participants at the Texas workshop and 44% of participants at the Florida workshop were from the respective host institutions. Therefore, the over-sampling of faculty from the host institutions may have biased the results towards the dominant perspectives at the host institutions. To minimize the impact of oversampling, results are reported based on the first time they are articulated as opposed to the frequency at which they are mentioned.
Results & Discussion

Based on the thematic analysis of responses from the participants at both workshops, 54 unique characteristics emerged for summarizing how these educators described their Latinx students’ assets (28 characteristics), challenges (32 characteristics), or both (8 characteristics). These characteristics were compared across the two geographical regions (Figure 3 and Figure 4) and educator types (Figure 5 and Figure 6). When possible, characteristics were named to reflect the exact terminology and word choice of participants.

Overall, eight characteristics were defined as both assets and challenges by the workshop participants (in alphabetical order): (1) cultural diversity, (2) bilingual, (3) comfort working in groups/teams, (4) commuter, (5) family responsibilities, (6) time management, (7) work experience, and (8) motivation. Cultural diversity, for example, sought to describe student membership within multiple cultures as an asset, while at the same time, some faculty viewed students’ experiences “adapting to the US norm of work, being on time, and academic honesty” (FL, teaching faculty participant) as a challenge. Participants’ responses were similar when describing their students as “bilingual”, which while being an asset, could also be a challenge for students whose first language was not English. As one FL teaching faculty member explained it, “language nuances of English and business terms” or as a TX tenure-track/tenured faculty explained, “English not first language...challenge in oral presentations.”

In the case of work experience and family responsibilities, the participants noted how some of their students were working professionals with families, while others were going to school and working full-time. One FL tenure-track/tenured faculty explained how “students bring [a] great deal of experience from work and jobs they have.” This response was counter to the framing of these work and job experiences as “demands” and “burdens”. The participants also described how their students had many family-related demands, which required them to get off-campus jobs that did not always allow for schedules that made balancing work and school easy. The discussion of these demands aligns with previous studies of Latinx students who cited family pressures as making it difficult to study [18]. Yet, studies of Latinx students’ experiences have also emphasized the importance of peer and familial support to persistence [19] and family as a source of motivation for students [20] contributing to their persistence.

A third of the participants discussed student motivation as both an asset and a challenge. Participants specifically described their students’ excitement, hope, energy, and tenacity. One FL, tenure-track/tenured faculty explained how “my students bring enthusiasm to learn how to develop [class-related] applications.” Two faculty from the TX workshop, on the other hand, alluded to challenges students faced around motivation. Given existing research on motivation, the source of this challenge could be related to students feeling a lack of control over their learning, a lack of competency in the coursework, or a lack of relatedness to the material, their peers, and/or the instructor [9], [13]. Additional research is needed to understand the source of these faculty reflections. Lastly, while many of these eight characteristics could overlap, the “comfort working in groups/teams” illustrated participants’ observations of their students’ strength as team members. “Most are accustomed to working in groups/teams” (TX, Tenure-track/tenured faculty). One participant disagreed noting that this was a challenge for their students. Overall, the importance of peer support and family could potentially link to students’ comfort and strengths as team members.
Figure 3. Comparison of engineering educators’ description of their students’ assets from the two geographical regions of the workshops. (The asterisk denotes descriptors that educators described as both assets and challenges.)

Figure 4. Comparison of engineering educators’ description of challenges their students face from the two geographical regions of the workshops. (The asterisk denotes descriptors that educators described as both assets and challenges.)
Geographical Comparison

In comparing characteristics across the two regions represented at the first two workshops, twelve characteristics emerged as common to Latinx students in both regions (Figure 3 and Figure 4). These included the characteristics of cultural diversity and family responsibilities participants viewed as both assets and challenges. Participants from both regions also highlighted students’ desire to learn and succeed as assets. In addition, participants discussed the hard-working nature and inquisitiveness of their students as assets.

The participants at the workshop in Texas tended to identify nearly equal numbers of unique assets (24) and challenges (21) where the participants in Florida identified more challenges (17 vs. 24). The Texas participants also emphasized the tension between experiences and responsibilities outside of school, describing them as both assets and challenges for students. In Florida, these were largely viewed as challenges. Together, this trend could suggest that the participants representing HSIs at the Texas workshop (from institutions across Texas, New Mexico, and Arizona) are shifting towards a more asset-based perspective of their Latinx student population than those at the Florida workshop, though it is not absent in Florida. This shift towards models of education that value all assets that diverse students bring to the classroom is linked to increases in student achievement and motivation [21], [22]. Additional research with a larger sample is needed to better understand the extent to which faculty in these and other regions view their Latinx students through an asset-based lens. Though both groups consisted of engineering educators, participants at the workshop in Texas more readily described their students in terms of characteristics typical of descriptions of engineers: problem-solving skills, use technology, and intelligence. Overall, most of the characteristics the participants used to describe students were generic and applicable to Latinx students in general, rather than specifically descriptors of Latinx engineering students.

Comparison Across Educator Type

When comparing characteristics across educator type, all types saw their students as motivated and wanting to succeed (Figure 5). Overall, Lecturers/Instructional Staff identified fewer unique characteristics about their students compared to their Tenure/Tenure-Track and Teaching faculty counterparts. This is likely due to the differences in the focus of their positions and the amount of time spent focused on instruction. While Tenure/Tenure-Track faculty and Teaching faculty articulated close to the same number of assets for their students (17 vs. 14), Teaching faculty articulated a higher number of challenges (Figure 6). Of the eight characteristics identified previously as both assets and challenges, Tenured/Tenure-track instructors were the only group to identify all eight as assets while the teaching faculty identified all eight as challenges. This could be due to a couple of possible reasons. Teaching faculty may be developing closer relationships with students and are more readily able to articulate the challenges that they face. Alternatively, because of the lack of support that they report receiving, the teaching faculty may tend to default towards a deficit-based view of their students and therefore more readily articulate challenges. Additional research on the asset-based and deficit-based perspectives of a broader sample of HSI engineering faculty is needed.
Conclusion and Implications

As part of a broader effort to support engineering education reform at HSIs, this paper aims to further the understanding of how educators at HSIs perceive their undergraduate students. In particular, a qualitative study was conducted with 36 engineering educators from 13 HSIs in Arizona, New Mexico, Florida, and Texas who attended one of two Rethinking Engineering Education at HSIs workshops in the spring of 2018. Before and throughout the workshops, participants engaged in individual and group activities that helped them reflect on their students and their students’ experiences in the engineering curriculum. Their responses to an activity exploring the assets and challenges of their students were analyzed to capture how the educators at these HSIs describe their students’ characteristics, including assets, needs, and opportunities, that could be used to amplify current efforts at HSIs.
The findings of this exploratory work serve as a starting point for advancing the engineering education community’s understanding of the asset and deficit framing that is occurring at HSIs. In the community’s attempts to shift toward viewing “out-of-school cultural practices of students... as resources, tools, or assets”, it is critical to consider the starting point for that shift [20], [22, p. 140], [23]. These results specifically highlight how the cultural differences that students bring to the classroom (e.g., bilingual, cultural diversity, familial relationships), for example, can be viewed as both assets and challenges. Discussions of student motivation raise questions regarding what factors within the learning environments of engineering programs at HSIs are promoting or hindering Latinx students’ motivation. Additional research that can triangulate faculty’s perceptions with student experience and course climate will support future educational innovation efforts at these HSIs.
In addition, this exploratory work demonstrates the potential for faculty development programming that provides opportunities for educators to develop a deeper understanding of their students. By realizing the characteristics of their students that can impact their in-class and out-of-class experiences, engineering educators can work to meet students where they are [8]. For example, given the high number of Latinx students at HSIs that hold jobs while taking classes, instructors could leverage those experiences when discussing important teamwork and project management issues by having students reflect on previous in-class and out-of-class team/project experiences. Students’ strong connections to family and peers could also provide motivation for engineering-related community engagement projects, experiences that develop students’ abilities to engage with user populations, and/or connect course topics with community-related challenges (e.g., hurricane relief, immigration).

Overall, the findings of this study seek to complement existing work exploring the educational experiences of Latinx students within college [19] and within engineering specifically [20], [24], by capturing educators’ perceptions of their students at HSIs. Through this work and similar studies, the engineering education community can begin to shift the conversation towards more asset-based language and support current and future educational efforts that seek to increase the representation of Latinx students in engineering.

Acknowledgment
This research was funded by the U.S. National Science Foundation through grant numbers 1764378, 1764249, and 1764166. The views presented are those of the authors and not necessarily those of the NSF. The authors wish to thank Dr. Michele Williams, Callie Mitchell, Caroline Salas, Jennifer Diaz, and Evelyn Martinez for their contributions to facilitating the workshops and analyzing data. In addition, the authors want to thank the study participants for their time, their enthusiasm, and their invaluable engagement in the study.

References


