The AMPLIFY Project: Experiences of Engineering Instructional Faculty at Hispanic Serving Institutions

Introduction

The AMPLIFY project, funded through the NSF HSI Program, seeks to amplify the educational change leadership of Engineering Instructional Faculty (EIF) working at Hispanic Serving Institutions (HSIs). HSIs are public or private institutions of higher education enrolling over 25% full-time undergraduate Hispanic or Latinx-identifying students [1]. Many HSIs are exemplars of developing culturally responsive learning environments and supporting the persistence and access of Latinx engineering students, as well as students who identify as members of other marginalized populations [2]. Our interest in the EIF population at HSIs arises from the growing body of literature indicating that these faculty play a central role in educational change through targeted initiatives, such as student-centered support programs and the use of inclusive curricula that connect to their students' cultural identities [3]–[7]. Our research focuses on exploring methods for amplifying the engineering educational change efforts at HSIs by 1) making visible the experiences of engineering instructional faculty at HSIs and 2) designing, implementing, and evaluating a leadership development model for engineering instructional faculty, thereby 3) equipping and supporting these faculty as they lead educational change efforts.

To achieve these goals, our project team, comprising educational researchers, engineering instructional faculty, instructional designers, and graduate students from three HSIs (two majority-minority and one emerging HSI), seeks to address the following research questions: 1) What factors impact the self-efficacy and agency of EIF at HSIs to engage in educational change initiatives that encourage culturally responsive, evidence-based teaching within their classrooms, institutions, or beyond? 2) What are the necessary competencies for EIF to be leaders of this sort of educational change? 3) What individual, institutional, and professional development program features support the educational change leadership development of EIF at HSIs? 4) How does engagement in leadership development programming impact EIF educational leadership self-efficacy and agency toward developing and using culturally responsive and evidence-based approaches at HSIs? This multi-year project uses various qualitative, quantitative, and participatory research methods embedded in a series of action research cycles to provide a richer understanding of the successes and needs of EIF at HSIs [8]. The subsequent design and implementation of the AMPLIFY Institute will make visible the features and content of instructional faculty development programs that promote educational innovation at HSIs and foster a deeper understanding of the framework's impact on faculty innovation and leadership.

Research Design Overview

Thus far, the research team has focused on the first action research phase of listening. Using a multiple case study research design, we sought to address the following questions: 1) What brought these EIF to their faculty positions at an HSI? 2) How are instructional faculty roles within engineering at HSIs defined? 3) What are EIF beliefs about and approaches to teaching and learning? and 4) What individual, institutional, and societal factors impact the agency of EIF faculty at HSIs to engage in educational change? Seventeen study participants were recruited from six HSIs: two 4-year public universities (n=7), two 2-year public colleges (n=5), and two 4-year private universities (n=5). Up to two virtual interviews were conducted with each

participant, lasting around 45-60 minutes each. Three interviewers used the same nine guiding questions, with optional follow-up questions, to maintain consistency across all interviews. Each of the interviewers piloted the interview protocol, receiving feedback from the research team to further ensure consistency. A video-conference platform was utilized to audio-record the interviews.

We are currently completing the analysis of these interviews using a variety of theoretical frameworks (e.g., competing values framework [9], teachers as leaders [10], pedagogical content knowledge [11], engineering leadership [12], and agency [13]). Before analysis, the recordings were transcribed and de-identified. The transcripts were coded in NVivo. We overview our work and findings for RQ1 and RQ3 in the following sections. Preliminary results for RQ1 and RQ3 were also disseminated at the 2021 Frontiers in Education Conference.

RQ1: What brought these EIF to their faculty positions at an HSI?

Motivation
Recruitment and retention of EIF is critical as they play a key role in students' satisfaction and persistence due to their high number of contact hours with students in the classroom [14]. Understanding EIF's experiences and motivation for pursuing instructional faculty positions can help faculty developers and administrators better design and implement recruitment and retention practices for these faculty. This research question centered on identifying the factors that motivate teaching-focused professional-track faculty to pursue engineering instructional faculty positions at HSIs for this sample.

Data Analysis
The data obtained from the interviews was used to explore EIF's previous experiences in industry and academia and motivations for shifting careers. This analysis used a constant comparative approach to explore emerging themes about the EIF's decisions to pursue an instructional faculty position at their current institutions [15]. A codebook was developed based on emergent themes related to the personal and professional motivational factors of each EIF as they pursued their current position. For this research question, two researchers (who did not serve as interviewers) established the codebook and conducted the analysis. The researchers coded three interviews together to ensure consistent interpretation of the codebook, calculating inter-rater reliability in NVivo to ensure consistency above 90%. The remaining interview transcripts were analyzed separately, with regular debriefings among the two researchers and the entire research team.

Results and Discussion
The themes identified during the data analysis can be grouped into two main categories of Personal and Professional Motivational Factors, with corresponding subcategories (Tables 1-2).

Personal Motivational Factors

Work-life Balance. Though three personal motivators emerged during the analysis, a desire for an improved work-life balance was the most prominent personal factor acknowledged by the EIFs, mentioned by 9 out of 17 participants. Participants mentioned that spending time with their loved ones and/or having children were important factors in their pursuit of a balance between work and personal life. Similarly, these factors influence their decision to start a career in academia. Other

personal motivators identified less frequently include a family member's work relocation (n=3) and the need for financial stability (n=1).

Table 1: EIF's personal motivational factors for pursuing instructional faculty positions

Personal Transitional Motivators	Participants (n)
Work-life Balance	10
Family member's work relocation	3
Financial	1

Professional Motivational Factors

Enthusiasm for Teaching. The most popular subcategory within the professional factors, mentioned by 12 out of the 17 participants, was their enthusiasm for teaching. From the 17 participants in the study, all participants from 2-year public institutions (n=5 of 5) expressed their enthusiasm for teaching as one of the main motivations for pursuing an instructional faculty position. EIF at 4-year public (n=4 of 7) and private (n=3 of 5) institutions mentioned this motivation less frequently.

Table 2: EIF's professional motivational factors for pursuing instructional faculty positions

Professional Transitional Motivators	Participants (n)
Enthusiasm for teaching	12
Enthusiasm for learning	5
Enthusiasm for engineering discipline and/or field	4
Enthusiasm for research	3
Flexible schedule	3
Career advancement	3
Enthusiasm for service	1

Enthusiasm for Learning. Enthusiasm for learning was mentioned by 5 out of the 17 participants as one of the reasons why they became EIF. These participants saw instructional faculty positions as opportunities to continue learning while working alongside their students during in-class activities and projects and improving their teaching skills through professional development opportunities. Professional development opportunities can be important resources to help maintain EIF's motivation to learn and grow [7], [16].

Enthusiasm for the Engineering Discipline and/or Field. Four out of the 17 EIF interviewed mentioned their enthusiasm for their discipline as one of the factors motivating them to pursue their current position. EIF expressed how these positions enabled them to embrace their enthusiasm for engineering in two main ways, by 1) being able to work on their predilect field of engineering during their summers and by 2) including topics related to their interests in the engineering discipline in their classes. Other professional motivators that were less frequently identified during analysis include enthusiasm for research (n=3), flexible schedule (n=3), career advancement (n=3), and enthusiasm for service (n=1).

Based on these findings, we hope to further promote and nurture EIF's efforts toward educational innovation, their practices and values. Additionally, we hope to encourage engineering administrators at HSIs to consider how these personal and professional motivational factors influence the recruitment and retention of future instructional faculty. Additional details on this portion of our work can be found in [17].

RQ3: What are EIF beliefs about and approaches to teaching and learning?

Motivation
Our motivation for answering the third question grew from recognizing the critical role faculty play in enhancing or hindering learning through their interactions with students [14]. How faculty perceive their students' epistemologies impacts their approach to curriculum design and whether they seek opportunities to provide culturally responsive learning experiences. Therefore, understanding and exploring faculty beliefs about teaching and learning helps inform the design of faculty development programming focused on amplifying student-centered, culturally sustaining practices.

Data Analysis
Our team began by analyzing participant responses to a sub-set of the initial nine questions, specifically those that asked participants to describe a day in their course and discuss how they manage their classroom, work with students, and use strategies to help students succeed. To analyze the interviews, a codebook was developed from an adapted version of the Pedagogical Content Knowledge theoretical framework [11]. Two research assistants (who did not serve as interviewers) used a blend of deductive and inductive coding methods to code the interviews and analyze the results [18], [19]. The researchers coded three interviews together to ensure consistent interpretation of the codebook, calculating inter-rater reliability in NVivo to ensure consistency above 90%. The remaining interview transcripts were analyzed separately, with regular debriefings among the two researchers and the entire research team.

Results
Of the 17 EIF participants, 12 expressed knowledge of their students' backgrounds. Their knowledge could be categorized as asset-based (n=3), deficit-based (n=4), supportive-based (n=7), or awareness-based (n=3) perspectives of their students' backgrounds. Table 3 summarizes the definitions of these four categories and provides example quotes from the participants. The themes of supportive and awareness-based perspectives surfaced during the emergent coding process. EIF with supportive and awareness-based perspectives acknowledge student backgrounds and external influences. Those with supportive-based perspectives take this information and adjust for those external factors in the design of learning experiences. Asset-based perspectives push this knowledge of student backgrounds even further and reframe the educational experience to be enhanced by or leverage the students' external factors and background [20], [21]. Overall, EIF participants most often gravitated towards supportive-based perspectives (n=7 of 12), describing instances where they provided support to students despite circumstances (e.g., recording lectures for those who could not attend the class). As in [22], to avoid further propagating deficit-based views of Latinx and other HSI students, the results focus on the awareness, supportive, and asset-based faculty perspectives of students' backgrounds.

Understanding the perspectives instructors adopt is vital for designing faculty development opportunities at HSIs. These results complement existing literature on asset- and deficit-based framings, particularly related to understanding the structures that instructors at HSIs adopt within their classrooms [6], [7], [23]. Additionally, these findings further current work by providing a novel expansion of the binary framing of perspectives as either asset- or deficit-based by shifting to a continuum, acknowledging the awareness and supportive-based framings that instructors can hold of their students' backgrounds. This framing of perspectives as a continuum may better represent how faculty development programs can support faculty reframing their perspectives from deficit to asset-based perspectives. Additional details on this portion of our work can be found in [22].

Table 3: Examples of faculty perspectives of students' backgrounds

Awareness-Based Framing (n=3)	Factual knowledge of students' backgrounds. Faculty acknowledge their students' context and environment but do not hold a specific perspective or take action.
"The other issue we had is ... and my institution did try to help, a lot of students didn't have personal computers, or they were sharing it with their family. It became an issue because, yes, we have class at 6:00. They know they have class at 6:00, but maybe they don't have the internet."	
Supportive-Based Framing (n=7)	Accommodating students' backgrounds. Faculty acknowledge their students' context and environment, recognize inequities, and take actions they believe will improve their learning experience.
"… one of our students and they were on [FAFSA] and everything else. And they came up and they had spent almost $2,000 on textbooks, more than their tuition. And I just about flipped out. […] So, I said that that's it. We are using [free] open-source material online. This is ridiculous."	
Asset-Based Framing (n=3)	Leveraging students' backgrounds as assets. Faculty acknowledge their students' context and environment and see them as assets to leverage, improving their learning experience, not just accommodating them.
"But the great thing about the students at [current institution] is that they come from a ton of different background… with that diverse population, the great thing is that we get very different students. So we get experience from many different aspects of engineering."	

Future Work

Our research team is currently working on answering RQ4. This question revolves around the individual, institutional, and societal factors that impact the agency of EIF at HSIs to engage in educational change. Agency is often described as volition or the sense of using one's will [24]. Other literature describes the process of becoming agentic; for instance, agents or people can adopt perspectives about situations (e.g., asset framing) and perform actions (e.g., using culturally responsive techniques) based on their available moves [25]. Similarly, an agent can decide not to act (e.g., deciding to stay silent in a situation) [13]. In this process, agents are influenced positively or negatively by their environment (e.g., departmental culture) [26].

RQ4 seeks to identify the factors that impact EIF agency towards educational change. The ongoing data analysis is based on an adaptation of a framework for professional agency [26] towards educational change. Our team is leveraging this framework to identify events of agency towards educational change displayed by the participants. In identifying acts of agency by participants, our team has adopted a narrative approach to observe the agency phenomena. The analysis of this research question is currently being performed by three researchers with weekly

reports to the rest of the research team. Preliminary results indicate that EIF's agency towards educational change is impacted by various factors, including departmental influences, identity, and desire for student impact.

Conclusion

This study seeks to amplify the educational change leadership of Engineering Instructional Faculty (EIF) working at Hispanic Serving Institutions (HSIs). Our research interest in this population arises from the high contact hours EIF have with undergraduate students and their role in developing culturally responsive learning environments in engineering. The EIF interviewed in this study are multi-faceted individuals with diverse career pathways into instructional positions. They value work-life balance and have a high sense of enthusiasm for learning, teaching, and the engineering discipline, contributing to why they are motivated to pursue and maintain their faculty positions. These EIF's perspectives of their students' backgrounds span a continuum between asset and deficit-based perspectives. Many gravitate towards asset and supportive-based perspectives that can be leveraged as opportunities to provide culturally responsive interventions. These findings will ultimately support the design and implementation of instructional faculty development programs that promote educational innovation at HSIs, such as the AMPLIFY Institute.

Acknowledgment

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