WIP: Identifying Structural and Cultural Characteristics of Hispanic-Serving Institutions in Engineering Education – A Morphogenetic Approach

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Abstract

This work-in-progress (WIP) paper presents the methodological approach of Phase 1 of a larger study exploring how Hispanic-serving institutions (HSIs) can better "serve" Latinx engineering students, as illustrated through a particular case study institution. The main goal of Phase 1 is to examine the impacts of the HSI designation on institutional systems and identify the resulting structural and cultural characteristics that may influence the experiences of undergraduate Latinx engineering students. Ultimately, this study seeks to identify how colleges of engineering at HSIs can leverage their institutional systems to enable and sustain educational transformation as they pursue their goals of serving undergraduate Latinx engineering students.

This qualitative case study combines Margaret Archer's (1995) morphogenetic approach as a theoretical framework [1] and the *Multidimensional Conceptual Framework of Servingness in HSIs* [2] to reach the stated goals. It further employs the use of an underutilized form of case studies, the *normative* (value-laden) case study [3] to connect the results of the study to broader societal values about what it means to "serve" Latinx engineering students at HSIs. With the ever-increasing number of HSIs and a continued need to redefine the field of engineering towards diversity, equity, and inclusion, the need to explore how HSIs can better serve Latinx engineering students becomes imperative.

Background

The 1992 amendment to the Higher Education Act (HEA) conferred the title of Hispanic-Serving Institutions (HSIs) to those "accredited, degree-granting, public or private, non-profit colleges and universities with 25% or more total undergraduate full-time equivalent Hispanic student enrollment" [4]. Beyond the 25% enrollment requirement, however, there are no clear indicators of what a federally designated HSI is, what it should do, or how it ought to "serve" Latinx students, bringing to the forefront the most pervasive argument amongst HSI scholars: that these institutions are merely "Hispanic-enrolling" as opposed to "Hispanic-serving" [5]. As such, scholars claim that HSIs are not serving Latinxs any better than non-HSIs since, prior to their HSI designation, these institutions were initially conceived of as majority-serving institutions that evolved to enroll Latinx students due to changing demographics. This context is distinctly different than other minority-serving institutions, such as Historically Black Colleges and Universities (HBCUs), who share institutional commitments to address black and African-American students' needs from inception. In contrast, HSIs do not necessarily share in this implementation of culturally-relevant and responsive practices for Latinx students [5].

Given the dynamic nature of the HSI system, understanding the role that these institutions play in providing access to postsecondary education for Latinx students is a complex endeavor. In the last 10 years, HSIs have grown by 93% and currently enroll 67% of all Latinx undergraduate students, even though they only account for 17% (n=539) of all institutions of higher education in the United States (US) [6]. Such a significant increase can be attributed to the rapid demographic growth of the Latinx population in the US combined with the fact that HSIs are enrollment-defined [7]. Within the broader landscape of Minority-Serving Institutions (MSIs), HSIs are the largest group, accounting for more than half of all other MSIs combined [5].

Additionally, HSIs are also extremely diverse in terms of the sectors they serve, with almost half of them being two-year institutions and almost a third of them being private institutions [6]. Lastly, HSIs also enroll a large percentage of other minoritized groups, such as Black/African-American and Indigenous/Native-American students [2].

In addition to responding to the challenge of Latinx student success in general, HSIs are also called upon to respond to demands for a highly skilled and diverse workforce in Science, Technology, Engineering, and Math (STEM) fields. Often touted as top "producers," HSIs consistently enroll and graduate a large number STEM Latinx students. For example, in 2009, HSIs graduated nearly 65% of the STEM certificates, 61% of the STEM associate's degrees, and 40% of the STEM bachelor's degrees earned by Latinx students even though they only accounted for 9% of all institutions of higher education in the US at the time [8]. Within engineering, HSIs also provide a critical gateway for Latinx students. *Excelencia in Education* reports that out of all Latinx students pursuing engineering degrees, 59% of them do so at HSIs [9]. The importance of HSIs to the engineering field is further underscored when considering that only 34 HSIs have the capacity to award at least one ABET-accredited engineering bachelor's degree. This means that approximately 1% of all institutions of higher education in the US are responsible for awarding almost 60% of engineering bachelor's degrees to Latinx students.

In spite of HSIs being a significant entry point for Latinx students to engineering, research exploring the importance of this institutional context and how it translates to the students' experiences is significantly scant. Within the engineering education literature, research on Latinx students has largely focused on students at Predominantly White Institutions (PWIs), which consistently highlights their marginalized experiences as a result of the institutional context [10]. Alternatively, some of the research on HSIs to date has focused on the ability of such institutions to positively contribute to traditional student outcomes broadly in STEM fields, but not engineering specifically [11]. One of the few studies that exists at the intersection of both fields found that, although Latinx engineering students graduate at the same rates at HSIs vs PWIs, the quality of their experiences while attending an HSI has a significant impact in their engineering identity development and subsequent post-graduation intentions [12]. Considering that engineering is a field with a long history of exclusionary practices and culture [13] and that HSIs are enrollment-defined as opposed to historically-defined, attending a college of engineering at an HSI does not necessarily translate to having a culturally-enhancing experience.

Given that HSIs provide broad access to engineering degrees for Latinx students, and the continuous need to redefine the field of engineering towards diversity, equity, and inclusion, it is imperative that we begin to construct an understanding of what it means to "serve" Latinx engineering students at HSIs. Although HSIs have the potential to heavily influence Latinx engineering students' success and their overall college experience through enhanced academic outcomes and culturally-relevant support, very little is known about the institution's capacity to realize that potential through their colleges of engineering. Therefore, research on engineering at HSIs represents a significant opportunity for contributions at the intersection of these two fields.

Our study contributes to this body of knowledge by providing an explicitly engineering-focused understanding of "servingness" for colleges of engineering at HSIs, as illustrated through a particular case-study institution. Our work places analytical focus on the interplay between the system (i.e., structures and culture) and the agent (i.e., students) to systematically derive the study's recommendations. This project combines two frameworks to guide the aims of the study.

Conceptually, the work is guided by Garcia, Núñez, and Sansone's (2019) *Multidimensional Conceptual Framework of Servingness in HSIs* (referred to as the "servingness" framework) which provides a holistic understanding of different dimensions that are important in defining servingness at HSIs [2]. Theoretically, the work is grounded in Margaret Archer's (1995) morphogenetic approach [1], a sociologically-informed theory that allows for exploring complex socio-cultural systems in a way that places equal emphasis on systems and people. This WIP paper describes Phase 1 of the study, which will identify the current structural and cultural characteristics of the system and their potential influences on students' agency.

Conceptual framework: Garcia, Núñez, and Sansone's servingness framework

We have adopted Garcia, Núñez, and Sansone's (2019) *Multidimensional Conceptual Framework of Servingness in HSIs* to ground our study in the HSI literature, while at the same time providing the necessary flexibility to operationalize the concept of servingness as relevant to colleges of engineering. This framework, which represents the most comprehensive and current work in the HSI scholarship, argues that serving Latinx students at HSIs requires a multi-pronged approach that spans across several dimensions, two of which are: 1) External Influences on Serving, and 2) Structures for Serving. At a high level, *External Influences on Serving* refers to the systemic, political, and historical factors that have framed the concept of HSIs and what it means to serve Latinx students. These are factors external to the institution that shape its capacity to develop *Structures for Serving*, which are conceptualized as the way that institutions internally generate and maintain systems for serving their stakeholders, in our case students [2].

For our study, we reconceptualized the *External Influences on Serving* dimension and the *Structures for Serving* dimension into a single *Systemic Influences on Serving* dimension. This decision was made to recognize the fact that, although the broader societal systems, institution-wide systems, and college-wide systems coexist in a hierarchical structure, they each have the capacity to exert influences on each other across these boundaries. During Phase 1, we draw upon the servingness framework to guide data collection and analysis, as described in the methods section.

Theoretical framework: Margaret Archer's morphogenetic approach

Given the study's focus in understanding how HSIs as an organizational system can influence students' success, selecting a social theory that emphasizes structure and agency was imperative. We chose Archer's morphogenetic[1] approach because it explicitly includes a cultural component in addition to structure and agency, making it particularly appropriate for this study. Moreover, Archer's theory places equal emphasis on systems and people, which avoids being prematurely deterministic and allows us to look at the interplay between structure, culture, and agency [1].

Archer posits that the social world is comprised of three analytically distinct strata – structure, culture, and agency – each of which has its own set of properties. *Structure* is concerned with material resources and social objects that hold power and predispose agents towards certain actions (e.g., roles, institutional structures, social positioning). *Culture* is broadly concerned with the world of ideas that are capable of being grasped, deciphered, understood, or known by someone and that are expressed through language (e.g., beliefs, values, ideologies). *Agency* is concerned with action taken by individuals or groups of individuals as they strive to reach

[1] Archer uses the word morphogenesis to refer to change processes. The word comes from the Greek *morphe* (shape) and *genesis* (creation), which is the biological process through which an organism develops its shape.

particular goals [1]. This analytical distinction between structure, culture, and agency resonates with the HSI literature, which argues that both institutional structures and organizational culture are essential to conceptualizing servingness at HSIs [14]. This distinction is also relevant within engineering, where in spite of targeted diversity efforts (structural strata), many Latinx students still report feelings of marginalization (cultural strata) [15].

Phase 1 of this study leverages Archer's theory primarily through her concepts of structural emergent properties (SEPs) and cultural emergent properties (CEPs), which we refer to simply as *structural characteristics* and *cultural characteristics*, respectively. Archer argues that the structural and cultural characteristics of a system coexist across two dimensions: (1) the extent to which their relationship is necessary or not (e.g., HSI designation is not possible without the necessary 25% enrollment threshold), and (2) the extent to which their relationship is compatible or not (e.g., HSI designation can be compatible with goals of culturally-enhancing education for Latinx students). Different combinations of these relationships have implications for the sustainability of the system and exposes agents to specific situations that they must mediate in accordance to their goals [1]. Phase 1 of this study is concerned with identifying said structural and cultural characteristics and their relationship to each other. Future work will elaborate on its significance for student agents and thus is not addressed in this paper.

Methods

This study will employ a qualitative case study methodology, more specifically, the *normative case study* [3]. This type of case study is based on the work of Flyvbjerg (2001), who argues that researchers have the opportunity to approach certain paradigmatic cases with a social and political approach [16]. From this perspective, the case serves as a point of reference, or "exemplar", to highlight more general characteristics of the macro system in which the case is embedded. It is precisely this condition of the case as an "exemplar" which guides its selection for study and thus the goal of such research is generally to combine explanation and evaluation in order to contribute to normative (value-laden) theory [3]. Following this guideline, we chose the case study institution because of its unique characteristics as a four-year HSI that enrolls over 25% of undergraduate Latinx engineering students. As a result of the institution's geographical location in Florida, its student demographic makeup is also compositionally different than the majority of HSIs that are concentrated along the southern US border with Mexico.

The main goal of Phase 1 is to examine the impacts of the HSI designation on the institutional system and identify the resulting structural and cultural characteristics that may influence the experiences of undergraduate Latinx engineering students. The research question for this phase is: *What are the structural and cultural characteristics that influence the conditions on which students find themselves during their time at the College?* To answer this question, we will identify the structural and cultural characteristics that are manifested externally from the institution and internally within the institution through an analysis of key relevant documents. The results from this phase will inform subsequent phases of the study, which will focus on understanding the student experience more deeply and are not discussed in this paper.

As guided by the servingness framework and our reconceptualized dimension of *Systemic Influences on Serving* (see conceptual framework section) we will conduct our analysis across three systemic levels: one at the internal level (the college), and two at the external level (the institution at-large and the HSI federal legislature). It is important to note that the internal and

external influences that will be identified in this phase refer to structural and cultural characteristics both within and across the boundaries of the systemic levels identified.

Data collection. A series of key relevant documents will be collected and analyzed to achieve the goals of this phase. Each systemic level (i.e., college, institution, legislative) will have a corresponding set of *normative* documents that have been selected based on the procedures outlined below. Borrowing from Goldstein (2010), we define normative documents as those that "articulate a course of action towards the selection of goals and the definition of values, beliefs and ideologies that drive [the system] to seek improvement and change" (p. 35) [17]. Document selection will be guided by a timeline of key events both in the history of HSIs (Table 1) and the history of the institution (Figure 1). The initial assumption is that the most relevant documents were generated around those times, and thus such approach is expected to yield a representative (albeit not exhaustive) list of documents that are believed to depict a full picture. However, the final selection of documents will depend on the themes that arise during data collection and data analysis and will be expanded if need be. Each of these data sources are further described below.

Systemic HSI level: Federal legislative documents. We have chosen to focus on legislative documentation only at the federal level and not at the state level, since the HSI designation is established federally and is subsequently adopted by the states. This decision has been made under the assumption that the language around the HSI designation used at the state level mimics that used at the federal level and would not provide additional analytical value. This assumption will be revised if need be as we engage in data collection and analysis. The list of documents selected for analysis was developed in reference to *Excelencia in Education's* Timeline of Events on HSIs [18] (see Table 1). All events that had an associated document were selected, for a total of seven documents spanning the years between 1992 to 2019.

Table 1: Systemic HSI Level - List of Documents Selected for Analysis

Document	Year	Description
Title III Part A	1992	Amendment to the Higher Education Act from 1992. Establishment of the "Strengthening Institutions Program" under Title III Part A.
Title V	1998	Amendment to the Higher Education Act from 1998. Establishment of the "Developing HSIs Program" under Title V.
Title V Part B	2008	Reauthorization of the Higher Education Act from 2008. Establishment of the PPOHA Program under Title V Part B.
Title III Part F	2010	Development of the HSI STEM Program under Title III Part F
NSF HSI Program	2016	Creation of the NSF "Improving Undergraduate STEM Education: HSI Program"
NAE MSI Report	2019	Publication of the NAE's "MSIs: America's Underutilized Resources for Strengthening the STEM Workforce" report.

Systemic institution and college levels: Institution and college normative documents. Our selection of normative documents at the institutional and college-level is adapted from William (2013), who argues that diversity planning initiatives tend to take on a normative role and are regarded as a change-making tool. William (2013) suggests that mission and vision statements, diversity plans, diversity reports, and academic and strategic plans can provide a holistic representation of the normative values, beliefs, and ideologies espoused by an institution of higher education, in addition to also delineating strategies for achieving them [19]. Within engineering education, Cross, Lee, Gaskins, and Jones (2018) have taken a similar approach for analyzing diversity initiatives [20]. An operationalized description of the normative documents is

presented on Table 2. For this study, we will focus on documents generated around the times of interest as highlighted in Figure 1 for both the college and the institution at large.

Table 2: Systemic FIU and CEC Level - Documents Selected for Analysis. Adapted from William (2013).

Document	Description
Mission and Vision Statements	Mission and Vision Statements for both the institution at-large and the College of Engineering.
Diversity Plans	Plans outlining a comprehensive institutional or college-wide HSI agenda.
Diversity Reports	Progress reports, updates, annual reports, and other documents illustrating HSI efforts and implementation at the institution or college.
Academic and Strategic Plans	Academic and strategic plans with at least some component focusing on issues of the institution or college as an HSI.

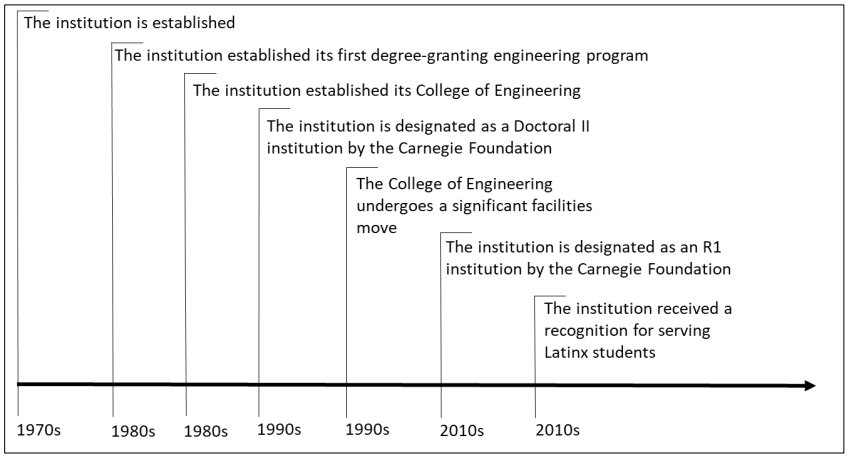

Figure 1: Timeline of Relevant Events at the institution and the college of engineering

Data analysis. Data analysis will be comprised of a combination of inductive and deductive approaches to qualitative analysis. For each document at each systemic level, a first round of coding will be conducted to identify both the structural and cultural characteristics. To identify the structural characteristics, we will use the list of themes and codes developed by Garcia et al.'s (2019) servingness framework as a starting point of *a priori* codes, while also employing *open* coding to identify structural characteristics that are specific to this context and do not fit the list of codes in Garcia's study. To identify the cultural characteristics, we will utilize *value* coding, defined by Saldaña (2016) as the application of codes unto data that reflects the values, attitudes, and beliefs about the phenomenon under study [21]. In this case, these codes will apply to the institution's values, attitudes and beliefs about their role in serving Latinx students. Once the structural and cultural characteristics have been identified, we will conduct a second round of coding in order to identify how these characteristics stand in relationship to each other according to Archer's dimensions of necessity and compatibility (see theoretical framework section). Specifically, we will utilize *versus* coding, which Saldaña (2016) describes as the process of identifying concepts that stand in direct conflict with each other and categorizing them in dichotomous or binary terms [21]. To ensure the trustworthiness and credibility of the conclusions being drawn, we will engage in researcher triangulation with the research team during this phase [22]. We will finalize the data analysis with the articulation of a series of relevant scenarios that describe the relationship between structural and cultural characteristics across all levels of the institutional system.

The subsequent example is provided to illustrate how the data analysis approach delineated in the preceding paragraph would answer this phase's research question. A structural characteristic (identified through the first round of coding) at the HSI federal level is the requirement of the 25% enrollment threshold. As a result, the institution may wish to establish a specific program targeting the recruitment and retention of Latinx students in an effort to maintain this designation. Such program would be a structural characteristic (also identified through the first round of coding) at the institutional level. This situation places both structural characteristics – the 25% threshold and the institutional program – in a relationship of *necessary compatibilities* (identified through the second round of coding), where the structures are mutually reinforcing. This means that one is dependent on the other for their continued success, i.e., the recruitment program would not exist without the need to meet the threshold to qualify as an HSI.

Conclusions and future work

This work-in-progress (WIP) paper presented the methodological approach, data collection, and data analysis plan for Phase 1 of a study focused on exploring how colleges of engineering at HSIs can better serve their undergraduate Latinx engineering students. The goal of Phase 1 of the study is to identifying the structural and cultural characteristics at a particular Hispanic-serving institution (HSI) that influence the conditions in which undergraduate Latinx engineering students find themselves during their time at the institution. Ultimately, the overall goal of the study is to articulate how colleges of engineering at HSIs can maintain or transform their institutional systems to align with identified servingness goals.

Once completed, this study has the potential to yield results that will advance the current conversation about HSIs in several ways. First, HSIs are a key organizational dimension in engineering and their role in the education of Latinx engineering students is an underexplored line of inquiry [23]. Second, the majority of the HSI literature to date has focused on institutions whose Latinx population is mostly of Mexican heritage (by virtue of their geographic location) [5]. Our case study institution provides a different demographic makeup that promises to highlight intragroup differences and resist a monolithic depiction of Latinx characteristics and needs. Third, by looking at federal influences, institutional influences, and student experiences, this overall project will place analytical emphasis on the interaction between macro, meso, and micro characteristics in ways that are often limited due to scoping concerns. Lastly, this project also seeks to introduce the engineering education community to the use of normative case studies [24] as a methodological approach and expand upon the use of Margaret Archer's morphogenetic approach [1] as a theoretical framework.

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