How do Mathematics Instructors at Hispanic Serving Institutions Justify their Instructional Decisions?

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An underutilized strategy for addressing the underrepresentation of Black, Indigenous, and people of color (BIPOC) in the U.S. STEM workforce is directing more attention to Minority Serving Institutions (MSIs). Unlike some MSIs, Hispanic Serving Institutions (HSIs) are defined by the current demographics of their student population rather than the intention of the institution to serve a specific population. As instructors are the mediators between students that attend the HSIs and mathematics content, we use the framework of professional obligations (Herbst & Chazan, 2012; individual, interpersonal, disciplinary, and institutional) to investigate if or how they are being intentional about the ways their practice can impact BIPOC students. We found from preliminary analysis of nine interviews that instructors are recognizing the four professional obligations in some common ways. A tension exists between the disciplinary obligation to portray mathematics as culture-free and attending to students as individuals while fostering an inclusive classroom environment.

Keywords: Hispanic-Serving Institutions, Professional obligations

Introduction

The underrepresentation of Black, Indigenous, and people of color (BIPOC) in the U.S. STEM workforce is a widely recognized issue (NAS, NAE, and IOM, 2011; NSF, 2017; Palmer et al., 2015). An underutilized strategy to address this problem is to direct more attention to Minority Serving Institutions (MSIs) that serve large percentages of these students (NASEM, 2019). MSIs provide the primary pathways to STEM careers for minority students and are thus best positioned to address the urgent STEM workforce supply issue (NASEM, 2019).

There is a large variation in the types of MSIs that exist, so the best ways to bolster support for the faculty and students are likely not uniform. Postsecondary institutions with an enrollment of at least 25% or more Latinx undergraduate full-time students can apply for Hispanic Serving Institution (HSI) status (U.S. Department of Education, 2021). Unlike Historically Black Colleges and Universities (HBCUs) that are created with the intention of serving a specific demographic, institutions become HSIs based on the current demographics of their student population.

In the NASEM (2019) report on MSIs, a literature review of what practices and strategies best create the most success for students of color revealed the importance of intentionality. This included the creation of initiatives, policies, and practices that were intended to create a culturally mindful environment. While the report described several exemplary program-level initiatives, the review of the literature revealed that little is known about the intentionality of the faculty and lecturers working directly with students (NASEM, 2019). For instructors, we view intentionality as the making of instructional decisions with a conscious justification. We suspect,

due to the designation of HSIs by their student demographics rather than their historical mission, that instructors at HSIs might not be well prepared to purposefully serve their BIPOC students. This is consistent with research by Hubbard and Stage (2009) that found few differences between HSI faculty and their faculty counterparts at predominantly white institutions in terms of perceptions and attitudes towards teaching and students. Recent and continuing shifts in demographics (Laden, 2004) have left many institutions to grapple with the implications of being an HSI.

Instructors are a crucial aspect of students' experiences and success in mathematics disciplines because they are the mediators between the content and the students. Mathematics instructors are used to a sense of autonomy over the content and pedagogy in their classrooms, even given the constraints of course syllabi and curriculum (Hora & Ferrare, 2012), and while they have extensive training in their disciplines, they often have little pedagogical training when they begin teaching (Ellis et. al., 2016). Instructors at HSIs are well-positioned to address the underrepresentation of BIPOC students in the STEM workforce, but can also replicate the existing inequities if they rely on their disciplinary enculturation to shape their pedagogical choices. Thus, we gathered information on the intentionality of faculty at HSIs in making their instructional decisions. This can inform the types of policies, professional development, and other strategies that can best support BIPOC students at HSIs.

Theoretical Framing

Given the importance of intentionality, we investigated how instructors made decisions that explicitly serve the student populations in their institutions. Cohen et al. (2003) posed that instruction is not merely about what teachers do, but also about how instructors shape the relationships between the teacher, students, and content, within the environment that surrounds all three. Very little research exists on instruction in the particular contexts of STEM at HSIs. Yet we know how important this environment is, in particular, for retaining students in STEM fields (Hubbard & Stage, 2009; NASEM, 2019).

We draw from the theory of *practical rationality* (Chazan, Herbst & Clark, 2016; Herbst & Chazan, 2012), which poses that instructors not only draw from individual resources like content and pedagogical content knowledge (Shulman, 1986) and individual beliefs for making teaching decisions, but also from social resources. One such social resource that instructors can use to justify their actions is *professional obligations*, which are shared by members of the profession and are tied to the environments in which they work.

Herbst and Chazan (2012) identified four professional obligations that serve as justifications for instructional actions (Herbst & Chazan, 2012). The four obligations include: 1) upholding the policies and practices of the department, institution, or state (*the institutional obligation*); 2) attending to the unique psychological, emotional, and other needs of students (*the individual obligation*); 3) representing the particular discipline being taught accurately and authentically (*the disciplinary obligation*); and 4) maintaining a classroom environment that is socially and culturally appropriate (*the interpersonal obligation*). For example, instructors could justify the decision to use more active learning in their classroom using the obligations: the individual obligation could motivate them to meet the needs of students who could learn more from instant feedback on their thinking; the disciplinary obligation could motivate them to give students an experience practicing science or mathematics in a more authentic way.

With this framing, we ask the following research question: How do faculty recognize their professional obligations to justify instructional decisions in the HSI context? We hypothesize that the way instructors recognize their professional obligations might show areas for more instructor

intentionality in the HSI context. This could inform the ways administrators and researchers support faculty growth and development.

Methods

We used a random stratified sampling technique to identify the institutions we asked to participate in this study. This paper is based on nine interviews with undergraduate mathematics instructors from eight different HSIs. Participants represent a range of institution categories (associate's, master's, doctoral) and locations (West, Southwest, and Southeast). They come from a larger multidisciplinary (including physics, biology and chemistry) dataset of 40 interviews still being conducted at the time of this paper's submission. See Table 1 for participant details.

We coded the transcripts for each of the four professional obligations and looked across instances of each obligation to see emerging themes. The goal of this process was to create an organized framework of teacher decision-making in HSI environments.

We report evidence of the various ways STEM faculty at HSIs recognize the four professional obligations. Our data cannot, however, support causal claims about these themes being a product of the HSI institution status.

Results

We found that all four professional obligations contributed to the ways that participants in our study justified their instructional decisions. We highlight ways each professional obligation manifested in the context of HSI undergraduate mathematics environments.

Institutional obligation: Rare unless mandated by law

Brittany and Jessica noted that part of the institutional obligation that instructors now must recognize in the state of California is new legislation that prohibits mathematics coursework that lengthens the time of graduation (Assembly Bill No. 705, 2017). Instead of using placement exams that sometimes lead students through a lengthy string of remedial mathematics courses, math departments now progress students through any non-credit remedial mathematics courses in one year. Jessica explained that she supports the bill because, previously, the timeline to get through the mathematics courses "weeds out a lot of people".

The new legislation in California was the only explicit recognition of an institutional obligation related to instructing at an HSI by any of the nine instructors. Matthew began the interview by apologizing and asking what an HSI was, indicating that he had likely not made any instructional decisions based on departmental initiatives or policies related to teaching at an HSI. Most instructors denied much involvement from the department or institution in shaping their courses. For example, Francesca said the department reviewed her class, "But after a semester, they pretty much left me alone, because I know my standards are very high." Thus, any recommendations or requirements by the department or institution for policies that would directly support their BIPOC students went mostly unnoticed by instructors as they made pedagogical decisions.

Individual obligation: Different identities and assessment

Three instructors recognized the obligation towards meeting the needs of individual students by acknowledging the different identities that students brought to the classroom. Brittany and Samuel explained that, in comparison with the students they taught at a non-HSI, the students they teach at their current institutions more often carry identities beyond their student identity. Brittany said, "Student is a third title. I mean, we have mom as the first title, or dad, or caretaker

or, a business owner, construction worker." Samuel recounted his initial shock when students in his class talked about teaching the mathematics content to their own children.

Table 1. Demographics, position, institution Carnegie classification, location, and field of each participant

Pseudonym	Self-identified demographics	Position	Carnegie classification	State	Field
Jessica	Hispanic or Latina female	Tenure-track Instructor	Associate's Colleges: Mixed Transfer/Career & Technical-High Traditional	CA	Mathematics
Brittany	White female	Assistant Professor	Associate's Colleges: High Transfer-Mixed Traditional/Nontraditional	CA	Mathematics
Steven	Caucasian male	Professor	Master's Colleges & Universities: Larger Programs	CA	Mathematics
Matthew	White male	Associate Professor	Associate's Colleges: Mixed Transfer/Career & Technical-High Nontraditional	TX	Mathematics Education
Samuel	White male	Assistant Professor	Doctoral University: High Research Activity	TX	Mathematics Education
Theresa	White female	Associate Professor	Doctoral University: High Research Activity	TX	Mathematics Education
Francesca	White female	Adjunct Professor	Associate's Colleges: High Transfer-Mixed Traditional/Nontraditional	CA	Mathematics
Niya	Indian female	Lecturer	Doctoral University: High Research Activity	TX	Mathematics
Tomas	White, Latino male	Visiting Professor	Doctoral University: Highest Research Activity	FL	Mathematics

Samuel and Brittany both expressed that this changed their view of assessment. Samuel said that, since coming to an HSI, he stopped taking attendance and instead reached out to students individually if he saw they missed class. Brittany has a nontraditional grading scheme for homework, so students have opportunities to practice and are not penalized for having other priorities that make meeting deadlines difficult. We interpreted Samuel and Brittany as not viewing things like late work as a product of laziness; instead, the students' complex identities caused these instructors to view late work as a product of their students' competing priorities. Consequently, they were inclined to work with their students to help them fit mathematics in with the rest of their lives.

Disciplinary obligation: Utility of content and representing a culture-free topic

Three instructors justified their instructional decisions as helping their students to realize that mathematics is useful and applicable to other courses and real-life situations. For example, Brittany explained that she wanted students to be able to critically analyze the statistics they encounter outside the classroom. Steven worked with undergraduate learning assistants (Otero, 2015) to implement student-centered instruction in his course. One of the learning assistants pointed out content that was useful in his later coursework. Steven used this knowledge to stress to students the utility of the content they were learning.

How the instructors represent the discipline depended on how they viewed the discipline. Two instructors expressed views that their mathematics departments considered mathematics to be a culture-free subject. Francesca praised her department for this: "We don't see a color or sex or anything. We see a raw being that you can teach mathematics to. Mathematics has no color." Theresa, a math educator, explained that "We have a lot of faculty who are very aware of issues of identity and professional perception of self in the discipline, but by no means the majority. … Overwhelmingly, the department leans towards math is math. Math is neutral. Math doesn't discriminate."

Two instructors, including Francesca, expressed that they taught and treated all students similarly due to this understanding of the discipline. Francesca, however, continued that "mathematics is this infinite number of like sides to it, you know, like a diamond, like more than a diamond. And the way people understand is different." So although she felt that mathematics is an objective subject, she also found herself teaching it differently to different individuals. The stance that mathematics is culture-free is closely related to instructors' (lack of) concerns for the interpersonal environment of their classroom.

Interpersonal obligation: Inclusivity and Student engagement

Three of the mathematics instructors explicitly stated that concerns for the inclusivity of their classroom did not play a role in their teaching. For example, Jessica stated that the demographics of her students did not play a role in her teaching. Instead, she relied more on the questions students asked or the correctness of their answers to adjust her teaching. For those that did have concerns about inclusivity, one way instructors used this obligation to justify their actions was in terms of making the course content more inclusive. Matthew and Samuel sought to adjust examples so they were more relevant to the populations in their class. Theresa tried to be inclusive by being aware of the experiences that the students who were African American or Hispanic were having in the class. She tried to give extra attention to whether they were comfortable sharing their ideas and whether they were feeling heard by herself and the groups they were working in on a day-to-day basis.

The interview protocol did not directly ask about student engagement, but many instructors expressed that they aimed to foster an environment that encouraged students to engage with each other. In response to a question about maintaining an inclusive environment, Jessica said she facilitated activities on the first day of class to give students a sense of community and connections to other students within the classroom. For example, she has students discuss in groups what fears they might have after reading the syllabus. Steven tried to get people working together inside the class so that they would be more likely to reach out to other students for help outside the class as well.

Scholarly Significance

As the primary mediators between the Latinx students that attend HSIs and the STEM content, instructors have the opportunity to impact students' experiences as they prepare to enter the workforce. We asked how faculty recognized their professional obligations to justify instructional decisions in the HSI context. Instructors at HSIs gave justifications for their instructional decisions that recognized the four professional obligations (summary in Table 2). This study highlights where potential might exist for instructors to better serve their BIPOC student populations. Information about how they are recognizing the obligations revealed tensions between the belief that mathematics is above culture and wanting to foster an inclusive community that respects the unique identity of individuals. Without having opportunities to address this tension, it is likely to remain unresolved.

Table 2. Themes from the ways HSI mathematics faculty recognized their professional obligations in their instructional decision-making

Professional Obligation	Ways the professional obligations were recognized
Institutional	● Adapting classes to the requirements around remedial courses
Individual	● Respecting the varied identities of the students ● Changing view of assessment to better accommodate students' lives
Disciplinary	● Aiming to show students the utility of the discipline ● Viewing mathematics as a culture-free discipline
Interpersonal	● Using or creating inclusive materials ● Fostering student engagement

These accounts inform three ways to support instructors. First, this work offers clarity about an unresolved tension that may exist among mathematics instructors' professional obligations. Instructors may struggle to treat the discipline as culture-free while recognizing their individual and interpersonal obligations, and never encountered the opportunity to address it directly. Second, this work shows what facets of professional obligations instructors are not taking into account. Policy-makers or departments could use this information to motivate how they try to direct instructors' efforts. For example, instructors did not mention practices associated with culturally relevant pedagogy, either from their own volition or incentivized by the institutions where they work. To the contrary, some instructors reported that they make decisions to treat all students similarly. Departments or policymakers could use these results to legitimize professional development on such a topic. The results from this study show that instructors may be open to attending to the different ways individual students learn, even if they view mathematics as culture-free.

Third, if instructors value certain facets of professional obligations, but there are better actions that could serve those intentions, this could inform the types of resources made available to those instructors. For example, we found that instructors prioritize student engagement as part of their interpersonal obligation. If instructors are unaware of practices (or the need for practices) that make BIPOC students feel a greater sense of belonging so they can engage with their peers,

professional development can be tailored to those needs by appealing to instructors' interpersonal obligation.

As we continue this work we will ask if these themes appear in a larger, representative national sample of STEM instructors at HSIs. We intend to look for patterns of these themes coupled with the use of evidence-based practices and similarities and differences across disciplines. For example, in the natural sciences more than mathematics, more instructors describe giving students authentic disciplinary experiences through activities that model what scientists do. Involving students in laboratory research to develop their disciplinary identity is mentioned more often than involving students in theoretical mathematics research. As these decisions are mediated by content, we expect that even if the professional obligations remain the same, how instructors instantiate them will vary by discipline.

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