

The Structure of Change: A Content Analysis of Engineering Diversity Plans and Mission Statements

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Abstract—The purpose of this work-in-progress research paper is to document the development of a coding process that can be used to critically examine the underlying assumptions and espoused approaches represented in diversity plans developed by administrators that signed the American Society of Engineering Education (ASEE) diversity pledge. In this paper, we report initial insight from developing a coding process for subsequently conducting a qualitative content analysis. We developed our coding process by reviewing a sample of engineering diversity plans (n=8) from institutions across the nation. Our future work will use this coding process to analyze a larger set of diversity, identify themes that can be used to improve efforts across the nation. This work is directly geared towards deans, department heads, faculty members, and other members of the engineering education community who should be responsible for improving diversity and inclusion in engineering.

Keywords— *diversity; inclusion; strategic plan; institutional change*

I. INTRODUCTION

By 2050, more than half the U.S. population will belong to a racial/ethnic minority group [1], significantly impacting the pool of potential students obtaining science, technology, engineering, and mathematics (STEM) degrees and entering the workforce [1]. Given the rise in underrepresented ethnic/racial minorities, it is critical that the nation focus on the success of these populations in STEM fields. While the overall U.S. STEM pipeline is leaky, the rate of program completion by minority populations is even more disturbing [2].

In response to calls for broadening participation in engineering, scholars have identified a variety of educational and social factors that affect participation of historically underrepresented groups in postsecondary education; these barriers relate to epistemology, pedagogy, intergroup relations, and institutional culture/practices [3]. To address such varied factors, engineering departments and colleges must be deliberate about creating diverse and inclusive environments. However, to date, deliberation has yielded

insufficient action as diversity and inclusion remains largely unrealized in engineering [2].

In hopes of encouraging momentum in this area, the American Society of Engineering Education (ASEE) declared the year 2014-2015 as the *Year of Action in Diversity* [4]. Recognizing the urgency to act, over 200 engineering deans signed a pledge committing to several actions to provide increased opportunities to populations underrepresented in engineering. One component of the pledge focuses on creating and implementing a diversity plan, articulating the definition of and vision for diversity and inclusiveness for the respective institution. Implementing such a strategic plan is important because it has implications for the role and value of diversity and inclusion being integrated into the culture and core values of engineering learning environments. Because this effort is relatively new, there is a need to better understand the manner in which engineering schools have approached this component of the pledge. Such an understanding will facilitate more consistency and accountability across diversity efforts within engineering schools, programs, and colleges. The research team was motivated to develop a tool for the community to provide guidance and topics to consider when developing a diversity strategic plan.

II. PURPOSE AND RESEARCH QUESTIONS

The purpose of this work-in-progress is to document the development of a coding process that can be used to critically examine the underlying assumptions and espoused approaches represented in diversity plans developed by administrators that signed the American Society of Engineering Education (ASEE) diversity pledge. Addressing this purpose is important because while diversity is frequently studied at the personal (e.g., individual experiences) and social (e.g., support programs), less attention is given to structural influences. If diversity plans similarly neglect to consider this problem holistically, progress is unlikely.

Towards this purpose, we pose the following research question: *What are the salient components of engineering*

diversity plans and mission statements? In this paper, we report initial insights from conducting a qualitative content analysis of 8 readily available engineering diversity plans from institutions across the nation.

Through this process, we developed a coding process for evaluating, and comparing diversity strategic plans and mission statements from engineering colleges and departments. We offer these insights to the community in hopes of alleviating many of the challenges we observed, such as defining terminology (e.g., diversity and inclusion) and aligning measurement tactics with goals and outcomes.

III. THEORETICAL FRAMEWORKS

Because this work is exploratory, multiple theoretical frameworks informed our analysis, each selected based on our research question and in response to patterns we noticed in reviewing and discussing each plan. Three theories emerged as most salient for our study purpose and explanatory power. One, provided a visual representation of institutional or organization change theory articulated by the four categories of change strategies presented by Borrego & Henderson [5]. The second theory provided definitions for characterizing the learning environment in this comprehensive model proposed by Terenzini & Reason [6]. Finally, the third framework focused on diversity from an institutional perspective proposed by Smith [7]. Combined, these frameworks provided our research team with a complete holistic framing with consistent terminology to meaningfully discuss institutional change as represented in each diversity plan and mission statement.

IV. METHODOLOGY

A content analysis is a flexible yet systematic research method to quantify patterns in text communication or determine the frequency and saliency of particular words or phrases to identify keywords or repeated ideas [8]. To develop an analysis plan, we used a convenient sample of plans to which the members of the research team had access. The final sample set, which is representative fraction of the total plans available for the larger study, included eight plans. Of the eight engineering schools, all are doctoral-granting research institutions, the majority of which are large, public, residential institutions.

The analysis approach was a data-driven thematic analysis with multiple rounds of coding. In a data-driven approach, the researcher strategically reads the data multiple times before any analysis takes place [9], identifying keywords, trends, and themes to be considered. Our data reduction was iterative, including open coding followed a priori coding [10] to identify salient components of the plans. Each proposal was coded independently by two members of the research team, and, after multiple rounds of coding, the research team debriefed on the final list of codes, as discussed in the results.

V. RESULTS

Through data analysis, we identified four salient components of the diversity plans and mission statements: (1) Structure, (2) People, (3) Metrics, and (3) Environment. We will discuss each of these components and its significance in the following sections.

A. Structure

The first salient component that we identified was the plan structure. The structure was operationalized as the types of information *explicitly* included in the plans related to how the plan was developed and the process to achieve diversity goals. This theme included seven concepts: (1) definition of terms; (2) vision or values; (3) metrics or data information; (4) responsible party or accountability; (5) alignment; (6) timing or sequence; and (7) future plans. The combination of these concepts will allow developers of diversity strategic plans to locally define the value of diversity, essential goals, and the progress evaluation in the context of resources, personnel, and policy.

The structure is important for identifying the baseline status of the college, enabling the reviewers to understand the background and context of the current practices regarding diversity and inclusion. For example, some plans included explicit definitions and conceptions of diversity and inclusion based on the history of the college, what events led to approaches, and what has worked or failed in the past. It is also important to note that the structure of the diversity plan may vary by the capacity of the college. Capacity as related to structure is the development of human and institutional resources including expertise to accomplish the goals of diversity and inclusion, both within the college and the surrounding community [7]. Once the background and capacity of the college is understood, it is possible to predict what is a reasonable amount of organizational learning. Organizational learning is the process of making sense of how the institutional factors and the structure mediate the strategic goals and metrics of diversity and inclusion.

B. People

The second salient component related to the mentioning of specific groups of people. The engineering diversity plans varied in how diversity was defined in the context of the campus and local community. Some plans were broad in identifying demographic groups, identity, and populations; while others conducted environmental scans to tailor the demographic focus to best fit the needs of the internal environment (e.g., current demographics) and the external community in which the institution exists (e.g., state it is located in).

It is important to know that several of the diversity plans defined diversity using well-known social identity markers such as race, gender, ethnicity, physical ability, age, religion, and sexual orientation. Fewer plans, however, mentioned socioeconomic status, first-generation status, and national

origin; and seldom mentioned gender identity, language, veteran status, political perspective, or marital status--each of which could be considered. In addition to social demographics, people also included status at the institution. The plans were fairly consistent in concentrating on faculty, staff, and students. Moreover, some plans specifically referenced faculty, staff, and administrative leadership positions. There was far less discussion about diversity in postdoctoral researchers, alumni, or K-12 students.

C. Metrics

The third salient component identified was the discussion of metrics, or measures of success. Though noted as a part of the structure of the actual document, the specific patterns related to the content in this section warrants further discussion. Unsurprisingly, diversity plans often referred to compositional diversity (e.g., the percentage of female faculty, URM faculty, female students, and female staff), retention (e.g., retention of new hires, all faculty, students), and degrees awarded, often in reference to national averages. Other indicators included measures such as progress towards tenure, attendance and assessment associated with diversity-related events, number of diversity literacy certificates earned, and the participation of underrepresented groups in programs such as summer research, study abroad, co-ops, and internships.

Upon identifying the variation in the inclusion of metrics, we identified a framework for diversity [7] that could be used to inform the process of selecting appropriate and comprehensive metrics. The usefulness of this framework as it relates to this component of engineering diversity plans is that it categorizes performance indicators into four areas: (1) climate and intergroup relations; (2) access and success; (3) education and scholarship; and (4) institutional viability and vitality. If a diversity plan is to be comprehensive, progress in each area should be monitored and the results should be disaggregated. For example, a diversity plan could incorporate collecting data about perceptions of institutional climate, diversity of faculty and staff by level, the availability of courses that includes diversity-related issues, and student persistence. Smith [7] also offers five different approaches to monitoring progress that should be considered. For example, upon identifying indicators, administrators could decide to simply monitor change over time or monitor change in comparison to outstanding performers, peer institutions, or national averages

D. Environment

Lastly, in reviewing a diversity plan it is important to note which parts of the environment are mentioned as it has implications for determining which parts of a college environment are considered to be a part of the problem or potential solution. For example, while some might consider changes to the curriculum related to diversity and inclusion, others might consider this part of the experience off limits. Upon identifying the variation in the acknowledgement of certain elements of the environment, we identified a

framework for studying college impacts [6] that could be used to inform the process for deciding which influences need to be considered.

According to Terenzini and Reason [6], two sets of outcomes related to the organizational context and individual student experiences impact student outcomes. This includes: (1) internal structures, policies, and practices; (2) academic and co-curricular programs policies and practices; (3) faculty culture; (4) classroom experiences; (5) out-of-class experiences; and (6) curricular experience. Though this framework is focused on outcomes related to students, it provides a comprehensive way to think about which parts of an environment might warrant change and facilitates identifying gaps in a diversity plan. For example, upon identifying this framework, our research team noticed that few plans discussed curricular experiences and focused much more on out-of-class experiences and boundary-crossing activities such as recruitment.

VI. FUTURE WORK

Our next steps are to use these salient components to examine a broader set of diversity strategic plans. We will obtain diversity plans for the institutions who have committed to diversity via the ASEE diversity pledge. After analyzing these plans to identify themes and prevalent practices, our research team will create a rubric that will allow institutions to evaluate how their plans are in relation to their diversity goals. Universities will be able to outline a plan that can bring systemic change within a higher education system has created barriers for protected groups. It is our hopes that this work will lead to the development of diversity plans that help focus the energy, resources and time of all institutions to ensure that everyone is moving in one direction. Increasing diversity does not solely increase numbers. There is evidence that diversity improves the academic and social performance of the entire student body [11].

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