Board 387: Sociotechnical Systems Perspective of Underrepresented Minority Student Success at a Predominantly White Institution

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Sociotechnical systems perspective of underrepresented minority student success at a predominantly white institution

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1. Introduction

To assess and evaluate a college's capacities to bring about transformational change in its efforts to promote student success, the college can be viewed as a complex *sociotechnical organization* [1] with two subsystems at work – a *social subsystem* consisting of people including key stakeholders such as URM students, faculty, staff, and administrators, and a *technical subsystem* consisting of all elements that can impact capacity building, including goals, policies, processes, programs, data, technology, and knowhow. A *sociotechnical systems analysis* reveals catalysts in the *social system* to enable *people capital* so we can leverage and connect these catalysts in the social system with the catalysts in the *technical system* to enable resources like *money and knowhow*. We can then strengthen the processes and structures either already in place or to be created anew for meeting expressed and latent unmet needs, and for delivering transformative experiences for students. Using a *systems lens* to view and analyze the dynamics of the social and technical system in a college, can help generate views of the organization that *integrate* both structural resources, needs and constraints on capacity, and grassroots efforts, resources, needs and constraints on capacity. The social and the technical subsystems in an organization are interdependent – that is, one does not have a purpose without the other, so both will need to be examined and designed jointly. The sociotechnical systems theory[2] was one of the first to use a group, instead of an individual as the unit of analysis. Sociotechnical systems analyses include modeling the responsible autonomy of the stakeholders involved, adaptability to changing external conditions, and aligning the performance of systems to meaningful goals and tasks. Sociotechnical systems approach has been used to understand many research problems[3] including knowledge management[4], organizational learning[5]–[7], learning and teaching[8]–[10], innovation[11], and process improvement in higher education[12], [13].

2. Project Objectives

The overall objective of this project funded by the NSF-IUSE program is to employ a sociotechnical systems lens and framework and identify and evaluate organization-wide capacities and change catalysts in a predominantly white institution's college of engineering. The college of engineering is viewed as a sociotechnical organization with social and technical subsystems. The social subsystem models who talks to whom about what. The technical subsystem models the main activities and programs in the organization.

The specific project goals are to assess and evaluate the organization's capacities for enabling URM student success, and identify catalysts that can improve the organization's capacity. The

specific goals and aims of the project are threefold: (1) to assess and evaluate the technical system's capacity to support recruitment and retention through a technical system analysis; (2) assess and evaluate the social system's capacity to support recruitment and retention through a social system analysis; and (3) generate systemwide catalysts by bringing together the technical capacity analyses and the social system analyses.

3. Project Activities in Year 1

In year 1 of the project, the following two main data collection and analyses activities have been accomplished and continue to be in progress:

1. Participant Interviews: after IRB approval, 38 interviews have been completed and transcribed to inform technical and social system analyses. Each interview lasted about 40 minutes on an average. Interviewees include students, faculty, administrators, and staff from various departments and student service organizations in the college of engineering, and staff and administrators from organizational entities outside the college of engineering who routinely interact with the students, faculty and staff in the college.
2. After transcription, the interviews have now undergone preliminary qualitative analyses and coding. These codes and themes generated represent preliminary outcomes for technical system analysis and social system analysis.
3. The investigator team continues to code the data for generating the sociotechnical system themes to model both the social and technical system barriers and enablers from the perspectives of the main stakeholders including students in the college, faculty who interact with the students, administrators in the college, and staff members in the college. The preliminary findings have been used to develop the SEISS framework to represent the findings using the sociotechnical systems lens. Additionally, the perspectives of the staff and administrators outside the college are being coded to identify their key interaction points with the college.
4. The investigator team is now in the process of harvesting the main findings from the interviews so that the key attributes and operations and the barriers and enablers (technical model), and the key roles and the nature of the interaction within these roles (social systems analysis with the focal role network model and the GAIL model), can be generated.

4. Results Obtained in Year 1

Briefly, from interviews with URM students, the following major themes emerged:

<u>Social system barriers</u>

The main social system barriers were interactions with peers in classroom environment (leading to a sense of isolation and a lack of belonging), interactions with faculty and staff especially in relating to URM student needs and being empathetic, and familial concerns and being able to support their family financially.

<u>Social system enablers</u>

Interactions with their friends was the top social system enabler for URM students in PWI environments. Friends provided not only emotional support but also helped identify professional opportunities and networking for internships and jobs. Friends also helped them overcome their sense of isolation. Interactions with faculty also emerged as an enabler. Many participants

appreciated faculty members who pushed them to excel in math and science classes and helped them balance their workload. Finally, family support was reported as an enabler. Family provided them comfort and solace while attending to the rigors of college. They also felt that living at home would alleviate some of the financial burdens they faced.

Technical system barriers

The lack of numbers (and hence the lack of diversity and identity), curricular and instructional methods, and high school preparation were cited as the most important technical system barriers URM students faced. Students felt the low numbers of URM students in the college contributed to either feeling hypervisible or being isolated. They also felt that they felt underprepared for their classes especially compared to their white student counterparts. They felt part of this was due to poor high school preparation.

Technical system enablers

Technical system enablers students identified included the professional development opportunities they had, their participation in student organizations, particularly in identity-based organizations such as NSBE, SHPE and WISE, and how that helped them forge new contacts and provided emotional support during their study. They seemed to prefer participating in identity-based organizations more than they did in professional discipline-based student organizations.

Our preliminary results have also generated interesting insights about how faculty, administrators and most importantly staff members who interact with URM students view the barriers and enablers they experience in the college with respect to URM student success. A more detailed analyses of the main themes that emerge is ongoing, but from the initial analysis some important observations include the following:

- recognition among the administrators and the staff working with URM students that diversity is important in the student body.
- recognition among administrators and staff that the mission of enabling URM student success is important but that the mission is somewhat poorly defined and understood.
- Indications that URM student success efforts and the learning that may be involved in goal setting, communicating about these goals and strategies to achieve them, and monitoring and rewarding achievement of these goals are just beginning in the college.
- there is no one unified strategy for recruiting undergraduate students and in particular URM students into the college, with the departments either self-navigating the recruitment without college resources, or not actively recruiting URM students given the fairly centralized admissions and recruitment structure.
- a need for recognition and celebration of staff efforts for promoting student success particularly when their work involves URM students.
- departments in the College have taken several initiatives in the past year to promote DEI - some of these efforts including participating in a college DEI council, ensuring that faculty hiring committees have a DEI council representative during the hiring process, and having interested faculty undergo diversity training.
- the need to revisit how the student recruiting and college admissions interact with the university admissions and recruiting and strategizing and rethinking centralized structures

for admissions while at the same time recognizing all the tradeoffs involved and that staffing resources can be increased for this purpose.

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