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Full Paper: First Year Engineering Undergraduate Academic Co-Advising Improvement

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***Abstract* – In this descriptive study, we examined engineering student satisfaction with academic advising in our new co-advising model as well as compared to the past faculty-only advising model. We conduct this analysis through a critical lens by examining any differences by a student's combined sex and ethnicity. In the faculty only advising model, students had separate first-year instructors and faculty advisors. In the co-advising model, students' first year engineering course instructor also served as their academic advisor. Leveraging in-class discussions, the co-advising model infused several formative topics and activities into the first-year engineering course. These included major selection; identification of peer-support mechanisms; references to available counseling, tutoring and career-planning resources; periodical reminders regarding academic deadlines; check-ins to identify students at academic and/or medical risk; and early interventions for students who experienced academic or other difficulties. Our analysis of an extensive and representative data set (n =1210) of students from academic years 2015-2016 and 2016-2017 revealed 72 percent and 73 percent of students, respectively, agreed or strongly agreed (affirmed) that their advisor took an active role in ensuring their success in engineering, as compared to previous research reporting 31 percent affirmed the same statement in 2013. Our 2016 and 2017 data, unlike the 2013 dataset, allowed us to extract survey responses from underrepresented minoritized students (URMs) in two ways: ethnicity, as categorized by the Integrated Postsecondary Education Data System (IPEDS), as well as a binary sex variable of male and female. Under the co-advising model, Black or African American males were the highest in affirming their advisor took an active role in ensuring their success in engineering at 86 percent. Comparing co-advising to faculty-only advising model, each group had a higher percentage of affirmation. These metrics, along with other data analysis, suggest adopting elements of a co-advising model may improve the advising experience for URM engineering students.**

***Keywords*—academic advising, quantitative methodology, critical race theory, inequality, engineering first-time first years**

I. INTRODUCTION

Academic advising often serves as incoming first year engineers' earliest opportunity to build a relationship with a faculty member. Because demographics of the US undergraduate population have been and will continue to shift toward a more diverse population with regards to ethnicity [1], Patton and colleagues have implored higher education researchers to utilize Critical Race Theory (CRT) to examine systems and processes within higher education, how these institutions perpetuate racial inequities, and how they differentially affect students at the intersection of their identities [2]-[3]. In other words, it is not good enough for administrators to issue blanket statements about their support of students; they must critically examine if the outcome or satisfaction with such supports are consistent for Underrepresented Minoritized students (URMs).

Research on academic advising stands to gain from applying a CRT lens. For example, previous research at one institution reported a change in advising structure increased student satisfaction overall [4]; however, it failed to account for possible differing experiences among engineering undergraduates by sex and ethnicity. This paper aims to fill this gap in knowledge. To answer this question, we must examine how a shift in advising structure calls upon advising's core purpose, understand academic advising structures, and define the student learning outcomes expected from academic advising.

With regards to advising purpose, the National Academic Advising Association's (NACADA) expects advisors to "encourage, respect, and assist students in establishing their goals and objectives" and to "gain the trust of their students and strive to honor students' expectations of academic advising and its importance in their lives" [5]. Crookston asserted that advising is a form of teaching [6]. With these two holistic definitions in mind, it might be evident how pairing students with an instructor in the first-year engineering curriculum might increase their advising satisfaction by building respect and trust through prolonged contact.

Many different advising structures exist in higher education. Habley categorized seven academic advising models: faculty-only, supplementary, split, dual, total intake, satellite, and self-contained academic advising models [7]:

"Faculty-Only: All students are assigned to an instructional faculty member for advising. There is no advising office on the campus.

Supplementary: All students are assigned to an instructional faculty member for advising. There is an advising office that provides general academic information and referral for students, but all advising transactions must be approved by the student's faculty advisor.

Split: There is an advising office that advises a specific group(s) of students (e.g., those that are undecided about a major, underprepared, etc.). All other students are assigned to academic units or faculty for advising.
Dual: Each student has two advisors. A member of the instructional faculty advises the student on matters related to the major. An advisor in an advising office advises the student on general requirements, procedures, and policies.
Total Intake: Staff in an administrative unit are responsible for advising all students for a specified period of time or until specific requirements have been met. After meeting those requirements, students are assigned to a member of the instructional faculty for advising.
Satellite: Each school, college or division within the institution has established its own approach to advising.
Self-Contained Model: Advising for all students from point of enrollment to point of departure is done by staff in a centralized advising unit."

Based on the above definitions, our study's co-advising structure could be characterized as the split model where the first-year engineers are the specific group of students.

Building off of advising purpose and structure, we must also clearly define how to measure learning outcomes. With regards to advising student learning outcomes (SLOs), Aiken-Wisniewski and colleagues outlined three SLOs: 1) behavioral (engage in opportunities), 2) cognitive (knowledge gained based on participation in academic advising), and 3) affective (value of advising experience) [8-9]. Our study focused on student affect with future research including other components of SLOs such as behavioral as measured by resource utilization.

A. Relevant Literature

Our previous conference proceeding demonstrated an improvement in the student advising affect after shifting from a faculty-only model to a split model, reporting this finding in aggregate as the survey data was deidentified and did not collect student demographic data [4]. These results were based on student survey responses and advisor feedback. Survey questions asked about advisor availability, response time, curricular knowledge, policy knowledge, comfort in discussing career development, enjoyment of advising, taking an active role in success with a statistical increase in affirmative reporting on each metric [4]. In 2014, we shifted first-time first year advising from A) random assignment of advisor and largely transactional interactions (i.e., confined to necessary actions such as course selection, registration, and withdrawal) to a B) co-advising, course integrated with intentionally developmental activities. In sum, they switched how they advise first year students but not how they advise students beyond the first year. At this institution, all first-year engineers entered with engineering undeclared as a major as most do not graduate in the major they denoted at admission [4].

A second conference proceeding outlined a similar model of co-advising, differing by assignment to an instructor in the first year and not the students' instructor to avoid power dynamics [10]. This program initiated an evaluation of academic advising based on student behavior as well as utilizing predictive analytics to identify students most at risk of negative outcomes such as probationary status and transferring out [10].

Critical Race Theory (CRT) was originally developed in the field of law, based on the work of Derrick Bell and Alan Freeman in the 1970s. Its principles have since been applied to various institutions, including higher education. Patton, Harper and Harris in their chapter "Using Critical Race Theory to (Re)interpret Widely Studied Topics Related to Students in U.S. Higher Education" implored higher education researchers to utilize the CRT methodology in researching policies and practices in higher education [2].

Patton and colleagues utilized four concepts from their foundational scholarship – intersectionality, whiteness as property, community cultural capital and interest convergence. They analyzed three areas of higher education – college access, student development, and college engagement. Lastly, Patton and colleagues provided nine recommendations for those in higher education to critically examine rules and practices to expose issues of race neutrality and racelessness that could lead to racial inequalities. First, within the research process, researchers must examine racism, white supremacy, and power embedded in their research questions, methodology, interpretations and findings. Within those research questions, second, must be the utilization of critical questions coupled with intersectionality, taking into account the complexity of multiple identities (i.e. women of color) at play within education. Third, history plays a crucial part at interrogating the present. Fourth, higher education must notice when racism is coupled with other forms of oppression. Fifth, researchers must acknowledge that objective and neutral research (just like neutral rules) do not exist, specifically because our own experience impact what questions we ask and how we interpret the findings. Sixth, researchers must put thought into how they might impact education

policies at multiple levels (i.e. institutional, state and federal). Seventh, there is a need for research rooted within social justice and activism in order to work toward educational outcomes that no longer differ by race. Eighth, researchers need to work in concert with each other, especially across disciplinary boundaries in order to shed light on existing racist rules and practices. Lastly, and ninth, new perspectives are needed as well as direct reinterpretations of existing research in order to disrupt the existing knowledge, constructs and ideologies firmly rooted within higher education. Our paper focused on Patton's call to examine the full student experience to highlight how studies of academic advising, such as the two highlighted above, failed at critically examining improvements in advising practices.

II. BACKGROUND

A. Institutional Background

The institution in this study is a public, mid-Atlantic 4-year predominantly white research university that enrolls approximately 15,500 undergraduate students and is classified as "highly selective" in undergraduate admission. The university offers decentralized academic support through the individual schools and colleges and recently reported having one of the highest graduation rates of 4-year public engineering programs, including URMs. On top of a high graduation rate, the school of engineering had an impressive first year retention rate, retaining students within engineering who started in engineering. In 2015 and 2016, the school first-year retention rate was 96% and 97% respectively. While CRT could be used to assess many areas of the institution, including the above retention rates, this paper aimed to limit its scope on the assessment process of the first year advising experience of URM students.

B. Defining Advising Model

While the faculty-only advising model in place prior to 2014 hosted opportunities for students to seek guidance from both their academic advisor and the institution's support team, it often inhibited positive results gained from broader dialogues amongst all three constituents (Figure 1, Model 1). In the faculty-only model, students often bore the responsibility of consulting with their advisor and support team separately. In addition, the faculty-only model did not contain elements normalizing communication between academic advisors and the support team. While all parties may have desired more collaboration, the faculty-only model structure made such partnerships difficult to establish and maintain equitably.

Under the co-advising model, first-time, first-year students' *Introduction to Engineering* course instructor was also assigned to be their academic advisor (*Introduction to Engineering* is a required course and is taken in students' first semester with few exceptions). Whereas advisors and advisees had infrequent connections under the faculty-only model, coupling academic advising and a first year required course provided weekly, scheduled interaction. As a result of combining the roles of instructor and advisor, the co-advising model lowered previous structural barriers to dialogue amongst academic advisors, the support team, and advisees. (Figure 1, Model 2). Further, the co-advising model repositioned academic advisors as more central support for their advisees, relieving students of sole responsibility to bridge relationships with both their advisor and support team. While racial inequity in student experience within engineering was not the main impetus for the change in advising model, the administrators involved in the initial pilot anecdotally understood that the faculty-only advising model might differentially negatively affect URMs experience in engineering. In hindsight, the design of the co-advising model could have been more intentionally designed if previous assessment in 2013 had included student demographic information.

Under the co-advising model and without critically examining differences in experience by ethnicity, academic advisors were charged to implement new approaches to academic advising. Given a new role and dedicated facetime, academic advisors were able to weave formerly out of class formative topics and activities into their course throughout the semester. These topics and activities included major selection; identification of peer-support mechanisms; references to available counseling, tutoring, studying internationally and career-planning resources; periodical reminders regarding academic deadlines; check-ins to identify students at academic and/or medical risk; and early interventions for students who experienced academic or other difficulties. The Support Team in conjunction with the academic advisors developed this list as priorities to help raise student awareness of opportunities with the hope of positively influencing student behavior and engagement.

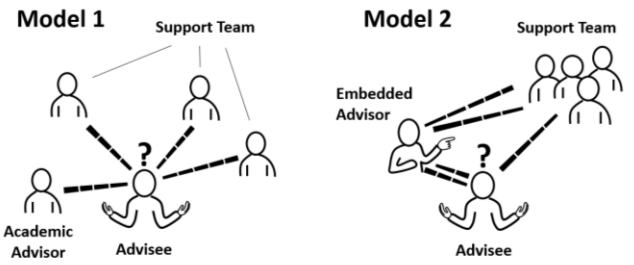

Fig. 1. Model 1: faculy-only advising; Model 2: co-advising, pairing students with advisor/instructor.

C. Challenges and Implementing Advising Model

Some faculty teaching Introduction to Engineering were reluctant to advise first-year engineers as they had advisees within the major already and did not want to commit to such an important function. The expansion to include instructors outside of Introduction to Engineering led to a future matching of the entire first-year class with one of their instructors for advising in their first semester. This initiative was organized and incentivized at the Dean's level and logistically supported through the centralize undergraduate office. To fully implement the advising model, the Provost's office initially funded the pilot with the understanding that continued financial support would come from the school.

To overcome these challenges, a faculty who served as the Director of First Year Engineering helped assemble the cadre of instructors who signed on to serve as first year advisors. This Director then partnered with the Undergraduate Office to solicit the faculty from each department who would serve in the faculty-only model. The Undergraduate Office paired each student possible with one of their instructors in the first semester (co-advising, model 2) and those remaining were assigned to a random faculty within an engineering department (faculty-only, model 1). The co-advisors signed on with the understanding they would get remuneration based on advising load. For this remuneration they agreed to serve as an advisor who took a developmental approach, considering advising as teaching [6], with at least two points of contact with advisees within ten weeks of the start of the semester and follow up support for those placed on academic probation or those needing additional guidance on major choice.

C. Research Question

Since we already knew from evidence in literature [4, 10] that such a shift in academic advising would have an aggregate improvement with regards to student satisfaction, we wanted to critically examine if all groups of students reported a similarly high satisfaction with the new co-advising model. More exactly, of the 2015 and 2016 first-time, first year engineering students at a highly selective, mid-Atlantic engineering program:

1. To what extent were there differences amongst reported student satisfaction with advisors taking an active role in their success <u>within co-advising</u> when combining sex and ethnicity?
2. To what extent were there differences amongst reported student satisfaction with advisors taking an active role in their success <u>between advising models</u> by combined sex and ethnicity?

III. METHODOLOGY

To answer this question, we obtained survey data through SurveyMonkey in March of 2016 and 2017, using the same Likert Scale questions as in a previous study for a baseline comparison [4]. Students filled out the optional advising survey concurrently with their major application, which meant the students were not promised anonymity unlike the publication with the 2013 survey. The 2016 response rate was 98.2% (r.r. = 600/611) and 2017 was 99.7% (r.r. = 604/606). Across both years, all ethnicities and sexes had a sample size differing less than 1% of the population, so arguably the sample was very representative of the enrolled engineering undergraduate population.

We combined the following 2016 and 2017 Likert Scale questions from previous research to ensure student anonymity.

-My advisor is generally available to meet with me.
-My advisor is knowledgeable about the curriculum.
-My advisor is knowledgeable about school policies and regulations.
-I feel comfortable discussing concerns about my academic career with my advisor.
-If my advisor does not know an answer to one of my questions, s/he actively helps me to find the answer.
-My advisor seems to enjoy advising.
-My advisor takes an active role in ensuring my success in engineering."

We utilized R software to provide descriptive statistics of frequency of reporting and to graph the data. We did not conduct any inferential statistic tests due to some of the small sample sizes in Model 1. Lastly, this study is IRB approved (45 CFR §46.101 (b)(2)).

IV. RESULTS

Our previous study reported a statistically significant improvement of student reported satisfaction with academic advising across all Likert scale questions, and the largest gain was advisors taking an active role in their success (Success) [4]. In Table 1, we reported the counts of students at the intersection of their ethnicity and sex within each model (faculty-only and co-advising). Across these academic years, about 15% of students were randomly assigned to faculty across departments (i.e. faculty-only model, Model 1) and about 85% of students assigned to co-advisors (i.e. Split model, Model 2).

To answer our first research question, we reported the percentage of responses to Success for both models (see Figure 2). Strikingly, the highest percentage to affirm satisfaction with Model 2 with regard to Success, at 86 percent, was among Black or African American males. On the other hand, the lowest percentage to affirm satisfaction with Model 2 with regard to Success, at 60 percent, was Hispanic females. These two data points can be further contextualized by the aggregate or overall reported percentage, at 76 percent.

To answer our second research question, we reported percentage gains in affirmative reporting for Success (see Figure 3). This further contextualizes the fact that although Hispanic females were below the overall satisfaction in Model 2, that Model 2 was still an improvement (gain of 20 percent affirmative reporting) as compared to Model 1. Visualizing the difference in student satisfaction allowed us to also examine if any group was "harmed" by shifting the model. In our case, all groups improved with Asian females improving the most at 42 percent increase in affirmative reporting.

	Model 1: Faculty-Only	Model 2: Co-advisor
Asian Female	16 (22.2%)	56 (77.8%)
Asian Male	31 (18.8%)	134 (81.2%)
Black or African American Female	0 (0%)	13 (100%)
Black or African American Male	3 (9.4%)	29 (90.6%)
Hispanic Female	5 (25.0%)	15 (75.0%)
Hispanic Male	10 (22.2%)	35 (77.8%)
Other Female	10 (13.5%)	64 (86.5%)
Other Male	23 (18.4%)	102 (81.6%)
White Female	32 (15.5%)	175 (84.5%)
White Male	72 (15.8%)	385 (84.2%)
TOTAL	202 (16.7%)	1008 (83.3%)

Table 1. Count and percentage of students by combined IPEDS ethnicity and sex by advising model, joining 2015-2016 & 2016-2017 survey results.

V. DISCUSSION AND CONCLUSIONS

While previous conference proceedings have established a baseline improvement in academic advising student experience by shifting to a co-advising or split model, no study has been conducted to critically examine if this is true at the intersection of sex and

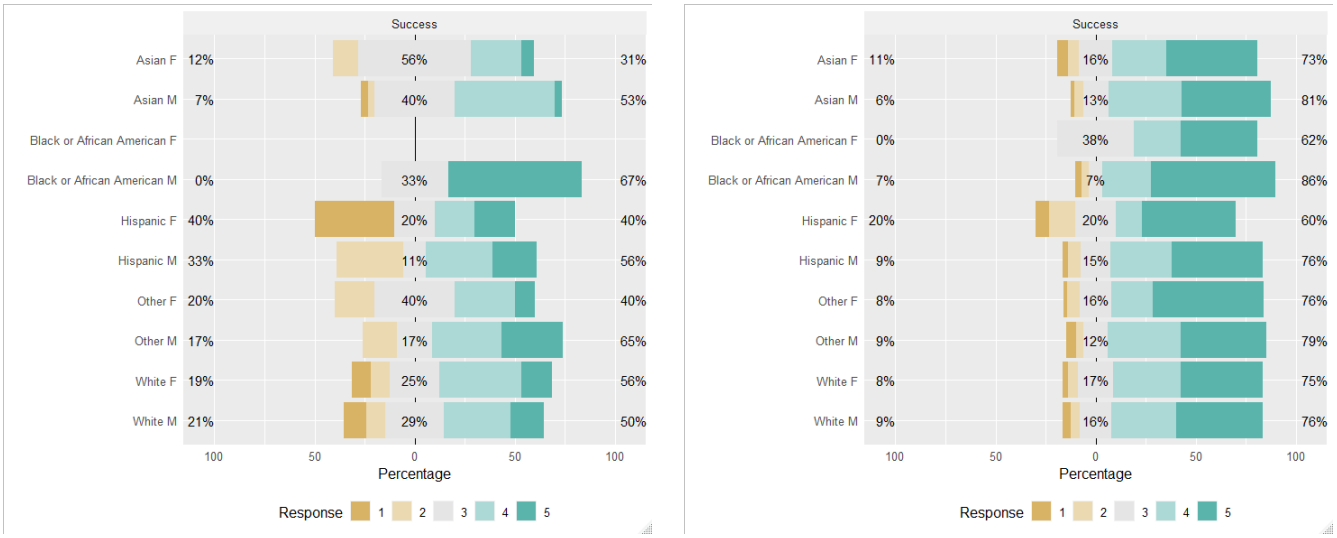

Fig 2. Model1 1 (left) and 2 (right) student academic advising perceptions of advisor taking an active role in student success in engineering for grouping by sex and ethnicity. (1=Strongly Disagree, 2 = Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree). Note: No Black or African American Females experienceied the faculty-only advising model in either the 2015-2016 or the 2016-2017 academic year.

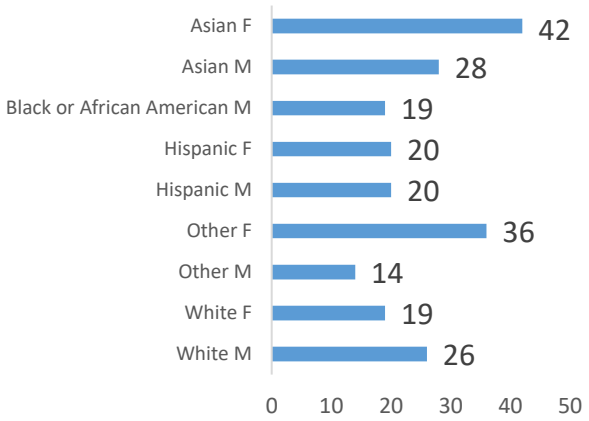

Fig 3. Percentage increase in affirmative reporting of advisor taking an active role in student success in engineering by sex and ethnicity. Note: No Black or African American Females experienced the faculty-only advising model in either the 2015-2016 or the 2016-2017 academic year.

ethnicity within engineering. In comparing groups within the co-advising model, we found that some groups lagged behind the overall affirmative reporting. It is equally important to point out the improvement within each subgroup when the model was shifted from faculty-only to the co-advising model.

As our design of the new advising model failed to intentionally target racial inequity, we found it important to do an ex-post facto assessment to ensure that co-advising was not leading to greater inequity. We encourage administrators to both intentionally design as well as assess programs and policies with race in mind. We also encourage administrators to not only conduct this research when it is in their own self-interest (as defined as Interest Convergence by Patton and colleagues) such as for marketing or rankings.

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