

Engineering Competition Team Recruitment and Integration Strategies Impact on Team Diversity

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Abstract—Engineering Competition Teams (ECT) recruit and integrate new members every year. We interviewed groups of students at two national and international competitions about the methods they use to recruit and retain students, in an effort to understand why ECT have low participation of students from underrepresented groups. None of the teams that were interviewed were especially diverse, in spite of our efforts to interview diverse students. We categorized their recruitment activities into strategies that require direct person interaction with a degree of personal invitation (active) and those that do not (passive) using a theoretical framework provided by Cegler [1]. Not all passive recruiting is done in ways that completely avoid personal interaction. Thus, for ECT, Cegler's passive category was separated into two categories: direct and indirect recruiting. Teams generally had more numerous recruiting strategies than integration strategies. We analyzed integration strategies using the theoretical framework of legitimate peripheral participation [2]. We found that while a handful of teams were using strategies that could fit into this theoretical framework, most were making critical mistakes including trying to integrate too many students and failing to allow new recruits to work at meaningful projects. The paper concludes with recommendations for recruiting and integration practices that may improve team diversity.

Keywords—diversity, engineering competition teams, qualitative, recruitment, retention.

I. INTRODUCTION

Engineering Competition Teams (ECT) allow college sponsored groups of engineering and (and other) students to design and build engineering artifacts to meet competition rules and specifications and compete regionally, nationally, or internationally. These competitions are sponsored by numerous engineering professional organizations, such as the Society for Automotive Engineers (SAE), the American Society of Civil Engineers (ASCE), and the American Institute of Chemical Engineers (AIChE). Typical artifacts built include formula one style racing cars, concrete canoes, remotely controlled airplanes, and Baja racing vehicles. ECT can have a handful of members, or have as many as 60 or more members, although large teams are unusual. Teams typically have partial or complete financial support from their academic institution with the remaining funding coming from donations. ECT usually receive mentorship from university personnel (e.g. faculty, staff, technicians, graduate students).

Like engineering as a whole, ECT do not reflect the racial/ethnic/gendered makeup of U.S. society. Underrepresentation of women and some racial/ethnic groups persists in engineering in the U.S. even after decades of efforts to change representation in the field. In 2013, only 19.1% of engineering bachelor's degrees were awarded to females, 9.3% were awarded to Hispanics, and 4.3% were awarded to Black or African Americans [3] in stark contrast to the representation of these groups in the general U.S. population (51% female, 16% Hispanic, 14% Black or African American [4]). This disparity in representation is also evident in ECT. Our research team's review of hundreds of team websites, observations of regional, national and international competitions, and interviews with student ECT participants and faculty team advisors have confirmed that in general ECT are less diverse than the engineering colleges that host them.

ECT provide students with hands-on engineering experiences that can balance the mathematical and theoretical presentation of engineering provided by coursework. The degree to which industries value this type of engineering experience can be seen by the long list of donor corporations supporting competitions and offering teams reduced price parts and services (e.g. [5, 6]). Therefore, students who are excluded from participation miss obtaining preparation that is valued by industry. The lack of diversity in ECT membership is also inconsistent with industry demands for a diverse workforce [7]. There is little research to explain the lack of diversity on ECT, aside from that performed by our research group [8-11]. A literature review that focuses on diversity in teams in general, mostly in the business context, is available [12].

This study is part of a large research project investigating the factors that contribute to cultures of inclusion or exclusion within ECT. In the initial phase, we used semi-structured interviews with ECT members from a single institution to explore their motivations in joining the team and their experiences as team members. Our findings show that ECT

This work was funded by the National Science Foundation's Directorate of Undergraduate Education's STEM Talent Expansion Program Grant No. DUE-1068453. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

exaggerate the limitations of engineering as a whole in failing to attract and retain diverse student populations. A case study of one team showed that students who are interested in joining the team must prove themselves to be worthy to senior members, a dynamic that conflicts with the developmental purpose of the team [9]. Two other case studies of the team experiences of female engineering students have shown that female participation is constrained by biases influenced by gender stereotypes and indicate that the absence of effective strategies for integrating new team members is a barrier to female participation [8, 11].

The goal of the Research Institute for STEM Education (RISE) (<http://rise.oucreate.com>), that conducted this research, is to identify and rectify structural inequities within engineering education that limit participation by students from underrepresented populations. We view the inclusion of people from groups that are underrepresented in engineering (e.g. women, racial/ethnic minorities, socio-economically disadvantaged students, students who are the first in their families to attend or graduate from college, sexual minorities, students with visible and invisible disabilities) as an imperative, not only because engineering will be better if we use the talents of the whole population, but because we want everyone to have an opportunity to participate in this lucrative and enjoyable profession. As such, our focus will always be on making recommendation for engineering education to be more equitable, rather than suggesting how members of underrepresented groups must change to fit into the prevailing cultures of engineering.

The structure of this paper is as follows. The next section will present the methodology for the research. It will be followed by a section that introduces two theoretical frameworks: one for recruitment strategies and another for integration strategies. These theoretical frameworks will be used to interpret the research results. The following section, Results and Discussion, will describe and interpret results in the context of the literature. The last section will summarize conclusions, present recommendations and suggest future work.

II. METHODOLOGY

The data for this paper consist of field interviews with 20 unique teams attending two large international engineering team competitions. These two competitions featured the design and construction of an engineering artifact from primarily a single engineering discipline. Each group interviewed consisted of member(s) of a team from a single institution. With the permission of the organizations hosting the competitions, the researchers approached teams and advisors during the competition to request an interview. A semi-structured protocol guided the interviews, but left ample opportunity for follow-on questions. The researchers used a targeted sampling strategy attempting to secure participants from the range of institutional types, sizes, and engineering compositional diversity represented at the event, although participation was ultimately limited by the willingness of teams to be interviewed during the event [13]. The data for

this study were drawn from the researchers' interview notes. These notes were written during and reviewed and revised shortly after the event, a methodology that is well established in social science research [14]. The notes include summaries of the group discussion and short quotes from team members that offered particular insights into group dynamics and processes.

While it might seem that transcribed video or audio recording would provide more complete records of interviews, the noisy and crowded competition venues made this impossible. In addition, recordings can impact the willingness of people to participate in an interview, since participants can be personally identified as the information source in perpetuity. The impact of recording participants is especially strong for members of underrepresented groups who are more identifiable and may feel more vulnerable.

These data were analyzed using iterative and inductive analysis [15]. The interview notes were transcribed and qualitatively coded using NVivo software. Rather than analyzing the data with predefined factors and categories, we allowed patterns in the data to arise organically. This process puts the data in a primary position and allows it to speak freely, rather than being constrained by predefined researcher beliefs about what should be found. The patterns were further analyzed and ultimately grouped to create categories that represent broader themes within the data. These categories led us to define classifications for ECT recruitment and integration strategies that were interpreted using two theoretical frameworks. These explanatory frameworks were selected after the coding of data, based on the patterns and categories that emerged from the data itself. Following the characterizations, we use some participant descriptions to help readers visualize and contextualize the processes.

III. THEORETICAL FRAMEWORKS

The theoretical framework used to analyze the recruitment strategies came from Cegler's separation of recruiting strategies for TGBL (similar to LGBTQ, but without the explicit inclusion of students who identify as Queer and/or Questioning) students into two categories: active and passive [1]. Examples of passive recruitment included advertising on TGBL-friendly social media outlets and recruitment websites. This advertising was accomplished by strategies such as adding TGBL-related campus services to websites and materials. Active recruitment involves deliberately identifying and reaching out to students who self-disclose a TGBL identity through organized events and partnerships with TGBL-friendly programs like Campus Pride. Cegler found that passive recruitment strategies were more common than active ones because they require less work from the university. He also pointed out that reaching out to students with a TGBL identity is complicated by the fact that many teens have not yet disclosed their sexual orientation in all contexts, especially to their families. While this theoretical framework was developed in the context of the TGBL community, we have chosen to use it both more broadly (to analyze students of unknown sexual orientation and gender

identities) and more narrowly (to analyze students in engineering alone). The transfer of theoretical frameworks to new domains is commonly done. As an example, Bourdieu's theories about social domination and cultural reproduction [16] form one basis for critical cultural theory. This theory was developed, in part, by examining the middle and upper classes in Europe. Critical cultural theory been both broadened (e.g. to include race in addition to social class and economics) and narrowed (to focus on issues related to the U.S. legal system's entanglement with race) in critical race theory [17].

Data on integration strategies were analyzed using Lave and Wegner's Legitimate Peripheral Participation (LPP) as a theoretical framework [2]. LPP was developed to describe the learning process of new members entering and integrating into formal or informal Communities of Practice (CoP). CoP are groups of individuals whose purpose is centered on the development and use of technical knowledge, craftsmanship and skill in a social context (often a context of a profession, although that is not required). Examples of communities of practice given in the work include midwives, tailors, and butchers. Engineering, especially ECT, can be thought of as a CoP. LPP was inspired by the observation that the popular framework of apprenticeships was not adequate to describe why some CoP were uniformly more successful in integrating new members than others. LPP involves having newcomers actively perform tasks (participate) that are part of the genuine work of the CoP (legitimate), but are not the central tasks (peripheral). These tasks are performed in the social context of the CoP, allowing the new member to develop critical technical and social skills that are necessary for success in the CoP. As a newcomer gains skill and social knowledge, they perform less peripheral, more essential, legitimate tasks eventually leading to their full integration as members of the CoP.

IV. RESULTS AND DISCUSSION

We will first present the analysis of the interview data about recruitment of new ECT members. The analysis of data related to integration of new ECT members will follow. This section will conclude by comparing the demographics of teams with the strategies used and examining whether these strategies have impacted the representation of URM on the team.

A. Recruitment

A list of all recruitment strategies identified is included in Table 1 below along with the number of teams utilizing each strategy. Cegler's active category has an element of personal interaction and invitation that is missing from many of the recruitment strategies for the teams that are voluntary student organizations. Most teams are using passive strategies. We separated the passive strategies into two categories: direct and indirect recruitment. Direct recruitment strategies require the physical presence of a team member with potential recruits. Indirect recruitment strategies do not require team members and recruits to interact. Examples of direct recruitment strategies include class visits, club visits, welcome events, and hosting an open shop. Indirect recruitment strategies include

posting flyers, posters, websites, or reliance on club reputation.

Two of the teams interviewed were not voluntary student organizations, but instead represented a group of students using an ECT as their engineering capstone project. One of these teams intends to move away from allowing ECT to be capstone projects in the near future. The other team uses an active recruitment strategy: they select a small group of promising students to mentor and take to the competition during their third academic year as preparation for inviting these students to join the team the next year (labeled hand selected in Table 1). Students who successfully achieve integration into a capstone affiliated team have the privilege of using an extra-curricular activity/interest for the capstone rather than having to juggle these responsibilities independently. The impact on team diversity is ambiguous. The composition of the team had varied from four White males the previous year, to two White females and three White males in this competition year. The mechanism for determining who is and is not worthy of an invitation was not discussed. Even if it were a structured and open application process, there is evidence that women are considered less qualified than men of equivalent credentials [18], and that people with African American sounding names get fewer opportunities to interview than people with equivalent qualifications and White sounding names [19].

TABLE 1. CLASSIFICATION OF RECRUITMENT STRATEGIES

Classification	Recruitment Strategy	# Teams
Active	Word of Mouth	5
	Hand selected	1
Passive Direct	Welcome Events / Volunteer Fairs	10
	Class Visits	4
	Club Visits	2
	Open shop	2
Passive Indirect	Website	9
	Flyers/Pamphlets	6
	Reputation	2
	Posters	1

Recruiting through word of mouth (personal friendships) is another active strategy. However, friendships are subject to the force of homophily—the tendency of people to have friends who are similar in social identity [20]. Many teams unknowingly touched upon this topic. Homophily is implied by student remarks that there was no reason to recruit participants outside of their major, in spite of the fact that these engineering artifacts could benefit from expertise in many majors. Other teams expressed homophily when they reported recruiting people with shared athletic interests, including an esoteric sport unrelated to the engineering artifact. Homophily is implied when one team member told us that members of the team are “brothers,” a term that is often

reserved for people who share gender, family, socio-economics, and usually race.

We had hoped that active recruitment strategies might create an inclusive team culture by providing more personal and meaningful invitations to students. This is not supported by most of the data. There is some evidence that having students who are members of underrepresented groups recruit is thought to increase diversity. The female project manager of one team would run presentations at open house events to encourage more female students to join the team, as their team captain summarized: “not only can girls see what they can do as engineers but that girls can be team leaders, too”. This is supported by a study of recruitment and retention of high school girls into STEM educational pathways. The study found that prospective female students like to speak with female representatives and females prefer to get help from other females [21]. The force of homophily can be used to make the teams more diverse, although it does require some existing diversity to be workable.

Active and direct recruiting strategies may be ineffective for increasing diversity in teams with a homogenous social identity for a variety of reasons. The lack of diversity of the team will be immediately apparent, especially to members of marginalized groups. Another disadvantage of direct recruiting is that the individual students doing recruiting may project a variety of biases, like those we found when Industrial Engineering students were taunted as “imaginary engineers” [22] as well as gender and racial/ethnic stereotypes and prejudices. Several teams report that they use the designed artifact in recruiting by putting the artifact on display in the student union or in other recruiting locations, showing videos of the team’s artifact, and demonstrating the artifact during institutional events. Traditional recruiting efforts that emphasize the adventure and hardware sides of engineering may not motivate women. [23]

Passive and indirect recruiting strategies may also fail to attract students who feel marginalized. It takes quite a bit of courage to go to a random meeting with an unknown group of people when you already feel like an outsider. An advantage of passive recruiting is that it allows people with cultural sensitivity to preview recruitment materials before the materials are made public.

The target audience for recruitment might also have an impact on the diversity of the team. Our analysis showed that the majority of the teams’ recruitment efforts target incoming and freshman engineering students, although nearly half of the teams did not mention recruiting specific groups of students. As seen in Table II, a limited number of teams participated in recruitment strategies outside of freshmen and engineering majors.

TABLE II. CLASSIFICATION OF RECRUITMENT STRATEGIES BASED ON TARGET AUDIENCE

Audience		# Teams
Classification ^a	Freshmen	6
	High School/Prospective Students	2
	All Years	2
Major	Engineering	11
	All Majors	2
	Visual arts	1
	Business	1
Other	Personal Friends	4

^a Classification was not discussed by all teams

B. Integration

The challenge of integrating new team members was demonstrated by ubiquitous stories from teams that were able to get many people to attend introductory meetings, but failed to keep new members interested and engaged. One team said that they typically have 30 first year engineering students and 10 students from other majors attend the initial informational meetings. Of these 40 students, only 3-4 continue to participate, on average. Another team reported extensive recruiting efforts resulting in 100-120 students coming to the first couple of meetings, while only 5 typically continue more than 3 weeks. Many teams reported retaining 5 to 10 percent of the students who were initially interested enough to attend preliminary meetings, although some teams do better. A problem reported by many teams is that there is insufficient amount of work to perform for large numbers of people with a limited engineering background. The strategy of recruiting the high school students, prospective students and freshmen commonly targeted by teams as shown in Table II, may make integration of new members difficult.

The categorized integration strategies are shown in Table III. The most commonly used strategy was having new members perform introductory projects not directly related to the team’s goal, which was used by half (10) of the teams. Of the twenty teams interviewed, over a third (7) had no explicit strategy for integrating new team members.

We classified integration strategies based on the degree to which responsibility falls on existing team members. Supplemental meetings and mentorship programs, for example, require the current members of a team to take responsibility for integrating new members. Having new members perform tasks without mentorship puts little burden on current members beyond defining the tasks to be performed. Similarly, shadowing can mean just follow me around and watch me work.

TABLE III. CLASSIFICATION OF INTEGRATION STRATEGIES

Classification	Integration Strategy	# Teams
Current Members Have Substantive Responsibility	Supplemental Meetings	3
	Mentorship	2
	Shadowing	2
Only new members have responsibility	Tasks	10
	No integration strategies	7

LPP offers insight into the prospects for success of these integration strategies. Having new members perform toy projects (e.g. a bird cage, turning random tubes on the lathe) apart from the team's work and culture is neither legitimate nor peripheral. If the projects are things like battery carts, tool cars, or a piece that may or may not be used, these are legitimate and peripheral. Shadowing makes it possible for a new member to view and start to emulate team culture, but it is not participation. Mentorship (used by only two teams) is also not necessarily LPP, since it could encompass things as simple as calling new members and inviting them to lunch to showing new members how to do simple related tasks that will ultimately lead them to full team participation via LPP. While having supplemental meetings does require team members to take responsibility for integrating new members, it does not accomplish LPP since meetings alone do not accomplish peripheral participation.

Some teams are using integration strategies that are closer to LPP. One team has freshman recruits pick their top three introductory projects and then the recruits are placed onto learning teams. Some of the teams repaired old cars, while others worked on support projects such as the battery cart or pit cart. Team members complained that first year students lacked critical skills and felt intimidated. They also felt that having their relatively small team try to mentor so many first year students was difficult. The first year students sometimes still did not feel included. Where this strategy fails to be LPP is that the ratio of new recruits to existing expertise is not appropriate for this type of mentorship.

Having new team members work on small design and production projects like a battery cart, wheel dollies and a set-up pad is also done by another team. This team also maintains their old cars instead of scavenging them for parts, which allows new team members to repair the old cars. Since the

problems that occur with old cars are similar to problems with new cars, this could be LPP. This team's integration rate is below 5%. Again, the ratio of existing team members to new recruits appears to be too low for LPP to succeed.

Another team has a more structured process. New recruits apply to be team members and are assigned a mentor. Unlike the team above, this team only assigns two new recruits to a single mentor, which would make LPP possible. New recruits are supposed to initially shadow team members to identify subsystems where they might want to work. Shadowing is not LPP because it lacks participation. However, shadowing does allow new recruits to learn the culture of the team. Where this team failed in LPP is that in the previous year new recruits did not see the car. For the year of the interview they will have required driving days, but whether the new recruits are peripherally participating or not is unclear. If the new recruits are fixing the car on driving days, it could be LPP. If the new recruits are shadowing team members, it is not LPP. Homophily can also reach into integration, especially when long term retention is considered. ECT can take over multiple facets of student life. As an example, two teams had many active team members living together near campus, rather like a social fraternity. These teams share one or more rental house(s) with second or third year members invited to move in once seniors graduate and move out. The interviewer asked how the team members thought a young woman would feel about this team house. They responded that the girls were mostly second year and wouldn't have been asked to share anyway. This team claimed to be interested in recruiting more female students.

Some responsibility for integrating into a team will, by necessity, always be carried by new members. New members have to find when and where team activities occur, come to scheduled events, meet team members, and plan time to accomplish tasks. Our previous work has shown that even when new members do these things, their integration into the team is uncertain [8, 11]. Some teams were very clear that the new members had sole responsibility for finding a way to integrate into the team. The common assumption was that if you were sufficiently interested it was up to you to find a way to get involved. A female team member said: "You have to want it. No one is going to reach out and pull you in. You have to be assertive." This burden is a heavy one to place on students in general, but is especially troublesome for students with marginalized social identities.

TABLE IV. SUMMARY OF RECRUITMENT AND INTEGRATION STRATEGIES BY TEAMS WITH SELF-REPORTED DEMOGRAPHIC DATA. #MEM STANDS FOR THE NUMBER OF MEMBERS. %F STANDS FOR THE PERCENT OF THE TEAM THAT WERE FEMALE. %URER IS THE PERCENT OF TEAM MEMBERS FROM UNDERREPRESENTED RACIAL/ETHNIC GROUPS.

	# Mem	% F	% URER	Recruitment		Integration	
				Direct	Indirect	Current	New
Competition Required Gender Diversity	17	29	0	1	2	0	0
	4	20	0	2	0	0	0
	10	20	0	1	1	0	0
	5	20	0	0	1	0	1
	6	17	0	1	0	0	0
	16	6	0	2	2	0	1
	4	0	0	0	1	1	0
Competition Had No Diversity Requirements	60-70	15	15	2	0	3	0
	25	16	8	1	2	0	1
	36	14	2	1	2	0	0
	40	13	0	1	0	0	0
	40	13	0	2	0	1	1
	35-40	11	3	1	1	0	1
	60	7	5	0	1	0	0
	30-35	6	3	2	1	0	1
	50	6	0	1	0	1	0
	42	2	2	0	1	0	1
	30-35	0	3	1	1	0	1
	20	0	0	3	1	1	1
	12	0	0	1	1	0	1

C. Recruitment, Integration and Diversity

Table IV shows the relationship between the demographics the teams reported and the team's use of identified recruitment and integration strategy categories. The table is separated into two areas (top and bottom) one for each of the competitions where participants were interviewed. The competition on the top has gender-based diversity requirements for team participation. The competition on the bottom has no diversity requirements for team participation. There are some small inconsistencies in the data (such as the impossible report of being 20% females on a four member team). We consider these small inconsistencies to be of no consequence. We have not included data on the diversity of home institution because this data could be used to verify the identity of individual teams that participated in our research, especially those that are large. Although we cannot report the data to preserve anonymity, the field researchers noted the visible presence (or absence) of women and URM to corroborate the reports.

We used institutional demographics to guide sampling methodology and have compared those data to the demographics reported by the participants for the teams. We are confident in our stand that the teams are less diverse than the institutions that host them [24].

As bleak as the data in Table IV seems to be at first glance, the situation is even more distressing upon deeper examination of the interview data. A number of the people of color and women on the teams are in non-engineering roles. Teams with a higher proportion of students who are female or from an underrepresented race/ethnicity recruit many of these team members from business schools to develop the business or financial reports or presentations. While having members of underrepresented groups participate on the team in any role does provide ECT members with an opportunity to gain experience working with people from diverse backgrounds, it can also reinforce stereotypes of who can and cannot be an engineer.

The teams from the competition with gender-based diversity requirements are, unsurprisingly, more diverse in gender than the competition without this requirement. The

competition rules (not cited to conceal the identity of the teams) require participation of females, although this is clearly not being achieved by all teams since one team has no female participants. The rules of this competition allow teams to borrow female participants from other teams during the competition, a practice that the research teams believes objectifies women.

A discouraging pattern seen in Table IV is that the competition with gender-based diversity requirements had no members of underrepresented minorities on any teams that were interviewed. As the main research questions addressed by the overall research project included participation of members of URM on ECT, the interviewers made every effort possible to interview teams with visible diversity. In other words, we intentionally oversampled women and racial/ethnic minorities to the degree this was possible. Requiring diversity in one dimension (such as gender) does not necessarily promote the inclusion of members of other underrepresented groups.

An examination of the teams in the competition without gender-related diversity requirements clearly shows the degree of isolation of females and URM on these teams. Most of the teams reported having only one or two women, the exception being an unusually large team that had around ten women. Only one team reported having more than three members of underrepresented racial/ethnic groups, even given the relatively large teams typical of these competitions. It should be remembered that while the URM categorization is often used in analyses of diversity, that label does not necessarily mean either a homogeneous or supportive social identity group.

D. Conclusions and Future Work

When this research was designed, it was our expectation that we would see that more diverse teams use a broader range of recruitment and integration strategies than less diverse teams. The data do not show this pattern, perhaps because none of these teams is particularly diverse. In addition, no team mentioned any strategy that was designed specifically to recruit or integrate members of any underrepresented group other than the one team that uses a woman to recruit other women. While this is disappointing, it should not be surprising. Struggles with diversity in STEM employment are well established in the U.S. [25]. These teams are, first and foremost, trying to win a competition. They are inexperienced in many dimensions. They are working on a complex task: building an engineering artifact that few of them have ever done before. They may have to manage personalities, competition rules and requirements, fund raising, budgets, scope creep, schedules, ordering parts, engineering design and deadlines, all while being engineering students. While those of us who value diversity recognize that a more diverse team is likely to be a more successful, the team members may not yet have this perspective. In fact, team members may not gain this perspective during their college education in engineering since an understanding of (or even exposure to) diversity

issues in U.S culture are not necessarily required in engineering disciplines [26].

This research has shown that while ECT recruiting strategies are not designed to recruit members of underrepresented groups, that integration is a much bigger problem for most teams. Teams are generally recruiting far beyond their ability to integrate new recruits. Teams have many more recruitment strategies than integration strategies. The current strategy that many teams use of casting a broad net in recruitment—especially to first year students—then seeing who is interested enough to continue to stick around is a failure when it comes to team diversity. The rhetoric of interest is particularly troubling because of the link between confidence, interest and retention for URM shown by Seymour and Hewitt [27] and in light of our prior case study work where teams use lack of interest as a scapegoat to cover poor treatment of new female team members [8].

Our work provides a pathway forward for integration strategies using legitimate peripheral participation. Rather than having large numbers of freshmen trying and failing to integrate into the team, it may be better to have a more structured application process where critical team needs (including both existing expertise and diversity) are met and a reasonable number of new recruits are strategically mentored for team roles. It is important to remember that structure alone does not make a process equitable. Assets that members of URM may bring to the team, such as community cultural wealth need to be valued [28]. It may be wise to consider best practices such as removing names from application materials to avoid stereotyping and bias [18]. Again, campus diversity offices and faculty in diversity studies may be able to provide the expertise necessary to make the process more just. ECT should not be permitted to turn institutional teams into a single race brotherhood or social fraternity. This recommendation echoes recommendations made for the need for strategic planning and intentional implementation to increase the success of diverse teams in the business context [12].

More research and data are needed to study the impact of recruitment and integration strategies on diversity of ECT teams. A fundamental shortcoming of this research methodology is that we talked to people who were successfully recruited and integrated into the team about their experiences. It is virtually certain that these experiences are different than those of the people who were not recruited and integrated, as prior case study research has shown [8, 11]. We used the case study methodology because the number of students who self-identified as being recruited but not integrated into the teams was extremely small, even after extensive research participant recruitment efforts. Just as students who had left engineering were reluctant to talk about their experiences [29], we found that students who have left ECT were not necessarily willing to talk with us. Longitudinal qualitative research, especially ethnography where a researcher is embedded with team(s) while recruitment and integration are occurring would allow

for a more complete analysis of how diverse students are recruited but fail to be integrated into competition teams.

V. ACKNOWLEDGEMENT

The authors gratefully acknowledge the funding that makes this work possible from the National Science Foundation's Directorate of Undergraduate Education's STEM Talent Expansion Program Grant No. DUE-1068453. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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