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WIP: Program Leaders' Perceptions of Recruitment Strategies for Engineering Bridge and Success Programs

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Abstract

Evidence demonstrates that **B**accalaureate **E**ngineering **S**uccess and **T**ransition (BEST) Programs support the transition, success, and retention of engineering students at 4-year institutions in the U.S. Program leaders encounter difficulties in recruiting students from all backgrounds into those programs, yet there is little literature focusing on program recruiting practices. To understand effective strategies for those programs to recruit students from a wide range of backgrounds, we employed an explanatory sequential mixed-method study using surveys and interviews based on the Diffusion of Innovations (DOI) framework. This work-in-progress (WIP) paper reports preliminary results on the recruitment practices, effectiveness, and barriers from program leaders' perspectives. The survey showed the highest-rated effective change agents are program teams, students, parents/family, faculty/instructors/mentors, and inclusive offices/initiatives, while the highest-rated effective communication channels are campus tours/visits, websites, emails, and mail/flyers. However, not all of them were the top frequently used recruitment strategies by those programs, probably due to the reported barriers such as lack of funding, time, and resources. The survey results align with interview results that suggested relationship recruiting as the most effective recruitment strategy.

1. Introduction

Baccalaureate **E**ngineering **S**uccess and **T**ransition (BEST) Programs refers to engineering intervention programs such as summer bridge, math bootcamp, and engineering scholars programs at universities in the United States that support students' college transition and retention in engineering [1-3]. BEST programs struggle to recruit sufficient underserved student [4-6] while state's new legislation and federal administration priority changes in recent years will make it even more challenging to recruit these students [7]. There are several studies of the importance of financial support, personalization, and targeted marketing for recruitment [4, 8, 9]. However, there are few if any studies on information diffusion strategies such as communication channels and change agents to recruit prospective students to BEST programs [10-12].

This study explores how BEST program leaders recruit prospective students to their program. Research questions include: (1) through what communication channels and change agents does the program leader distribute information about their BEST program to prospective students? (2) how effective are those channels and agents in recruiting underserved students? (3) How are the effective communication channels and change agents related to relationship-based recruitment?

2. Theoretical framework

This study is based on the Diffusion of Innovations (DOI) theory [13], a well-known theory that has been used to study the adoption of engineering education innovations, educational technologies, and public health interventions [14-16]. The theory proposes four main elements (the innovation, communication channels, time, and a social system) for innovation diffusion and five stages of the innovation-decision process: knowledge (awareness), persuasion, decision,

implementation, and confirmation. Variables influencing the adoption rate include perceived attributes of innovation, type of innovation-decision, communication channels, nature of the social system, and extent of change agents' promotion efforts. BEST programs are new to many prospective underserved students and thus can be considered innovative for them to adopt (enrolling in the programs).

Different communication channels exhibit different effectiveness at each innovation-decision stage [13], therefore, different strategies are needed to encourage adoption at each stage [11, 12, 14]. Cosmopolite (external to the individual's social system) and mass media channels are important for awareness while localite (local to the individual) and interpersonal channels are important for persuasion. Change agents with higher similarity (homophily) and trustworthy to the targeting populations and opinion leaders are important in persuasion [13]. Therefore, it is critical to use multiple communication channels and change agents, partner with people holding an existing relationship with underserved students, and implement mass and interpersonal communications for both awareness and persuasion during recruitment.

3. Methods

This study is part of a larger project that uses an explanatory sequential mixed-method design, including a 10-minute survey and an optional 45-minute follow-up semi-structured interview with BEST program leaders. Detailed in previous papers [10, 11], the survey instrument and interview protocols were adopted, piloted, and reviewed by subject-matter experts (SMEs), and approved by the Institutional Review Board (IRB). The survey included six Likert-scale, two multiple-choice, and five open-ended items, regarding basic information, current recruitment practices, effectiveness and barriers in recruiting underserved students, and student decision-making factors. Using the purposeful snowball sampling method, we distributed the survey to over a hundred BEST program leaders at the U.S. universities via email invitations, professional organizations' announcements, and survey recipients' referral [10]. Interviews were conducted over Zoom. We de-identified all data before analysis and conducted descriptive statistics analysis using SPSS and Excel for survey data and thematic analysis using NVivo 15 for interview data. The Likert-scale data were described by descriptive statistics and frequency distribution to visualize the dispersion and distribution of responses. They were analyzed along with other qualitative data to provide more complete answers to the research questions. Considering the sample size and the nature of our research questions, we used descriptive statistics, which offer a more transparent and methodologically appropriate representation of participant priorities. This method also provides a clear, intuitive metric for evaluating recruitment strategies, ensuring our findings remain accessible and meaningful to a broad audience of practitioners.

We obtained 31 valid survey responses during an era when many BEST programs changed or ceased existence due to the states' legislation and executive orders in the U.S. Most responses are from public research Predominantly White Institutions (PWI), but also include one Historically Black College and University, three Hispanic-Serving Institutions, three Asian American and Native American Pacific Islander Institutions, three private institutions (one exclusively for students who learn differently and one Catholic), two primarily undergraduate institutions, and three Master's institutions. Some responses did not provide institution and program information. Some responses chose "not in use", "not applicable', or "I do not know"

for certain Likert-scale items, which were treated as missing data in the descriptive statistics calculation. Eight of the thirty-one survey participants completed interviews. This paper mainly reports the survey results with some interview findings for context.

4. Results and Discussions

4.1 Recruitment practice implementation and effectiveness

This study investigated communication channels and change agents, two important variables influencing the adoption rate in the DOI theory. Figure 1, Figure 2, and Table 1 used stacked bar chart and the descriptive statistics to illustrate the distribution of BEST program leaders' responses regarding their Likert-scale rating of the usage and perceived effectiveness of different communication channels for recruitment. The three highest-rated communication channels in use were emails, websites, and campus tours/visits (Table 1). Emails and websites are mass media channels efficient in enhancing awareness while campus tours/visits are interpersonal channels more important in persuasion, according to DOI theory [13]. The effectiveness rating confirms the theory in that the campus tours/visits were rated highest in the effectiveness of communication channels, followed by websites and emails. Mail/flyer is the fourth highest-rated communication channel both regarding the usage and effectiveness. It brings awareness to parents or family, known influencers in students' social networks regarding decision making [6]. It is interesting to note that the highest-rated communication channel regarding usage (email) was not the highest-rated one in effectiveness (campus tours/visits) although it was rated as the third highest effective channel, showing relatively good alignment of communication channels' rated implementation and effectiveness. Another thing to note is that some localite and interpersonal channels important for persuasion such as visiting high schools and phone calls were among the lowest-rated communication channels in use, a possible reason for BEST programs' difficulties in recruiting underserved students.

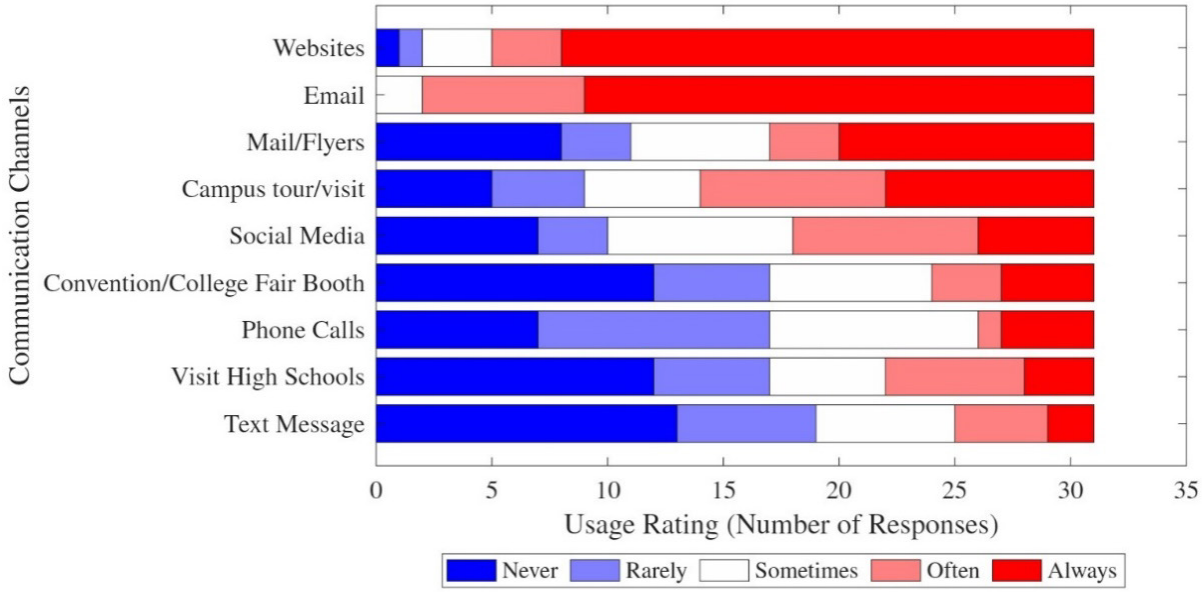

Figure 1. Survey responses on communication channels: their usage of recruiting all students

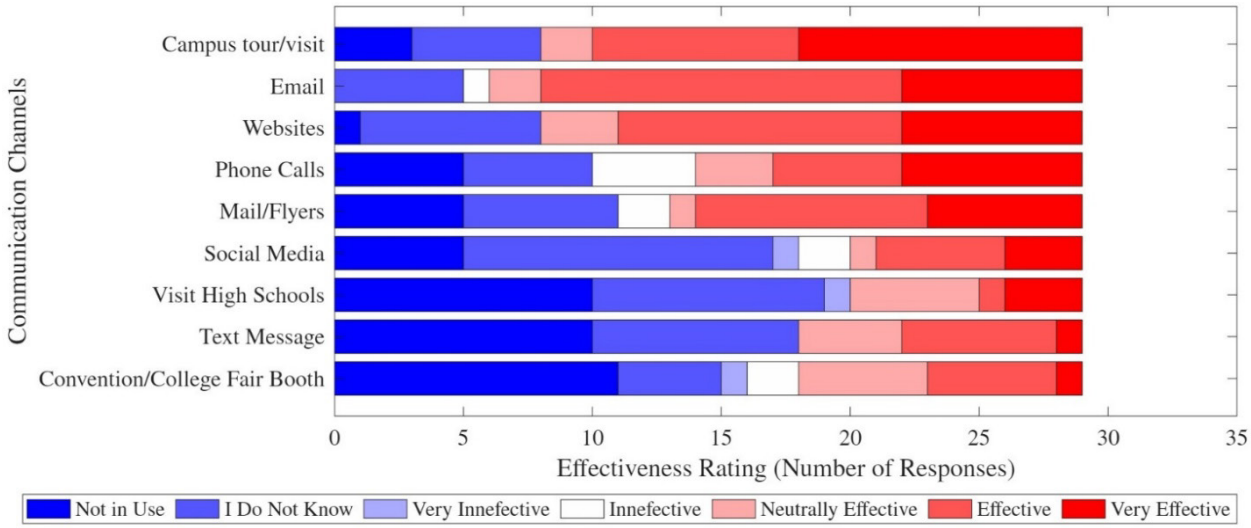

Figure 2. Survey responses on communication channels: their perceived effectiveness in recruiting underserved students

Table 1. Descriptive statistics of the survey questions Q3 (Rate how frequently the following communication tools were used to recruit all prospective students for your program) and Q6 (Rate the effectiveness of using those communication tools to recruit underserved students)

	Usage				Effectiveness			
	N		Mean	Std. Deviation	*N*		Mean	Std. Deviation
	Valid	Missing			Valid	Missing *		
Mail/flyers	31	0	3.19	1.642	18	13	4.06	0.938
Texting	31	0	2.23	1.309	11	20	3.73	0.647
Emails	31	0	4.65	0.608	24	7	4.13	0.741
Phone calls	31	0	2.52	1.262	19	12	3.79	1.182
Websites	31	0	4.48	1.029	21	10	4.19	0.680
Campus tours/visits (bringing students to your institution)	31	0	3.39	1.453	21	10	4.43	0.676
Booths at regional/national conventions, college fairs	31	0	2.42	1.432	14	17	3.21	1.051
Visit high schools (via STEM programs, career events/programs, booths, etc.)	31	0	2.45	1.434	10	21	3.50	1.269
Social media (Facebook, Instagram, Twitter, etc.)	31	0	3.03	1.402	12	19	3.58	1.311

* Missing here includes 6= Not in Use, 7= I do not Know, and truly missing data; excluded from the descriptive statistics calculation.
Usage frequency to recruit all students: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always; Effectiveness to recruit underserved students: 1= Very Ineffective, 2= Ineffective, 3= Neither Ineffective or Effective, 4= Effective, 5= Very Effective, 6= Not in Use, 7= I do not Know.

The five highest-rated implemented change agents were BEST program team, students, faculty/instructors/mentors, students, college admission advisors, and inclusive offices/initiatives while the five highest-rated effective agents were BEST program team, students, parents/family, faculty/instructors/mentors, and inclusive offices/initiatives (Figure 3, Figure 4, and Table 2).

Leaders' open comments further highlighted students' involvement and effectiveness as recruiters. The lowest-rated change agents in use were influential figures in faith-based organizations and social media influencers, with most responders not rating their effectiveness as they were not used. There was misalignment between rated change agents' usage and effectiveness. Parents/family was rated high in effectiveness, but not among the top five highest-rated usage; college admission advisors, rated high in usage, were not among the top five highest-rated effective agents. Together with the lower reported usage of other external partners (high schools, communities, faith-based organizations, and social media influencers), BEST programs tended to use internal partners for recruitment because they were easy to collaborate within the institution considering programs' resource limitations. But they are heterophily (outsiders) to prospective underserved students and less influential in their social networks, thus less likely to persuade adoptions of BEST programs according to DOI theory [13]. Although some external partners were rated lower on usage and effectiveness, interviews later illustrated that program leaders wished to use them if resources permitted, indicating their low rating may be partially due to funding/time constraints. Lacking use of homophily change agents and opinion leaders were possible reasons for BEST programs' recruitment difficulties. Students are both within the institution and homophily to prospective students, making them a unique effective and easily accessible change agent that should be emphasized. Additionally, increasing awareness of BEST programs among opinion leaders and change agents homophily to underserved students like parents/family, high schools, and communities may help recruitment.

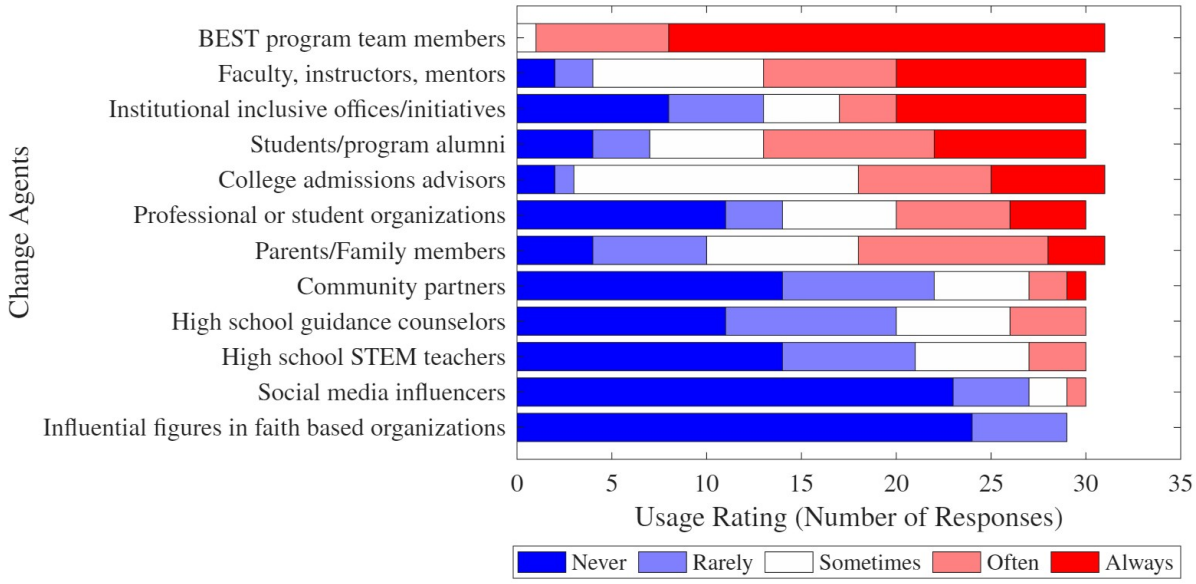

Figure 3. Survey responses on change agents: their usage to recruit all students

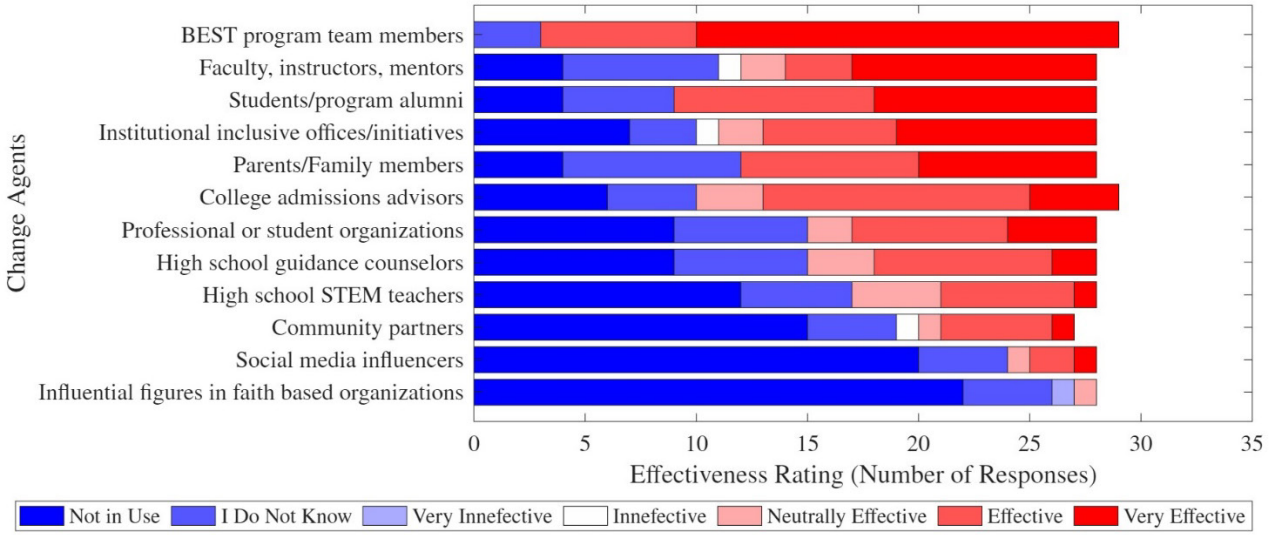

Figure 4. Survey responses on change agents: their perceived effectiveness in recruiting underserved students

Table 2. Descriptive statistics of the survey questions Q4 (Rate how frequently the following people were involved in recruiting all prospective students for your program) and Q7 (Rate the effectiveness of involving those people to recruit underserved students)

	Usage				Effectiveness			
	N		Mean	Std. Deviation	*N*		Mean	Std. Deviation
	Valid	Missing*			Valid	Missing*		
BEST program team	31	0	4.71	0.529	26	5	4.73	0.452
College admissions advisors	31	0	3.45	1.060	19	12	4.05	0.621
Institutional inclusive offices or initiatives	30	1	3.07	1.660	18	13	4.28	0.895
High school guidance counselors	30	1	2.10	1.062	13	18	3.92	0.641
High school STEM teachers	30	1	1.93	1.048	11	20	3.73	0.647
Community partners	30	1	1.93	1.112	8	23	3.75	0.886
Professional or student organizations	30	1	2.63	1.497	13	18	4.15	0.689
Students or program alumni	30	1	3.47	1.358	19	12	4.53	0.513
Influential figures in faith-based organizations	29	2	1.17	0.384	2	29	2.00	1.414
Social media influencers	30	1	1.37	0.765	4	27	4.00	0.816
Faculty, instructors, mentors	30	1	3.70	1.208	17	14	4.41	0.939
Parents or other family members	31	0	3.06	1.209	16	15	4.50	0.516

* Missing here includes 6= Not in Use, 7= I do not Know and truly missing data; excluded from the descriptive statistics calculation.
Usage frequency to recruit all students: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always;
Effectiveness to recruit underserved students: 1= Very Ineffective, 2= Ineffective, 3= Neither Ineffective or Effective, 4= Effective, 5= Very Effective, 6= Not in Use, 7= I do not Know.

For the effectiveness ratings, a noticeable number of participants chose “I do not Know”,

confirming the need to help program leaders to understand the effectiveness of different communication channels and change agents, probably because many BEST program leaders are from STEM backgrounds and are therefore less familiar with communication studies. Additionally, more participants chose "Not in Use" regarding change agents than regarding communication channels, particularly about change agents external to the institutions, such as social media influencer, influential figures in faith-based organizations, community partners, and high school teachers/counselors, showing the need to help program leaders to understand the benefits of the usage of external change agents.

4.2 Relationship recruiting

One interviewee pointed out the importance of relationship recruiting: "*stay connected to the people that have the relationship to the students that we're aiming for*". This aligns with the DOI theory [13]. Relationship recruiting was identified as an effective recruitment strategy based on interview results reported in another manuscript currently under review. People with a relationship to the prospective underserved students are effective change agents to persuade them to join the program. Additionally, interpersonal communications tend to help build relationships and trust, which is confirmed by interview results.

Relationship recruiting also aligns with the survey results, explaining why some communication channels and change agents are effective. For example, among the five highest-rated effective change agents from the survey, students, parents/family, faculty/instructors/mentors, and inclusive offices/initiatives, are all people and organizations with existing relationships to the underserved students. Although the BEST program teams may not have existing relationships with the prospective underserved students, they usually actively attempt to establish trustworthy relationships with them during the recruitment process. Among the five highest-rated effective communication channels from the survey, campus tours/visits and phone calls involve interpersonal communications, which are more effective for persuasion and relationship building, while the mail/flyers diffuse information to the parents or family members of prospective students who hold a strong existing relationship with them.

4.3 Recruitment barriers

Only 2 out of 31 responses did not report barriers out of their control to identifying and communicating with prospective underserved students about their programs in the survey and most of the responses reported multiple barriers. The top barriers were lacking time (19), resources (14), and funding (13) that may be interrelated and relevant to institutional support, followed by lack of knowledge on best recruitment practices (8). Nine reported "other" barriers that include gatekeeping, being understaffed, low institutional support, low engagement or awareness, and misperception. All barriers can be grouped into two categories: external constraints (e.g., institutional support, resources, partnership) and internalized recruitment practice resulting in difficulties in converting prospective students to enrolled students.

External constraints were the major barriers. Different communication channels and change agents have strengths at different decision stages according to DOI theory [13]. Besides what and through whom to recruit, when and how recruiting occurs is also important. Therefore, effective

recruitment strategies should combine various communication channels and change agents targeting different decision stages with dedicated promotion efforts, which need institutional support in terms of time, funding, personnel, resources, and partnership. Lack of support hinders implementing adequate strategies and indicates lacking a social system supporting program leaders in recruiting underserved students. One open-ended comment showed concern about the state's Diversity, Equity, and Inclusion (DEI) ban. Since the survey was designed in 2023 when some states had already started banning DEI initiatives, DEI-restrictive legislation was not probed in the survey to protect leaders, but some interview responses collected in early 2025 showed increasing concerns about DEI restrictions. Many state and federally funded BEST programs, including this research project, were terminated due to the state legislations and/or administration priority changes. This DEI-restriction barrier is related to the "social system" element in the DOI theory, which will pose new challenges to recruitment.

Internalized recruitment practice difficulties, related to leaders' recruitment knowledge and students' engagement, awareness, and perception, cannot be ignored. But they can be addressed by employing DOI-guided recruitment strategies. For example, some prospective students treat emails/texting as spam or perceive joining the program as unnecessary. This is probably because the message is not from a source considered trustworthy within their network. However, the same message delivered by a source holding an influential relationship with them is more likely to persuade them. Both Likert-scale and open-ended survey data as well as interview data showed students were effective recruiters, including those from student organizations with missions to broaden participation in engineering, because students/alumni related to underserved students are trustworthy and therefore influential to them. Additionally, partnerships with opinion leaders in their community should be explored.

5. Conclusions

As a part of a larger study, these survey results illustrated structural barriers and internalized difficulties in recruiting underserved students to BEST programs. This study also illustrated the importance of diversifying communication channels and employing change agents local and homophily to prospective students' social networks. Interpersonal communication and students are important and effective in recruitment, particularly at the persuasion stage of decision-marking. Many BEST programs struggle to recruit diverse students. Due to the resource allocation and other restrictions, their challenges are unique compared to university recruitment, where enrollment also decreased post-COVID. This study addresses this issue and fills the knowledge gap on identifying best information diffusion practices in underserved student recruitment, which are related to relationship recruiting.

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