A Statewide Effort to Diversify the Undergraduate Engineering Student Population

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Abstract:

Undergraduate engineering education is being transformed at every level of curricular, co-curricular, and extra-curricular experiences which requires an institutional shift in examining and redefining what it means to provide students with equitable access for student admission, and engagement, and success, in student admissions and graduation. Research shows that putting too much weight on high stakes standardized tests is resulting in a misrepresentation of actual student potential for academic success and may disadvantage students from historically underrepresented groups. This is especially true with undergraduate engineering programs where a minimum standardized test score is frequently required for admission. This dynamic is relevant in Nebraska where the demographics of the high school graduates, and in particular the growth of the Hispanic/Latino/a population, is changing quickly. In response to this, the University of Nebraska–Lincoln College of Engineering (UNL-COE) admits students who would not ordinarily be admitted under the college’s current guidelines, particularly with respect to minimum ACT score and enacting wraparound state of the art Engineering Support Service (ESS) to provide comprehensive institutional support to alternately admitted students. Students admitted using this alternative screening will receive targeted programs focused on engagement, training, and enrichment activities designed to increase their success.

This paper will report baseline data related to state demographics, diversity profile of the UNL-COE undergraduate student population, strategies being deployed to broaden admission considerations, student support systems, and student success. Mixed methods social science research and evaluation will contribute to knowledge on student perceptions and realization of academic and professional support in engineering and will enhance understanding of alternate academic pathways to success for alternately admitted engineering students.

Background and Significance

Undergraduate engineering education is in the process of a radical transformation; many programs have begun to restructure pedagogical practice and prioritize a broad range of essential socioemotional “soft skills” to both better prepare engineers to be leaders in the public sphere and in daily practice, and to recruit and retain a more diverse pool of talent to inspire innovation [1]–[7]. There are still many barriers to pursuing an undergraduate degree in engineering, particularly for historically underrepresented groups including rural youth, girls, persons of color, low-income populations, and English Language Learners [8]–[12]. Currently, women comprise approximately 19% of engineers, with disparities varying across different engineering programs [13]. At the University of Nebraska – Lincoln, for example, women are not fully represented in any program, but there are more women in Civil and Mechanical Engineering compared to Electrical and Computer Engineering. Despite the fact that women make up 57% of college attendees and generally have comparable test scores and greater GPA’s compared to men [14], [15], they are still less likely to apply for and enroll in Engineering Colleges [16], [17]. Students of color, particularly African Americans, Latino(a)s, and Native Americans, only make up a very small proportion of engineering majors, with little improvement in the last 10 years [18]. In addition to racial/ethnic
minority groups historically underrepresented in STEM more broadly, students who are from rural areas, who are the first generation to attend college, who are not able bodied, and those who lack financial resources are often not adequately prepared in their K-12 education, and often do not meet the minimum standardized test scores to be admitted into engineering programs, particularly at land grant universities. Many engineering colleges are creating institutional resources to support student success and to reduce the historical barriers to entering and completing an engineering undergraduate degree for students from diverse backgrounds [19]. A major focus of new pedagogical practice and student success initiatives are aimed at providing an array of student resources to facilitate success through enhancing social support, augmenting engineering identity, provide service learning opportunities, and academic support [3], [20], [21]. Of course, these students must first be admitted and there are significant barriers to many students who do not have strong math and science preparation or standardized test scores required for admission to most engineering colleges.

As the only engineering college in Nebraska, the University of Nebraska – Lincoln College of Engineering (UNL COE) administrators are reassessing admissions criteria to deemphasize standardized tests and to take a more holistic view of a student academic experiences. Research shows that putting too much weight on high stakes standardized tests results in a misrepresentation of actual student potential for academic success. Students, particularly students of color and girls, are often negatively impacted by stereotype threat which lowers scores and therefore do not accurately reflect student ability [22]–[26]. Students who are first and second-generation immigrants or refugees may not speak English as their first language and so they are doubly disadvantaged when it comes to standardized test scores.

It is important to recognize that the mission of the UNL COE is to:

- deliver relevant and challenging educational programs to attract an outstanding diverse student body
- prepare graduates for rewarding careers in their chosen professions and encourage graduates to extend their level of knowledge through lifelong learning
- conduct leading edge research advances engineering science and stimulate the intellectual development and creativity of both students and faculty,
- extend exemplary engineering service and transfer knowledge that contributes to the well-being and betterment of society.

In order to broaden participation in engineering, UNL COE will broaden the admission review process to deemphasize student test scores and to include a wider array of academic and social indicators in order to admit engineering majors from a broader spectrum of backgrounds and skillsets.

Broader admission review processes will likely identify additional students from underrepresented groups who have great potential to be successful in engineering degree programs, but who may have been excluded during admission due to lower standardized scores. We anticipate that this will result in recruiting a more diverse array of students who might not have previously considered or felt they could succeed in undergraduate engineering programs. Once admitted, we also intend to assess factors that lead to retention and attrition for these groups, particularly related to their uptake of student success initiatives [27]–[29]. At UNL COE there are many initiatives aimed at augmenting engineering education to include not just technical skills, but also leadership, intercultural appreciation, teamwork, self-management, service & civic responsibility, and understanding of engineering ethics [30]–[33].

Our interdisciplinary team includes a variety of engineering disciplines, student services staff to implement direct support efforts, and a social science researcher who is expert in broadening participation research and evaluation. Further, our team is likely to be successful due to having broad institutional support at the college level. This effort has strong potential to be successful and lead ultimately to a more diverse college across multiple engineering programs.
Changing Demographics

While the graduating high school senior class in Nebraska is growing, most of this growth is in the population of those identifying as Hispanic (corresponding to 60% of the growth), Asian American (10%), or African American (9%). Changes in the high school graduating class demographics have not translated to increased diversity of the entering freshmen class in the UNL COE. Instead, 40% of the growth of the COE first-year class over the same time was from the Asian American population. As UNL COE aims to broaden participation, efforts will aim to better align our incoming student demographics with those of the state’s high school seniors. The data shown in Table 1 details the changing demographics occurring in the state.

Current Admission Process

The University of Nebraska-Lincoln College of Engineering is co-located on two campuses in the state of Nebraska – the University of Nebraska-Lincoln and the University of Nebraska Omaha. Both campuses manage separate admissions processes and have different administrative structures in place regarding admitting engineering students. While each university has their own standards for university admission, the College of Engineering has an additional admission requirement as it relates to high school courses taken and test scores that are recognized by both universities. These are consistent across the college. It is unknown how long the current college admission requirements for the college have been in place.

The current UNL COE admission requirements include high school credit for the following (one unit is equal to one high school year):

- Four units of mathematics: two units of algebra, one unit of geometry, one unit of precalculus and trigonometry.
- Four units of English.
- Three units of natural science that must include one unit of physics and one unit of chemistry (chemistry requirement waived for students in construction management).
- Two units of a single foreign language.
- Three units of social studies.

A total of 16 units is required for admission. Applicants having an ACT composite score of 28 or greater (or equivalent SAT score) will be admitted to the college even if they lack credits in trigonometry, chemistry, or physics.

In addition to the course requirements, the college also requires minimum test scores for applicants to be considered for admission. To receive assured admission, an applicant must have a minimum ACT score of 24 (or equivalent SAT score) and no course deficiencies as listed above. Applicants who lack one or both of these requirements may be admitted based on test scores, high school rank and credits, or may be admitted to an exploratory program in Lincoln or Omaha if it is deemed they are not admissible to the college.

Below, Table 2 describes the practices of how the college has traditionally interpreted (and continues to interpret) the college admission policy as it relates to which applicants to further review. In the college review process, per the policy and in addition to the test score, the admission representative from the college considers high school class rank and courses taken to determine whether the applicant is admissible to the college. Applicants who score below a 21 composite ACT are not given that same opportunity as those with higher test scores, and the college does not review or see these applicants since they are automatically filtered to the university exploratory programs.
### Table 1. Demographic Changes in Nebraska 12th Grade Students and UNL COE FTF Students

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
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<tbody>
<tr>
<td><strong>Nebraska 12th Grade Students by Gender</strong></td>
<td></td>
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</tr>
<tr>
<td>2013-14</td>
<td>48.4% (12230)</td>
<td>51.6% (13028)</td>
<td>100% (25258)</td>
</tr>
<tr>
<td>2017-18</td>
<td>47.9% (12785)</td>
<td>52.1% (13904)</td>
<td>100% (26689)</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
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<tbody>
<tr>
<td><em><em>College of Engineering FTF Students</em> by Gender</em>*</td>
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<tr>
<td>2013-14</td>
<td>16.1% (97)</td>
<td>83.9% (507)</td>
<td>100% (604)</td>
</tr>
<tr>
<td>2017-18</td>
<td>15.5% (96)</td>
<td>84.5% (524)</td>
<td>100% (620)</td>
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<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>American Indian</th>
<th>Asian</th>
<th>Hispanic</th>
<th>Pacific Islander</th>
<th>Two or More Races</th>
<th>White</th>
<th>Total</th>
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<tr>
<td><strong>Nebraska 12th Grade Students by Race/Ethnicity</strong></td>
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<tr>
<td>2013-14</td>
<td>6.5% (1641)</td>
<td>1.1% (272)</td>
<td>2.8% (698)</td>
<td>14.2% (3576)</td>
<td>0.1% (33)</td>
<td>2.8% (716)</td>
<td>72.5% (1832)</td>
<td>100% (2525)</td>
</tr>
<tr>
<td>2017-18</td>
<td>6.7% (1775)</td>
<td>1.3% (353)</td>
<td>3.2% (844)</td>
<td>16.6% (4438)</td>
<td>0.1% (28)</td>
<td>3.0% (811)</td>
<td>69.1% (1844)</td>
<td>100% (2668)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
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</thead>
<tbody>
<tr>
<td><em><em>College of Engineering FTF Students</em> by Race / Ethnicity</em>*</td>
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<td>2013-14</td>
<td>1.7% (10)</td>
<td>0.0% (0)</td>
<td>3.1% (19)</td>
<td>5.0% (30)</td>
<td>0.0% (0)</td>
<td>3.1% (19)</td>
<td>87.1% (526)</td>
<td>100% (604)</td>
</tr>
<tr>
<td>2017-18</td>
<td>1.5% (9)</td>
<td>0.2% (1)</td>
<td>4.0% (25)</td>
<td>5.3% (33)</td>
<td>0.0% (0)</td>
<td>3.7% (23)</td>
<td>85.3% (529)</td>
<td>100% (620)</td>
</tr>
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</table>

Data for Nebraska 12th Grade Enrollment comes from the Nebraska Department of Education (https://www.education.ne.gov/dataservices/data-reports/)
Data for the College of Engineering comes from UNL's Academic Management Information System (AMIS) database
* Data excludes students who identified as Non-Resident Aliens or had an Unknown Race/Ethnicity for better comparison to data from Nebraska high schools

**Proposed Admission Process**

As the current process demonstrates above, the college relies heavily on standardized test scores when making initial admission decisions. While the college’s admission policy for assured admission is clearly stated, the policy for the additional college review of applicants who do not meet assured admission requirements provides minimal detail on which students the college can review for alternate admission, termed “college review.” As shown above, the college has interpreted this policy in only wanting to further review those applicants with a minimum 22 ACT score, automatically denying applicants who score a 21 ACT score or below without regard to their class rank or credits.
Table 2: UNL COE ‘College Review’ Guidelines

<table>
<thead>
<tr>
<th>ACT Composite Score (or SAT equivalent)</th>
<th>High School Course Deficiencies</th>
<th>Admission Decision</th>
</tr>
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<tbody>
<tr>
<td>28 and above</td>
<td>Yes</td>
<td>Assured admission, even if the applicant lacks trigonometry, chemistry, or physics</td>
</tr>
<tr>
<td>24 and above</td>
<td>No</td>
<td>Assured Admission</td>
</tr>
<tr>
<td>24 and above</td>
<td>Yes</td>
<td>College review to accept or deny</td>
</tr>
<tr>
<td>22 – 23</td>
<td>No</td>
<td>College review to accept or deny</td>
</tr>
<tr>
<td>22 – 23</td>
<td>Yes</td>
<td>College review to accept or deny</td>
</tr>
<tr>
<td>21 and below</td>
<td>N/A</td>
<td>Automatically denied from college placed in exploratory programs at the university level.</td>
</tr>
</tbody>
</table>

However, the college policy provides the flexibility to use these additional variables when making admission decisions on those who do not meet assured admission requirements. While the literature seems to point to standardized test scores as being less reliable indicators of success when compared to other high school academic variables, the college has not yet researched the additional variables and indices of K-12 academic performance and how they may predict success in the undergraduate engineering program [34]. The research literature is clear, however, that failure to take a more holistic approach employing and assessing multiple measures of academic performance may result in excluding diverse youth with strong potential to succeed in engineering programs. This is a missed opportunity that has widespread consequences for engineering as a profession, creating artificial barriers to students historically disadvantaged and underrepresented. Not only do we seek to expand access to potential undergraduate engineering majors, but also the college has a comprehensive student services team with a wide array of opportunities and resources to support the success of these students.

An initial cohort review of fall 2018 applicants who applied to the college but were automatically denied because of low standardized test scores demonstrates the need to further research the college’s admission criteria and determine whether other academic variables are stronger predictors of student success than a standardized test score for undergraduate engineers. This review showed that students who were placed in the exploratory program in Lincoln were more likely to enter the College of Engineering by changing their major and demonstrating COE transfer admission criteria if they (1) fulfilled the Physics requirement for first-year admission criteria, (2) had an unweighted high school GPA of 3.4 or higher, or (3) were male. This review indicates that women may need additional support than men if they are not admitted directly to their majors as first-year students. It also indicates that alternate admission criteria has potential to be more successful if it involves high school coursework and high school GPA. In addition, another example in the initial review demonstrates more than 80 students in this cohort placed in the top 25% of their high school class with approximately half of the 80 students identifying as first generation between the Lincoln and Omaha campuses. Should the research demonstrate that other variables are stronger predictors of success than standardized test scores, the college would let the research inform changes to the admission policy and the application of the policy in the college review process. This team intends to continue reviewing these preliminary data over time.

Since 2013, the college has allocated considerable human and operational resources for student success initiatives to assist undergraduate engineers. New initiatives include career advising, pathway programs targeting underrepresented populations in engineering, professional academic advising, and tutoring services for first and second year engineers in the general math, chemistry, and physics sequence.
required in the engineering curriculum. When combined with significant pedagogical changes to the first and second-year seminar courses, the college is poised to provide and respond with necessary interventions to support the persistence of these students.

The time is right for the college to explore whether the college’s admission policies and/or the way they are applied are restricting enrollment, access, and diversification in the college.

**Current College of Engineering Initiatives**

In determining support required to promote positive outcomes for students admitted alternately to UNL COE, a team of staff evaluated which existing initiatives would be important to support any new efforts. The college has a well-established initiative to support the development of non-technical skills that can be utilized strategically to prepare these students professionally and academically. Another initiative the team reviewed was a survey of underrepresented students in the college from 2017, which indicated several factors that may be equally beneficial to students targeted by the proposed admission criteria changes.

ESS currently offers several programs that promote retention, academic success, and skill development of students from a variety of backgrounds and preparation levels: a Multicultural Engineering Program, Women in Engineering Program, and the Engineering Readiness Academy. While the outcomes and structure of these programs would benefit alternately admitted students, the ESS team determined that a separate program specific to this cohort could be more beneficial and easier to research.

**Skill-Building: The Complete Engineer**

At the UNL COE, the Complete Engineer is an initiative that attempts to communicate the necessity of and support the development of non-technical skills in addition to technical skills. At its core, the initiative is a conceptual framework for UNL COE students to understand that their technical expertise must be paired with essential non-technical skills to be successful in their careers and be innovative as they solve the world’s most pressing engineering challenges. By providing opportunities for students to develop and apply their understanding of six competencies identified as core to this initiative, the college intends to graduate professionally prepared and exceptionally competent engineers. The Complete Engineer initiative is a complement to the technical competencies students learn through comprehensive and rigorous engineering curriculum.

The six competencies that make up The Complete Engineer were established following feedback from college partners and employers: intercultural appreciation, leadership, teamwork, self-management, service & civic responsibility, and understanding of engineering ethics. Table 3 provides more details and context for each of the six competencies.

The Complete Engineer is a broad framework rather than a program that students opt to join. It is used to steer the programs and services Engineering Student Services (ESS) provides. This includes advising, academic recovery coaching, and career coaching, core services ESS offers all students. In addition, many events offered for the engineering student population are designed with the six competencies as a guiding framework, or development of one or more of the competencies might be part of the event’s learning outcomes.

Students admitted alternately may especially benefit from connecting to the Complete Engineer. The intentional connection of a cohort of these students to the Complete Engineer through co-curricular programs, like the Complete Engineer Conference hosted each spring, could help these students develop their identities as engineers.
### Table 3. The Complete Engineer Competencies

<table>
<thead>
<tr>
<th>Competency</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Intercultural Appreciation:</strong></td>
<td>Serving society requires in-depth knowledge and appreciation of the various cultures, differences, and experiences that make up our world. Appreciating, understanding, and accepting the collective experiences and differences of the teams we lead and populations we serve will undoubtedly produce better societal solutions to engineering challenges.</td>
</tr>
<tr>
<td><strong>Leadership:</strong></td>
<td>In its simplest form, leadership is about influencing others to create positive change. It is not an overstatement to say that to be an engineer is to lead others to a solution. As such, practicing engineers must lead and lend their expertise in the service of society to those engaged in the solution.</td>
</tr>
<tr>
<td><strong>Teamwork:</strong></td>
<td>It is rare for a practicing engineer to serve without the benefit of a team. The teams will be composed of people from all walks of life and serving many roles. Working and performing on a team is critical to providing solutions that will meet the high standards of engineering service.</td>
</tr>
<tr>
<td><strong>Self-Management:</strong></td>
<td>There is no doubt that the hardest person to manage is yourself. As an engineer, you will be called to manage and lead projects, teams, organization, etc. Therefore, an effective engineer must first learn to lead and manage themselves by reflecting on one’s behavior and experiences, managing one’s time, establishing personal goals, handling stress, etc.</td>
</tr>
<tr>
<td><strong>Service and Civic Responsibility:</strong></td>
<td>Engineering is a service profession. Engineers are charged to use their talents and gifts to solve problems that impact others. The performance and practice of engineering is an act of service.</td>
</tr>
<tr>
<td><strong>Understanding of Engineering Ethics:</strong></td>
<td>Engineers are expected to exhibit the highest standards of honesty and integrity. Engineers are to hold paramount the safety, health, and welfare of the public. Those whom engineers serve deserve nothing less.</td>
</tr>
</tbody>
</table>

As one example, the competencies are also used in the required first-year seminar course, where students create action plans and write goals to develop each skill. The students in this course are asked at the beginning of the semester to reflect on their strengths and areas for development within the competencies, which aligns with an asset-based approach to student development that may particularly improve outcomes for alternately admitted students. The second-year seminar course that students are required to take focuses on career development. The Complete Engineer competencies are presented as highly desirable skills to the engineering industry, and students are coached through continuing to develop these skills and communicating these competencies through resumes, cover letters, interviews, and networking interactions to be outstanding candidates for jobs, internships, co-ops, and graduate or professional school.

The academic advisors and career services team in ESS also use the competencies to help students identify involvement opportunities to help students achieve their goals, such as internships or co-ops, undergraduate research, student organizations, student employment on-campus, courses that address these competencies explicitly, and other opportunities. This again demonstrates an asset-based approach and personalizes support for students.

Students who are alternately admitted will be educated about the Complete Engineer and directly supported in connecting with related opportunities to work toward their academic and career goals while building a strong professional skill set.
Baseline Data: Survey of Underrepresented Students

During spring term 2017, COE held two focus groups focused on understanding the needs of undergraduate women and students of color in the college. A survey was designed using the focus group results as a framework. The primary purpose of understanding the experiences of these groups specifically was to help inform the development of the Multicultural Engineering Program and the Women in Engineering Program, which will be fully established with first-year cohorts in the 2019-2020 academic year. In fall 2016, the College of Engineering undergraduate enrollment was 16.70% female, and 22.86% of undergraduates identified an ethnic origin other than “White, Non-Hispanic.”

Methods

A pilot survey was distributed to all undergraduates in COE in April 2017 to understand the experiences of underrepresented students in the college, specifically by gender and race or ethnicity. The survey responses were collected from 111 students, less than 1% of the College of Engineering’s undergraduate population of 3,560 at the start of that academic year. This is not a representative sample we can learn a lot from those who opted to respond. Although response rate was not representative of the demographics of Nebraska engineering students as a whole, it was a preliminary snapshot of historically underrepresented students as 68.82% women and 43.56% students of color, and indicates these student were more motivated to respond to this pilot survey. We acknowledge that there are still many student experiences not captured in the survey due to the low response rate. Current efforts will focus on obtaining a more representative sample of undergraduates, and obtaining ethnographic qualitative data through interviews to enhance understanding of the life course experience of alternately admitted students who are more likely to belong to historically underrepresented groups. Funding from NSF to broaden participation for individuals who have been historically underrepresent STEM will result in more comprehensive quantitative data representative of Nebraska of COE students more holistically and in the collection and analysis of more in-depth qualitative data collected in 2019-2021.

Pilot data Results

Respondents were asked to address the primary challenges they face to success toward completion of their undergraduate engineering degree. Academics were by far the primary challenge (30.47% overall). However, for students of color, academics were a more pronounced concern (43.90%). Women rated academics a greater concern than all respondents combined as well (41.38%). Sense of belonging was the second challenge overall (16.67%) and was a more prominent challenge for both women (18.97%) and students of color (19.51%). However, women rated discrimination as their second-greatest challenge, with 24.14% indicating they experienced some form of discrimination.

Significantly, an overwhelming 40.63% of all respondents reported some kind of discrimination when asked what challenges they as underrepresented students experience that their peers who do not share their identities do not experience. Isolation was also reported as a challenge these students feel they face that they do not think their peers of non-marginalized identities face. Of students of color, 17.95% reported isolation as well as 12.07% of women respondents. Many underrepresented students in the college also reported feeling that they were subject to higher standards than their majority peers – 9.38% of students of color and 10.34% of women-identified students reported feeling this added pressure.

In addition, respondents were asked to preference resources they wished COE offered. Many felt that the college did not need to provide additional resources overall (16.05%), but academic support was overwhelmingly desired by students of color (42.86%) and women (22.50%). Mentorship was indicated as desired by both populations, with women also identifying wanting meetups or organizations specifically for women students (12.50%) and social support/activities (10.00%). Other interesting
responses to this question include student requests for faculty, staff, and students to receive cultural sensitivity trainings.

The results of this survey, combined with the examination of current programs in COE, led the team of staff to draft a program structure for students who will be alternately admitted.

**Future Steps and Program Development**

Select members of the ESS leadership team determined that the development of a cohort-based program is the most effective way to support students admitted alternately. This program will invest resources in positive academic outcomes and persistence of these students, acknowledging that changing admission criteria alone cannot be responsible for broadening participation. Developing this program will allow ease of direct intervention, as well as support data collection to better understand outcomes for students who participate in a student success program and those who do not participate in a student success program. This program does not yet have a name, but this team aims to choose a name that will be attractive and empowering to prospective students, and hopes to avoid a program name that could indicate deficiency or lack of preparation in any way.

2.5.1 Program Outcomes

ESS seeks to offer this cohesive program and effective services specific to this cohort of alternately admitted students. The outcomes this program aims to achieve for students are as follows:

- **Academic outcomes**
  - Students will meet cumulative GPA requirements for professional admission
  - Students will be Calculus ready by the end of their first year

- **Retention outcomes**
  - Students will persist from semester 1 to semester 2
  - Students will persist from year 1 to year 2

- **High Impact Practice outcome**
  - Students will participate in at least one high impact practice (study abroad, undergraduate research, learning community, student organization, or other)

- **Skill-Based outcomes**
  - Students will be able to identify their strengths and skills
  - Students will demonstrate effective time management

- **Career Development outcome**
  - Students will be able to identify their career goals

- **Sense of Belonging outcomes**
  - Students will report a sense of belonging in higher education
  - Students will report a sense of belonging in the College of Engineering
  - Students will be able to identify their support network in the College of Engineering

**Program Elements**

To achieve the objectives outlined above, the program will be structured for a high level of connection within the cohort and with staff in COE. The hope is that this program will mitigate the problems and barriers identified in the survey of underrepresented students and highly expose students to development initiatives such as the Complete Engineer. The first three terms, through fall of their second year, were deemed especially important for program involvement, since students often find their second year is just as challenging as if not more challenging than their first year.
The program will rely heavily on cohort building so that students see each other as part of their support network in addition to staff, faculty, and programs. This will be achieved primarily through co-enrollment in a course sequence for the students’ first three terms: Freshmen Engineering Seminar (ENGR 10) in fall of their first year; Interpersonal Skills for Engineering Leaders (ENGR 100) in spring of their first year; and Sophomore Engineering Seminar (ENGR 20, focused on career development) in fall of their second year. These sections will be separate by campus, so that the Omaha campus co-enrolls together and the Lincoln campus co-enrolls together, and these sections will be reserved specifically for students in this program. While these students must complete the core requirements of these courses, freshmen and sophomore seminars are typically 7-8 weeks long and meet once per week for 50 minutes each. The sections of these seminars for this program will be extended to a full semester, 16 weeks, and potentially meet for a longer amount of time each week. The goal is that the extended time together will be used for programming to reduce meetings the students need to try to schedule around and will be used to foster community within the cohort.

Students will be supported by tutoring services to complete their math sequence in their first year to be Calculus ready by the end of the first year. The same support will be provided to help students complete the required Physics and Chemistry requirements by major within the duration of the program, and provide additional support to students who have deficiencies from high school in any of these core requirements.

Students in this program should be able to identify their support network within the college. The program will bypass the standard operating process in ESS of assigning an advisor based on last name and major, which often changes with staff vacancies or change of major. Instead, these students will be assigned one single point of contact from point of admission through the duration of the program, their first three semesters in college. This point of contact, a professional staff member in ESS, will provide success coaching to their assigned students. Success coaching meetings will be required twice per semester for all three terms in the program.

Success coaching will focus primarily on academic success strategies and student engagement for high impact practices: time management, identifying strengths, goal-setting, career development, connecting students to resources like tutoring, and identifying student involvement opportunities.

Student Selection

A pilot group of students who applied to COE but were not assured admission to COE originally will be invited to participate in this program. Invitations will be sent to any students who meet the criteria below, and a maximum of 30 students in Lincoln and 30 students in Omaha will be able to accept a spot in this program. The first 30 invitees to accept a spot will be confirmed, and others who are interested after these spots fill will be waitlisted past the enrollment deposit deadline of May 1.

Students will be identified for an invitation based on the preliminary data review outlined in section 2.3 as a pilot group in year 1 of this program. These criteria are:

- Not already accepted to their major in the College of Engineering
  - Lincoln: Students must be classified as Pre-Engineering in Lincoln, technically admitted to the Explore Center as their college at UNL
  - Omaha: Any student in Omaha who applied for the College of Engineering and is either (1) admitted to the Pre-Engineering major (not the major they applied for) in the College of Engineering; or (2) was denied admission to the College of Engineering by the University of Nebraska Omaha admissions office and was not seen in the COE college review process (usually classified as “Undeclared” major with “Academic and Career Development Center” as their college)
- ≥19 Math ACT sub score
• ≥3.4 unweighted high school GPA

Students will receive an email invitation detailing the program benefits and requirements. If they accept the program, students will be fully admitted to their major, rather than Pre-Engineering, and must fulfill all program requirements as detailed in section 2.5.2.

The aim of this program is that students admitted through the proposed new process will persist through graduation and achieve positive academic and professional goals as a result of the additional support they will receive. Students who are not a part of this program and were subject to declined admission will be evaluated as well to determine what other programs attract their participation, what perceptions they hold of the alternate admission program, and how their academic outcomes compare to students in the program. Results of evaluation of first year of this program will be used to make changes for the following years’ cohorts, and continued program evaluation will inform future changes. The college intends to continue and expand any efforts that are found to be valuable for student success and broadening participation for talented prospective students beyond the pilot period.

Future Broadening Participation Social Science Research

UNL COE is actively creating comprehensive programming to support students who are alternately admitted (students who scored below an ACT of 24 to include high school GPA and class rank). The cohort of students will be engaged in student success programs. Their academic and professional performance, attitudes, decision making, and self-efficacy will be monitored through a mixed methods assessment including a follow up quantitative survey and an ethnographic interview. The research questions of the project are as follows:

1. Does participation of alternately admitted students in student success programs increase student persistence in engineering programs from semester 1 to semester 2 and from year 1 to year 2?
2. What aspects of student success programs are valued most highly by alternately admitted students in encouraging their success in Engineering?
3. For alternately admitted students who do not participate in student success programs, what factors discourage their participation and what out-of-college programs do they participate?

Additionally, using institutional demographic data on admissions and retention, we will assess in what was broadening admission criteria recruits from diverse populations using an intersectional approach. Alternately admitted students will be surveyed twice on their use of student success services and the different types of support that contribute to academic success. The research will consist of semi-structured interview protocols at the beginning, the middle, and the end of each semester. In addition to answering key research questions, they will also provide detailed information about student success program utilization and effectiveness.
References


