Supporting informed major selection through curriculum-embedded modules and departmental engagement

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Abstract:

This Complete Evidence-based Practice full paper uses the push–pull model as a lens to examine how curricular and departmental interventions influence students' major decision-making processes within a first-year engineering program. Choosing an engineering major is one of the most important decisions undergraduate students make, as it shapes their academic path, informs potential career directions, and can influence persistence in engineering. However, many first-year students begin college with limited knowledge of the range of engineering disciplines, misconceptions about what different majors involve, or uncertainty about how their interests and strengths align with potential career paths. This study explores how structured learning activities and cross-departmental engagement can support students in making more informed decisions about their engineering majors.

To evaluate the impact of these interventions, this study employed a quantitative approach with pre- and post-surveys administered throughout the semester. The surveys captured changes in students' awareness of engineering disciplines, confidence in their major choice, and perceptions of the factors influencing their decisions. Within the push–pull framework, push factors refer to influences that encourage students to seek additional information or reconsider their options, while pull factors represent elements that attract students toward a particular discipline or strengthen their confidence in a chosen major. Two complementary interventions were implemented to support this process. First, curriculum-embedded modules required students, individually and in teams, to investigate a specific engineering discipline, examine its curriculum and career pathways, and share their findings with peers. Second, cross-departmental workshop panels brought together faculty, advisors, alumni, and industry professionals who discussed disciplinary practices, required skills, and career opportunities, followed by open question-and-answer discussions with students.

Preliminary findings suggest that integrating these activities into the first-year engineering experience improves students' understanding of available majors, increases confidence in their major selection, and helps students better connect their interests and self-perceptions with potential disciplines. These results suggest that combining curriculum-based exploration with opportunities for direct interaction with faculty and professionals can help students make more informed and intentional decisions about their engineering majors, offering practical guidance for institutions seeking to strengthen student persistence and satisfaction in engineering programs.

Keywords: Engineering Major Selection; First-Year Engineering Education; Push–Pull Model; Curriculum-Embedded Intervention; Departmental Engagement

Supporting Informed Major Selection Through Curriculum-Embedded Modules and Departmental Engagement

1. Introduction

This full paper uses a push–pull perspective to distinguish between the forces students bring with them and those introduced by our program. This conceptual distinction allows us to evaluate how the intervention shapes students' emerging disciplinary interests and ultimately contributes to major selection. First-year introductory engineering courses or programs have a pivotal opportunity to support and maximize the probability of both academic success and confirmation of major choice. Selecting an engineering major is a complex decision shaped by multiple academic, social, and personal influences. First-year students often enter their programs with incomplete information, varied prior experiences, and differing levels of confidence about their intended career paths. Understanding which factors originate from students' pre-existing motivations and which are attributable to specific program experiences is essential for evaluating the true impact of any educational intervention.

The engineering Common First-Year (CFY) at UNC Charlotte consists of four courses that may be completed in any sequence. ENGR1300 is a teamwork focused design course that features an open-ended, semester-long design project, opportunities for student-led investigation of degree programs, and activities to inculcate a proactive learning mindset. ENGR1301 strengthens foundational STEM concepts within Math, Physics, and Chemistry to prepare students for rigorous upper level work. ENGR1302 encapsulates logic and problem solving through programming to expand the student's ability to apply the principles of engineering to complex engineering problems [1]. ENGR1303 concurrently enhances the student's ability to learn and communicate through engineering visualization. The CFY at UNC Charlotte was designed to broadly achieve the full suite of ABET Student Outcomes for engineers at the introductory level with primary exposure and reinforced skilling through multiple course contact points. Course catalog excerpts are provided in the Appendix A.

In the literature, student engineering major selection is a continuous process governed by what Main describes as "the life course perspective" [2], where experiences in their secondary and post-secondary education intersect to shape a student's final major selection. Academic achievement often serves as a foundational predictor, such that students with higher high school GPAs and strong SAT math scores often gravitate toward specific engineering disciplines with more rigorous mathematics and science requirements [2]. This decision-making is further guided by an evolving social network where family members and teachers provide the primary influence during early development [3], but once students enter college, they rely more heavily on academic advisors, professors, and peer mentors to navigate their choice [4]. Structural factors at the university level, such as the requirement for a common first-year engineering program, provide a "two-step" selection process that allows students to explore their relative fit and academic abilities before committing to a specific engineering major [5].

The choice is also deeply personal, driven by a student's affective state and perceptions of the subcultures of each major. While most students enter their first year feeling "excited" or "proud" during the summer, the actual start of rigorous coursework often shifts them toward feeling "overwhelmed" or "stressed" [6]. Students often select majors based on specific perceived outcomes: mechanical engineering is frequently chosen for its broadness and innovation, while industrial engineering attracts those seeking a people-oriented or business-focused environment [7]. Identity and societal impact can play crucial roles for students who are significantly more likely to choose majors such as civil and environmental engineering because of a desire to "help society" or improve infrastructure [8].

Ultimately, selecting an engineering major involves a complex alignment of institutional pathways and personal identity. The transition from the broad influence of family and secondary education to the specialized environment of a university requires students to reconcile their early academic foundations with their growing professional goals. This process is not merely a matter of choosing a career, but an iterative refinement of one's place within the engineering community, where students must balance the demands of the curriculum with their own internal values and the evolving academic progress.

2. Theoretical Framework and Methods

The push–pull model was first formalized by Lee to explain migration as a process shaped by forces that either propel individuals away from an origin (push factors) or attract them toward a destination (pull factors) [9]. Subsequent scholarship has extended this framework to educational decision-making, most notably in studies of international student mobility, where conditions in the home context and perceived advantages of host institutions jointly influence enrollment decisions [10].

In this study, we adapt the push–pull framework by explicitly separating student-originated factors (e.g., prior interests, expectations, and confidence) from intervention-driven influences introduced through a common first-year engineering program. Grounded in Mazzarol and Soutar's reconceptualization of the push–pull model [10], this study employs the framework not as a binary classification of positive or negative forces, but as an analytical structure for isolating the mechanisms through which program experiences shape students' evolving major selection decisions.

Push factors are operationalized as student-originated motivations and influences that predate exposure to the common first-year engineering program. These include prior interests in engineering, identity-based motivations (e.g., "I have always wanted to be an engineer"), and social influences such as parental expectations or encouragement from teachers or peers. Push factors were identified through beginning of the semester survey responses, allowing us to capture students' motivations prior to meaningful engagement with program activities.

Pull factors are operationalized as intervention-driven influences intentionally embedded within the common first-year program, including exposure to departmental panels, hands-on engineering activities, mentorship opportunities, and curriculum content introduced during the intervention. These factors were identified through the end-of-semester survey and by comparing the two surveys. Those represent features of the program that students explicitly referenced as shaping their major selection process.

The push–pull framework guided analysis by distinguishing the influences of the CFY program and cross-departmental workshop panels. The panel discussions included representatives from multiple engineering disciplines and professional roles, including faculty members, academic advisors, alumni, and industry professionals. Each panel session was moderated by a faculty facilitator and structured around a series of guiding prompts designed to highlight disciplinary characteristics, required competencies, and career trajectories. Example prompts included: "What distinguishes your engineering discipline from others?", "What skills or mindsets help students succeed in this field?", and "What career pathways are common for graduates in this major?" Following the moderated discussion, students engaged in an open question-and-answer session with panelists. Students were encouraged to prepare questions in advance based on prior course activities exploring different engineering majors.

Student responses were coded to distinguish between motivations originating prior to program entry and influences attributable to program participation, enabling a clearer examination of how the intervention contributed to students' major selection confidence and decisions.

3. Research Design

The push–pull framework directly informed the design and analysis of both the beginning-of-semester and end-of-semester surveys. Data collection followed a pre–post design intended to capture students' pre-existing motivations as well as program-related influences that emerged during the semester. For data analysis, all structured items in the end-of-semester survey were systematically reviewed and categorized as measuring either push or pull influences, based on the operational definitions established in the theoretical framework. In addition, students were asked explicit survey questions prompting them to reflect on which factors they perceived as having "pushed" or "pulled" them toward particular engineering disciplines.

Because the pre-semester survey was developed prior to the finalization of the push–pull framework, its alignment with the model is necessarily more limited. To address this asymmetry, open-response items from the end-of-semester survey are critical to the analysis. These responses were qualitatively coded into push and pull categories, enabling the capture of motivations and influences not represented in the earlier structured items and providing additional nuance to students' reported decision-making processes.

The classification scheme was applied consistently across survey instruments to support reliable comparisons between pre- and post-semester responses. Together, this mixed quantitative–qualitative approach allows the survey data to distinguish between students' pre-existing motivations and influences attributable to their experiences within the common first-year engineering program. The study addressed two research questions:

RQ1: Which push factors measured at the beginning of the semester are associated with students' declared major choice (engineering vs. undecided, or specific engineering discipline)?

RQ2: What is the impact of various CFY-related pull factors on students' selection of an academic major?

In this study, push and pull factors are conceptualized as analytical categories describing how influences function within students' decision-making processes rather than as mutually exclusive variables. A given influence may operate as a push factor when it prompts students to seek additional information or reconsider options, and later function as a pull factor when it attracts students toward a particular discipline or pathway. For example, mentorship relationships may initially encourage students to explore engineering options (push) and later reinforce alignment with a specific major (pull).

4. Participants and Data Collection

This paper employs a longitudinal survey design. A longitudinal survey design was used to collect data that can be used to identify trends within the same population. The longitudinal data will be categorized into trend studies (study changes within some general population, a general t-test) and panel studies(examine exactly the same population over time, paired t-test)

Surveys were administered during the third week (pre-survey) and the final three weeks (post-survey) of the semester. All students(more than 1600) enrolled in the common first-year engineering courses were invited to participate in the Fall 2025. Participation was voluntary, and responses were linked across time points using anonymous identifiers to protect confidentiality while enabling longitudinal comparison. 778 students finished the beginning of semester survey in total, and 530 students finished the end of semester survey during the data collection process.

In addition, to evaluate the longitudinal impact of the common first-year curriculum, we compare and track students' information to identify a cohort of 310 students who provided valid responses regarding their major selection confidence at both the beginning of and the conclusion of the semester. This paired data collection was mainly used to analyze the pull factors of student major decisions, and also allowed for a direct assessment of how curricular interventions (CFY project, curriculum, and panel discussion) influenced students over time.

5. Data Analysis

This data analysis is guided by a push–pull framework to examine the factors influencing students' major selection. Within this framework, *push factors* refer to students' pre-existing characteristics and experiences that shape their academic choices, while *pull factors* capture school-related experiences that may attract students toward or away from particular majors. Drawing on prior conceptual work on pathways into engineering and a life-course perspective [11], push factors include students' academic identities and confidence, background characteristics, social influences, and individual interests, whereas pull factors are operationalized as institutional and programmatic experiences, including participation in the CFY program and panel discussions.

This section presents the data analysis using the push–pull framework to clarify how students' backgrounds, perceptions, and educational experiences relate to major selection and major change. The analysis begins by examining students' incoming academic preparation and psychological orientations toward engineering, including mathematics background, confidence, and sentiment toward engineering majors (Sections 5.1–5.4). Special attention is then given to students who entered college without a declared major, as this group reveals distinctive motivational patterns that challenge deficit-based assumptions about undecided students (Section 5.5). Building on these descriptive analyses, the study next addresses Research Question 1 by identifying push factors measured at the beginning of the semester that are associated with students' declared major choices (Section 5.6). The analysis then shifts to pull factors, focusing on how school-related experiences, specifically the CFY program and panel discussions, shape students' major decisions over time (Section 5.7). Finally, the section examines factors associated with major change versus retention (Section 5.8) and distinguishes these from neutral factors that do not meaningfully differentiate students' decisions (Section 5.9).

5.1 Math background and engineering-related confidence

The math level data was collected at the beginning of the semester survey during the fall semester of 2025 from students enrolled in the common first-year curriculum. Part of the survey instrument was designed to assess students' incoming academic preparedness (i.e., math level) and their psychological commitment to their chosen engineering discipline (i.e., confidence in selecting their major). A total of 655 valid data points were obtained after removing incomplete responses from the dataset. The primary variables of interest for this analysis were current math enrollment and major selection confidence. Current mathematics enrollment: students self-reported their current math course, categorized into five levels ranging from college algebra to more advanced than calculus II. Students rated their confidence that their target major was the right fit using Likert scale (1 = Not confident, 5 = extremely confident).

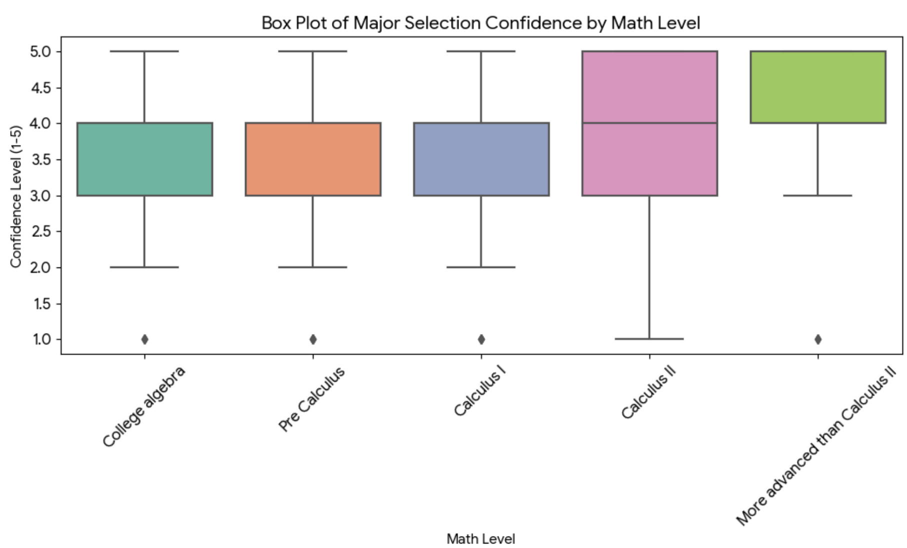


Figure 1. Box-whisker plot of Math level versus Major selection Confidence

Our analysis reveals a statistically significant relationship between students' math placement and their confidence in selecting an engineering major. A one-way ANOVA yielded a p-value < 0.001, leading to the null hypothesis that confidence levels are the same across math placements. As shown in Figure 1, the Box-whiskers plot of math level versus major selection confidence, there is a clear upward trend in self-reported confidence corresponding to math level. Descriptive statistics show that students who enrolled in college algebra had the lowest mean confidence (3.68) reported, while students who enrolled in more advanced than Calculus II had the highest mean confidence (4.14). While the advanced math cohort consistently reported the highest level of confidence, with a median value equals 5, students in developmental tracks (college algebra and pre-calculus) exhibited significantly lower means and larger variability.

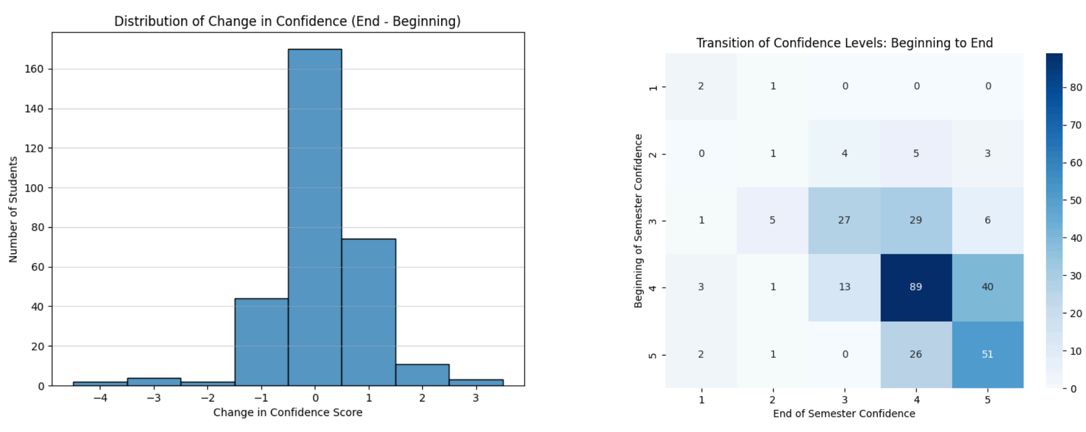
The statistical trend suggests that math preparedness serves not merely as an indicator of an academic prerequisite, but as a critical psychological anchor for students' professional identity formation (major selection here). This finding aligns with existing literature in engineering education (Hutchison, 2006), which posits that math self-efficacy is a primary driver of career interest and persistence. Consequently, the significant variance identified by the ANOVA results in this study validates the view that curricular interventions targeting students enrolled in college algebra and pre-calculus are essential for improving major selection confidence.

5.2 Shifts in confidence in major selection

Statistical analysis indicates a significant positive shift in students' confidence in their major selection over the semester. A paired t-test comparing pre- and post-survey confidence levels yielded a p-value of 0.022, meeting the conventional threshold for statistical significance ($p < 0.05$). To account for the ordinal nature of Likert-scale data, a Wilcoxon signed-rank test was also conducted, which confirmed this result with a p-value of 0.0049 ($p < 0.01$).

To further examine the nature of this shift, we analyzed the distribution of individual confidence changes and transition patterns using a histogram and a transition heatmap (Figures 2a and 2b). As shown in Figure 2a, the most frequent outcome corresponds to students whose confidence remained unchanged ($\Delta = 0$). However, the overall distribution exhibits a clear positive right skew, with noticeably more students reporting increases in confidence than decreases.

Figure 2b provides a more detailed view of these transitions by illustrating where changes occurred across confidence levels. Overall, the "center of gravity" of the cohort shifts toward the upper-right region of the matrix, indicating movement toward higher confidence levels.



(a) (b)

Figure 2. Histogram and heat map of change in confidence score (Change = End - Beginning)

Two dominant patterns emerge. First, high stability at elevated confidence levels is evident: the densest cell (deep blue, n = 89) represents students who both began and ended the semester with a confidence level of 4, while the second densest cell (n = 51) represents students who remained at the highest confidence level of 5. Second, upward mobility accounts for much of the observed positive skew. For example, 40 students moved from confidence level 4 to 5, and 29 students moved from level 3 to 4. Some downward movement was observed, most notably among 26 students who shifted from confidence level 5 to 4. However, overall, increases in confidence were more common than decreases.

As shown in Table 1, while the majority of students maintained their initial confidence level, again, the shifts were predominantly positive. The percentage of students who reported an increase in confidence (28.4%) is nearly double that of those who reported a decrease (16.8%).

Table 1. Confidence shift Categories versus their percentages (n=310)

Change in Confidence	Count	Percentage
Confidence Increased	88	28.4%
No Change	170	54.8%
Confidence Decreased	52	16.8%

5.3 Sentiment about engineering majors

To capture the qualitative state of a student's engineering identity, both the beginning and end of semester survey posed the following question: *"I am ____ about being an engineering student at* UNC Charlotte."

Responses were categorized into Positive, Neutral, and Negative Sentiment using natural language processing (TextBlob via Python) and manual verification. Empty responses were excluded from the sentiment analysis to ensure accuracy.

At the beginning of the semester, 209 students out of the 310 students provided valid qualitative responses. Among this, the sentiment was split among: positive (n=160, 76.6%); Neutral (n=45, 21.5%); and Negative (n=4, 1.9%). The high number of initial non-responses (n = 101) suggests that many students may have lacked the certainty to articulate their engineering identity effectively at the start.

By the end of the semester, there were 310 valid qualitative responses, where 75.2% are categorized as positive, while the neutral category accounted for about 19.7%, and the rest were negative. Out of the 101 students who left the sentiment blank, they converged to positive sentiment, mostly.

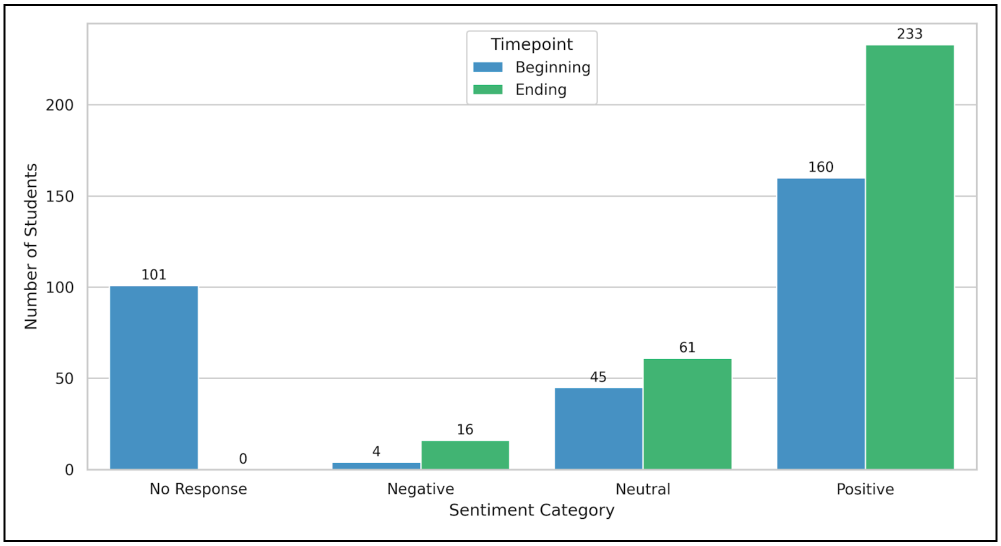


Figure 3. Students' sentiment toward engineering

5.4 Overall confidence in major decision-making

Figure 4 presents student sentiment groups and their corresponding level of confidence in major selections for both the beginning and end of the semester surveys. Students expressing positive sentiment consistently reported the highest confidence level (rising from 4.01 at the beginning of the semester to 4.19 at the end of the semester). In contrast, the neutral group (including anxious and nervous) exhibited significantly lower confidence scores (around 3.7).

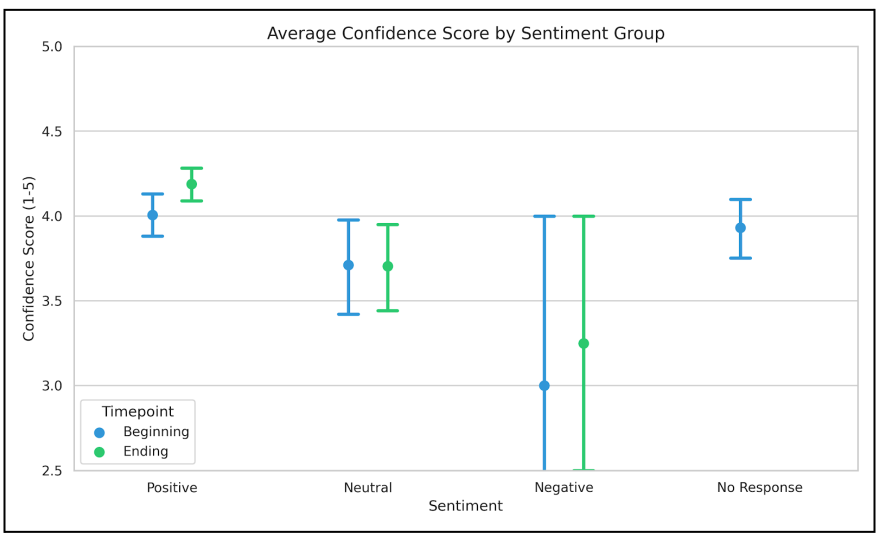


Figure 4. Comparison of the mean confidence scores across sentiment group

At the beginning of the semester survey, two questions were developed for students to choose their currently selected major(Q10) and their motivations for such selection (Question 14): what motivates you to pursue your major or engineering in general? Options included factors such as "Salary potential", "hands-on", "Help society", and "interest in what engineers do". Those motivations are labeled as push factors based on the definition.

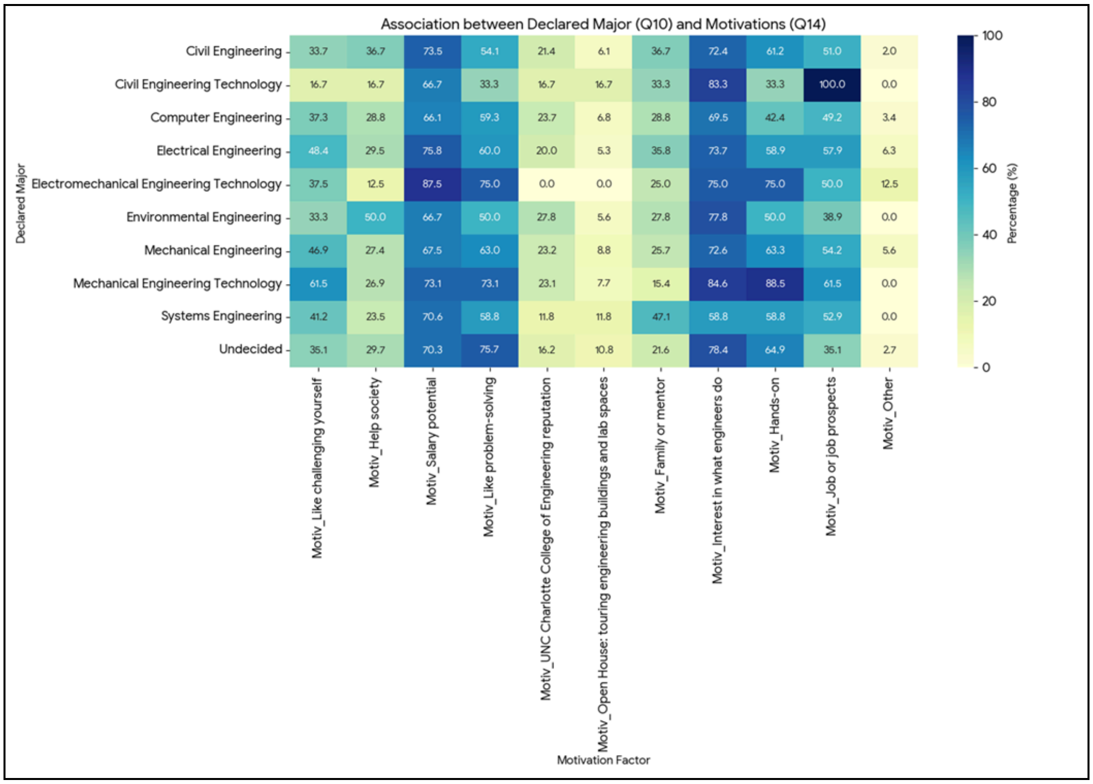


Figure 5. Heat map of push factors and major selection

Of the 718 students who provided a selection of majors, 669 provided responses to the motivational questions (Q14). Our analysis is based only on the 669 students. The motivational response data were transformed into binary (1 as selected, 0 as not selected). For example, if a student in mechanical engineering only selected “hands on” and “Salary potential”, the particular student will receive a vector score of 1s for both motivations and 0 for the rest. We group the data based on self-declared majors. For each major, the mean value for each binary motivational variable was calculated and converted into a percentage. This yielded the proportion of students within each specific major who cited a particular factor as motivation, as shown in Figure 5.

The results from the data reveal that first-year engineering students do not possess a monolithic professional identity; rather, they are segregated into different motivations (or push factors) that align with specific engineering disciplines. While “interest in what engineers do” serves as a universal baseline (70-85%) across the cohort, the data highlights a clear difference between the two groups: students in Civil and Environmental Engineering are mainly motivated by a desire to help society, while students in technology majors are driven by hands-on work and job opportunities . This is most evident in the civil engineering technology results, where 100% respondents cited “Job prospects” as a motivator, while simultaneously reporting the lowest intrinsic motivation for “problem solving” (33%). Furthermore, the “Hands-on” motivator acts as a critical filter, strongly distinguishing mechanical engineering technology students (88.5%) from their computer engineering peers (42.4%).

5.5 The undecided group: Motivation and self-direction

Contrary to the perception of undecided students as "directionless", the data paint them as the most intrinsically motivated "pure" problem solvers. This cohort reported the highest percentage of motivation for "Like problem-solving" (75.7%) of any group in this study, exceeding disciplines like electrical engineering and mechanical engineering. Furthermore, they reported low influence from "family or mentor" (21.6%), suggesting their presence in the college is a self-directed, intellectual choice rather than a response to external pressure.

5.6 Push Factors associated with declared major choice

RQ1: Which push factors, measured at the beginning of the semester, are associated with students' declared major choice (engineering vs. undecided, or specific discipline)?

The analysis of the beginning of semester survey reveals that students' declared major choices are significantly associated with distinct motivational "push factors". While broad motivators like "interest in what engineers do" and "salary potential" act as universal drivers across majors, they do not explain the variance between engineering disciplines. Instead, the specific choice of major is associated with four distinct motivational clusters:

1. The "hands-on" or tactile Push
2. The "help society" Push
3. The pragmatic or "job prospect" Push
4. The intrinsic "like problem-solving" Push

5.7 The pull factor: programmatic influences on major selection

RQ2: What is the impact of various CFY-related pull factors on students' selection of an academic major?

The major pull force deployed during the fall 2025 is the four CFY curricula and bi-weekly departmental panels (16 in total). While each course has a different focus, each contained at least one group project, with variations in length and complexity.

As shown in Figure 6, students self-report that the CFY curriculum effectively helps them develop skills and curriculum-related information. 66 to 75% of students reported that the course helped them understand the skills necessary to succeed. 62 to 68% of students reported improved knowledge of the curriculum for degree requirements. ENGR 1300 is ranked highly in terms of effectiveness for helping students develop career understanding. One unique feature of ENGR 1300 is the semester-long group project. Figure 7 compares the top learning outcome citations between the panel discussion and the group project. The group project had the greatest impact on skill development and sense of belonging, while panel discussions contribute to career understanding and curriculum knowledge.

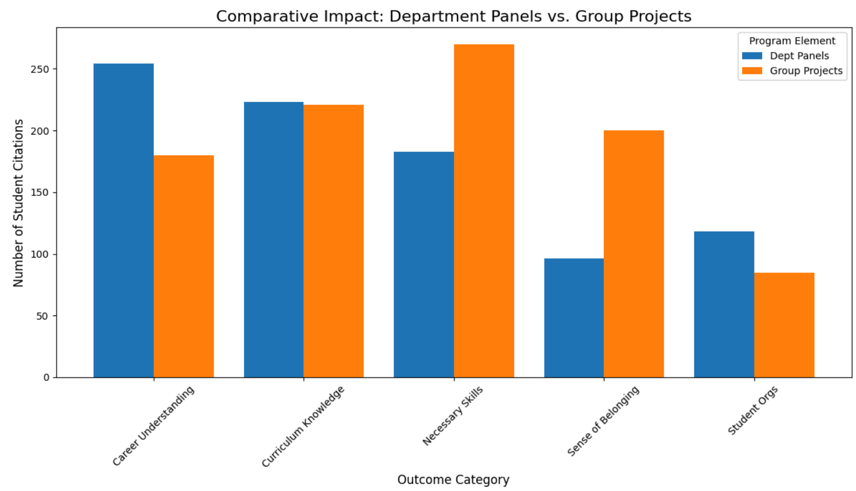


Figure 6. Top learning outcome from the CFY curriculum

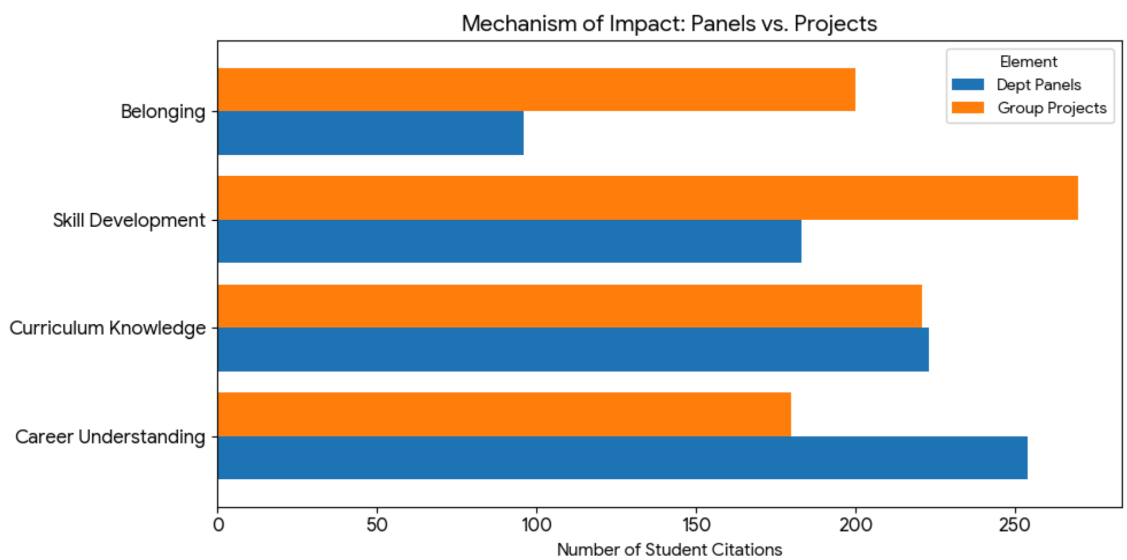


Figure 7. A comparison of the learning outcomes between department panels and group projects

Based on responses from 327 students who retained their first-choice major, both career goal alignment and advice from family and friends (classified as push factors) emerged as dominant influences. In addition, programmatic elements—specifically coursework, group projects, and panel discussions (pull factors)—collectively exerted a substantial influence on students' decisions to remain in their programs. Notably, 36.4% of these students identified group projects as a factor contributing to their decision to stay in their current engineering major.

Among the 64 students who changed their first-choice major, the most frequently cited driver was a realignment of career goals. However, independent exploration also played a critical role in this group's decision-making process, with 51.6% of students identifying it as a key factor influencing their change in major.

A comparison as shown in Figure 8, between students who retained their major ("retainers") and those who changed ("changers") highlights several retention factors, defined as influences cited significantly more often by retainers. Alignment with career goals showed the largest disparity between the two groups (+16.2 percentage-point gap), indicating that it functions as the strongest stabilizing factor. Advice from friends and family also favored retention (+14.6 percentage-point gap), suggesting that strong social support increases the likelihood of remaining in one's initial major. Importantly, group projects demonstrated a notable programmatic effect (+13 percentage-point gap; 36% vs. 23%), identifying collaborative, hands-on engineering experiences as a key institutional mechanism supporting major retention.

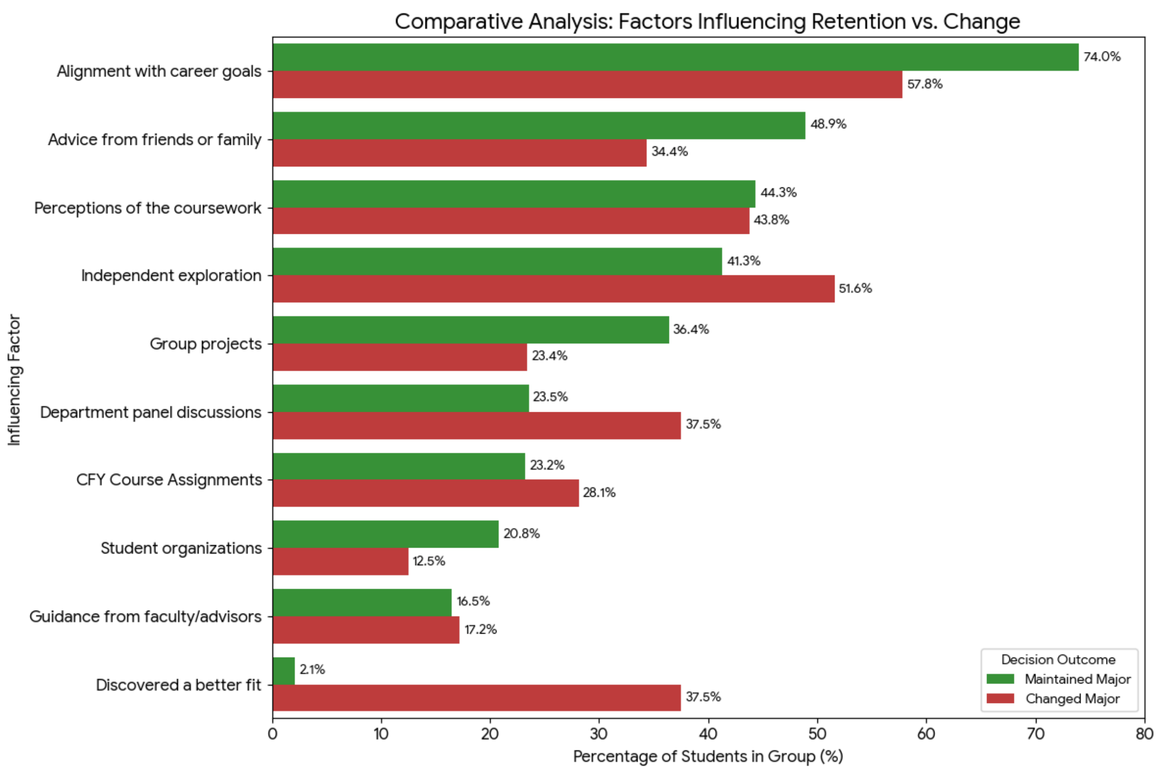


Figure 8. A comparison of factors that influence retention and change of major

5.8 Key Factors of Major Change

Several factors emerged as salient drivers distinguishing students who changed majors ("Changers") from those who remained ("Retainers"). First, the Departmental Panel Influence shows a -14% variance. Faculty-led departmental panels exerted a substantially greater influence on Changers (37.5%) than on Retainers (23.5%). This disparity suggests that structured, faculty-mediated exposure to disciplinary expectations can serve as a critical intervention, enabling students to recognize misalignment between their interests or goals and their current academic trajectory.

Second, the Independent Exploration shows a −10.3% differential. Changers were more likely to engage in proactive, self-directed exploration, such as researching alternative disciplines, prior to switching majors. This finding underscores the role of student agency in the decision-making process and suggests that access to exploratory resources may facilitate more informed academic migration.

Third, the Discovery of a Better Fit shows a −35.4% differential. The identification of a more suitable academic discipline represents the most pronounced distinguishing factor between the two groups and remains the defining motivation for major change. This substantial gap supports the view that switching majors is primarily driven by alignment with interests and long-term goals rather than by short-term academic challenges.

5.9 Neutral Factors in major decision-making

Perceptions of coursework difficulty and workload were reported at comparable rates by both Changers and Retainers of major selection based on survey data. This parity indicates that academic rigor alone is not a primary determinant of major attrition. Instead, the findings suggest that perceived misalignment with personal interests or career aspirations plays a more decisive role in prompting students to change majors.

6. Conclusions

This study examines the push and pull factors that shape students' major selection, retention, and redirection within the Common First Year (CFY) engineering curriculum. Longitudinal analysis of pre- and post-semester survey data indicates that the CFY curriculum supports more informed major selection, as evidenced by increased student confidence in their chosen discipline by the end of the semester. However, the persistent association between lower mathematics placement and reduced confidence in major selection represents a critical vulnerability that merits further investigation and targeted curricular or advising interventions.

The findings further suggest that the CFY curriculum influences major selection through distinct and complementary pull mechanisms. Collaborative group projects primarily function as a stabilizing force that reinforces commitment to an initial major and supports retention, whereas faculty-led departmental panel discussions serve as a navigational mechanism that facilitates intentional and informed major changes when students identify misalignment with their interests or goals.

7. Limitations

This study has several limitations in this preliminary research stage. First, our findings are based on a single first-year engineering program, which may limit generalizability to institutions with different curricular structures or student populations. Second, the study relies on self-reported survey responses measuring students' perceptions of knowledge, confidence, and influences on major selection rather than long-term tracking of actual major decisions. Finally, while the push–pull framework provides a useful lens for analyzing decision influences, individual factors may shift roles across time and context, suggesting that the distinction between push and pull influences should be interpreted as dynamic rather than strictly categorical. Regarding these limitations, our research group will do further research to investigate more important factors impacting students' major selection confidence in the engineering education area.

8. Acknowledgment

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Appendix A

UNC Charlotte Common First-Year course catalog excerpts:

ENGR 1300
This course will welcome students with a diverse cross-section of backgrounds into the engineering college/profession with a variety of hands-on experiences that informs them of the different engineering careers/disciplines and offers them an opportunity to apply the engineering design process to meaningful, real-world projects. Students will further develop learning efficacy while discovering their passion and finding meaningful connections in the engineering community. With a grade of C or above.

ENGR 1301
A study of foundational math and science, including vectors, vector algebra, units, Newton's laws, atomic structure, properties of matter, quantum mechanics, ideal gas law, chemical bonding, etc. The course consists of both lectures and breakout practice/lab sessions. With a grade of C or above.

ENGR 1302
An immersive project-oriented course where students explore real-world engineering problems, develop methodologies for solving problems logically and with computational tools, and validate solutions. A modern programming language is introduced. With a grade of C or above.

ENGR 1303
This course enables students to develop foundational knowledge and skills for visualizing and communicating complex three-dimensional designs and data sets. Through hands-on and practical applications, students learn techniques and tools to create visual spatial representations and conduct data analysis that aids in decision-making. Online 2D and 3D applications will be used, as well as spreadsheets and mathematical analysis software. With a grade of C or above.