A CASE for Success: Cultivating Counterspaces and Culturally Affirming Retention in Engineering Education (Work in Progress)

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Abstract

The College of Engineering's Center for Academic and Student Engagement (CASE) at North Carolina Agricultural and Technical State University supports undergraduate engineering and computer science students through academic support, advising, professional development, and engagement. Historically Black Colleges and Universities (HBCUs) have been shown to contribute to the persistence of Black students and other Students of Color in STEM; CASE extends this work by intentionally cultivating a culturally affirming environment, or counterspace, that fosters belonging, community, and shared expectations for success through structured programming. Counterspaces have been described as supportive spaces for individuals who are often marginalized or underrepresented in particular educational contexts.

Building on literature connecting culturally affirming environments and sense of belonging to persistence for Students of Color in STEM, this work-in-progress paper presents an emerging, theory-informed program model that integrates counterspace and belonging frameworks with Schlossberg's transition theory to align student-success programming with key transition points (e.g., entering college, progressing through major coursework, and professional identity formation). The paper describes four representative programs housed within CASE: the HOME summer bridge program, the First- and Second-Year Student Success program, the College of Engineering Ambassadors program, and the Grand Challenges Scholars Program (GCSP@NCAT).

Across these programs, CASE emphasizes self-advocacy, mentoring, leadership development, and cohort-based accountability to support academic momentum while strengthening students' identity and connection to the engineering community. This paper provides concrete, replicable examples of program mechanisms (mentoring structures, cohort formation, leadership roles, and portfolio-building experiences), describes who is served and how participants are identified, and situates the approach relative to similar bridge/cohort efforts documented in the literature. Finally, the paper outlines an approach for documenting implementation, outcomes, and adaptations required to sustain culturally affirming student-success work amid evolving institutional and external constraints. The contribution is a transferable program logic and implementation blueprint that other engineering colleges can adapt to strengthen persistence and belonging.

Keywords: counterspaces; sense of belonging; transition theory; HBCU; engineering retention; student success programming

1. Introduction and Motivation

Engineering persistence remains a national priority, especially for Students of Color who disproportionately encounter structural and cultural barriers in STEM environments. HBCUs have demonstrated strong outcomes for Black student persistence, and they often leverage community, culturally affirming practices, and close-knit support structures to do so[1]. Within this context, the College of Engineering's C.A.S.E. unit coordinates a portfolio of supports intended to strengthen academic success, professional readiness, and student engagement. This work-in-progress paper documents an emerging model that intentionally frames C.A.S.E. programming as a set of engineered "counterspaces" and transition supports that reinforce belonging and persistence[2,3,4,5,6,7].

2. Institutional Context and Scope: Who C.A.S.E. Serves

C.A.S.E. functions as a central hub for student support within the College of Engineering. C.A.S.E. services are designed to support the broader College of Engineering student population through academic support, advising and guidance, professional development, and student engagement. Within this broad service model, C.A.S.E. also administers and/or coordinates selective cohort programs that provide deeper, structured interventions at critical transition points. In this paper, we focus on four programs that map to distinct transition moments: (a) the HOME summer bridge program (pre-college and first-year transition), (b) the First- and Second-Year Student Success program (academic recovery and persistence during early-to-mid coursework progression), (c) the College of Engineering Ambassadors program (identity and leadership development; peer influence), and (d) the Grand Challenges Scholars Program (professional identity formation; global competence; portfolio development).

3. Theoretical Framework

3.1 Counterspaces and culturally affirming practice. Counterspaces have been described as identity-affirming environments where Students of Color can challenge deficit narratives, exchange support, and develop strategies for navigating culturally misaligned academic spaces[3,2,8,9]. In this paper, we treat C.A.S.E. program elements, including cohort structures, mentoring, structured reflection, and opportunities for leadership and agency, as mechanisms that build or reinforce counterspaces within engineering education.

3.2 Sense of belonging. Belonging is a multidimensional construct associated with academic adjustment, achievement, aspirations, and persistence[4,6,7]. We use belonging as an interpretive lens for how students experience program participation (e.g., feeling known, supported, and connected to peers, faculty, staff, and the profession).

3.3 Schlossberg's transition theory (4S system). Schlossberg's transition theory emphasizes that transitions are experienced as changes in roles, routines, relationships, and assumptions, and that students' ability to cope depends on the interaction of personal and contextual factors.[10,5] Building from this framework, we treat entry into engineering study as an *anticipated* transition that may nonetheless trigger *unanticipated* shifts in students' academic, social, and family lives. The transition can be described through the phases of *moving into*, *moving through*, and *moving out*,

where early acclimation requires students to learn institutional expectations and navigate elevated academic rigor.[10] Schlossberg's framework is operationalized through the 4S system, *Situation, Self, Support, and Strategies*, to specify what program features are designed to do at each transition point. For example, HOME reduces ambiguity in the *Situation* (clear expectations and early momentum through Calculus I), strengthens the *Self* (confidence and identity as an engineer through early academic success), builds layered *Support* (faculty/staff engagement and peer mentors), and equips students with *Strategies* such as help-seeking, self-advocacy, and planning behaviors.[10]

4. Program Portfolio: Concrete, Replicable Examples

The program portfolio is presented in sequence across common undergraduate transition points: entry, progression through coursework, leadership development, and professional identity formation.

4.1 HOME Program (pre-college bridge; cohort formation). HOME (*Helping Orient and Mentor Engineers*) is a five-week, cohort-based summer bridge program for incoming engineering and computer science students who arrive on campus before their first fall semester.[11] The program's design targets a high-leverage transition point ("moving into" engineering study) by offering an early, structured experience of STEM expectations, academic routines, and college-level norms. Students complete a credit-bearing mathematics course (e.g., Calculus I), engage in structured academic support, and participate in professional development and team-based activities that help them learn campus landmarks, navigate resources, and build relationships with peers and staff.[11,12]

A distinctive mechanism for belonging is the intentional creation of a shared cohort identity. Program leaders refer to participants as "HOMiEs," a label that functions as an in-group identity marker and reinforces unity, mutual accountability, and cultural belonging (i.e., students are known, named, and connected within the engineering community). Across the summer experience, students practice help-seeking and self-advocacy behaviors, and they receive repeated reinforcement that engineering success is a collective endeavor. The program culminates in a structured reflection and milestone-sharing experience in which students present key takeaways, challenges, growth moments, and next steps, thereby strengthening professional identity formation and normalizing reflective practice as an engineering skill. Importantly, HOME extends beyond the summer by sustaining cohort contact during the academic year (e.g., at least two gatherings per semester and ongoing professional development touchpoints).

4.2 The First- and Second-Year Student Success program (academic recovery; retention through structured supports). The First- and Second-Year Student Success program focuses on engineering and computer science students who are at elevated risk of attrition due to low or declining GPA (often near or below 2.5). The program is designed as a structured retention intervention that pairs academic monitoring with advising, strategic skill-building, and targeted supports intended to shift students' performance trajectories and preserve their pathway in engineering.

The First- and Second-Year Student Success program recruits students after a semester of graded coursework, including students with cumulative GPAs in the low-2s to mid-2s at recruitment; par-

ticipants in the cohorts identify as Students of Color and represent multiple engineering majors and computer science.

The First- and Second-Year Student Success program most directly addresses *moving through* transitions, supporting students once they encounter the sustained demands of engineering coursework. In Schlossberg's 4S terms, the First- and Second-Year Student Success program strengthens *Support* (advising and accountability), increases *Strategies* (time management, study planning, help-seeking), and reinforces *Self* (academic confidence and persistence mindset). As a counterspace, the program also communicates a culturally affirming message that students belong in engineering even while navigating academic setbacks, and that recovery is a normal part of becoming an engineer.

Jones and colleagues (2025) conducted a pilot study on this program, which was presented at the 2025 American Society for Engineering Education conference as a work-in-progress paper. In their study, they found that program participation did not increase participants' cumulative GPA by the end of their first year. However, they noted that participants continued in the program for an additional year, which may indicate that they saw benefit in program participation. Additionally, they noted that their preliminary study had a very small sample size (n=11) and that, while the researchers had IRB approval to disclose participants' program session attendance, cumulative GPAs, and academic standings, their IRB did not provide clearance to include program testimonials. Program testimonials may have provided context on program effectiveness and insight into which program elements were most impactful in contributing to their academic success, overall well-being, and sense of belonging. They also noted the recruitment timeline and the lack of incentives for study participation as factors contributing to their small sample size.

4.3 College of Engineering Ambassadors (leadership; peer influence; visibility). The College of Engineering Ambassadors program is a student leadership initiative in which selected students serve and promote the College through outreach, representation, and peer engagement.[13] Ambassadors are positioned as visible exemplars of scholarship and service within the college and across the university, and they are routinely consulted to provide student perspective on programmatic initiatives, messaging, and student-experience improvements. This structure operationalizes belonging and counterspace mechanisms by elevating near-peer role models, validating student voice in institutional decision-making, and making success pathways legible for newer students[14].

As a counterspace mechanism, the ambassador role normalizes excellence alongside approachability: students see peers who are both high-achieving and accessible, reducing stigma around help-seeking and strengthening identification with the engineering community. Ambassadors also serve as cultural translators who communicate expectations in student-centered language and model professional behaviors in authentic, culturally grounded ways (e.g., how to represent oneself, ask questions, and engage faculty/staff).

4.4 GCSP@NCAT (portfolio-based persistence; global competence). The Grand Challenges Scholars Program at NC A&T (GCSP@NCAT) is a co- and extra-curricular pathway that supports engineering and computer science students in building a globally focused professional identity through sustained engagement with a Grand Challenge area.[15] GCSP is a nationally recognized program model associated with the National Academy of Engineering and implemented across a global network of institutions.[16,17] GCSP@NCAT requires students to maintain a sustained focus

Table 1: Mapping CASE program mechanisms to Schlossberg's 4S transition system and belonging/counterspace functions (Work in Progress).

Program	Situation (clarity & structure)	Self (identity & confidence)	Support (relationships)	Strategies (skills & behaviors)
HOME	Early exposure to STEM/COE expectations; structured summer routine; Calculus I before fall	Cohort identity ("HOMiEs"); early academic wins; normalization of belonging in engineering	Cohort bonds; peer mentors; program director/staff visibility	Help-seeking norms; study routines; reflection/presentations; transition planning
First- and Second-Year Student Success	Academic standing monitoring; structured checkpoints; performance recovery plan	Rebuilding academic confidence; persistence mindset; belonging despite setbacks	Advising/accountability touchpoints; supportive community for students at risk	Time management; study planning; use of tutoring/office hours; self-advocacy
COE Ambassadors	Clear leadership role expectations; structured outreach/representation activities	Professional identity formation; leadership self-efficacy; visible excellence	Near-peer role modeling; feedback channels to COE leadership; peer networks	Communication, advocacy, and leadership skills; navigating institutional structures
GCSP@NCAT	Defined competency framework and portfolio milestones; structured pathway to impact	Purpose-driven engineering identity; global/civic self-concept; "engineer as change agent"	Faculty/staff mentoring; interdisciplinary collaborators; GCSP network exposure	Portfolio development; project planning; reflection; community-engaged problem solving

on a grand challenge while completing activities aligned with five competencies: *Talent*, *Multidisciplinary*, *Viable Business/Entrepreneurship*, *Multicultural*, and *Social Consciousness*.[15,17]

GCSP functions as a counterspace by legitimizing purpose-driven engineering work and by providing structured opportunities for students to connect technical learning to community impact, ethics, and societal benefit. From a belonging lens, portfolio development and cohort engagement reinforce professional identity ("I am becoming the kind of engineer who solves real problems") while expanding students' networks to include mentors, interdisciplinary collaborators, and community partners. In Schlossberg's terms, GCSP strengthens the *Self* through identity-affirming achievement, expands *Support* through mentoring and networks, and builds *Strategies* through planning, reflection, and goal-directed portfolio practices.

5. Relationship to Similar Efforts in the Literature

C.A.S.E. programming builds on documented approaches such as bridge programs and cohort models that support academic integration, community formation, and early academic momentum[6]. The HOME program itself has been described in prior practice work and positioned relative to other bridge efforts[18]. This paper extends that base by articulating how multiple programs can be coordinated under a single student-success unit to reinforce counterspaces and belonging across time, rather than only during entry.

6. Current Challenges and Adaptation in a Shifting Context

C.A.S.E. navigates an evolving context for culturally affirming student-success work. The core challenge is sustaining equity-oriented student support while operating amid shifting terminology constraints, reporting expectations, and funding landscapes. Adaptations include emphasizing student-success outcomes and evidence of impact, expanding partnerships with industry and alumni, refining communications to center access, engagement, and excellence, and protecting high-touch mentorship and cohort structures that students identify as critical.

This work is grounded in adaptive leadership, which emphasizes mobilizing stakeholders to tackle complex challenges through experimentation, conserving what works, discarding what does not, and inventing new approaches that build from the best of prior practice.[19,10]

7. Work-in-Progress Methods and Next Steps

To strengthen transferability, this paper specifies program mechanisms and implementation features across four C.A.S.E. programs and maps them to Schlossberg's 4S transition system and to belonging and counterspace mechanisms. Next steps focus on systematically documenting implementation and outcomes using multiple forms of evidence. Near-term indicators include participation and persistence signals (e.g., program engagement, academic momentum, student feedback, and retention proxies), complemented by program artifacts such as attendance records, mentoring logs, student reflections, and post-program surveys. As the evaluation matures, the evidence base can be extended through validated belonging measures, qualitative inquiry (e.g., focus groups or interviews), and longitudinal tracking of retention and progression to examine relationships between program participation, belonging, and persistence over time.

8. Conclusion

C.A.S.E. represents a coordinated, culturally affirming student-success ecosystem that aligns academic support, cohort structures, mentoring, leadership development, and portfolio-building experiences with key undergraduate transition points. By integrating counterspace and belonging frameworks with Schlossberg's transition theory, this paper offers a theory-informed logic for how program features can be designed to support persistence and professional identity formation. The program portfolio and 4S mapping provide a transferable implementation blueprint that other engineering colleges can adapt while attending to local context, student needs, and institutional constraints. Continued documentation of implementation and outcomes will further clarify which mechanisms are most consequential for strengthening belonging and persistence.

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