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WIP: Building and sustaining an engineering access and retention program at an R1 institution

Dr. Renee M. Desing, University of Washington

Dr. Renee Desing is an Assistant Teaching Professor in the Department of Mechanical Engineering at the University of Washington. Her research interests include diversity, equity, and inclusion in the engineering classrooms and workplaces. Dr. Desing graduated from Ohio State with her Ph.D. in Engineering Education, and also holds a B.S. in Industrial Engineering from the Georgia Institute of Technology and a M.S. in Industrial Engineering and Operations Research from the Pennsylvania State University.

Ali Cho, University of Washington
Laura Barrera, University of Washington

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Introduction

Persistent inequities in university-level engineering education continue to limit the participation and success of students from low-income, first-generation, and historically marginalized backgrounds. Research highlights the structural barriers that impact persistence and degree completion, emphasizing the need for coordinated transition and support programs [1], [2]. Program models that combine academic support, mentoring and social support, summer bridge experiences, and financial support components have demonstrated positive impacts on student success [2].

In STEM, these transition and support programs have proven positive effects on grades and retention in STEM programs. Summer bridge experiences improve first-year GPA and retention, particularly when they include STEM content to remediate knowledge gaps [3], [4]. Engineering-focused bridge programs report improved readiness, confidence, and belonging among incoming students (e.g., [5], [6], [7]). Proactive, high-touch advising, characterized by structured, frequent advisor-student contact, is connected with improved academic planning retention, particularly for first-generation and academically vulnerable students in engineering (e.g., [8], [9]). Supplemental instruction for STEM gateway courses is also associated with higher grades and university retention, particularly for underrepresented students [10]. In engineering, supplemental instruction is particularly impactful when implemented through a cohort-based model [11]. These practices also underpin academic redshirting which provides an additional preparation year to strengthen inclusion and retention in engineering [12], [13].

At the University of Washington, our academic redshirt program integrates summer bridge, individualized advising, and supplemental instruction within a two-year, cohort-based program to improve access and success in engineering [14]. First established 13 years ago, we began a multi-year redesign in Autumn 2023 to update all components of our program, from lengthening the mathematics-focused summer bridge program to a new intensive advising model and expanded supplemental workshops. The purpose of this paper is to present the structure of our redesigned program and its early findings, drawing on student feedback, advising engagement, and retention outcomes. We aim to provide an institution-specific case study of how coordinated updates across summer bridge, academic advising, and supplemental workshop components can support first-year engineering success.

History of the Program and Recent Redesign

The Washington State Academic RedShirt (STARS) program at the University of Washington (UW) [14] was established over a decade ago through support from the National Science Foundation. Designed as a two-year, cohort-based initiative, STARS aims to strengthen student success in engineering and computer science by providing structured academic and professional development. The program draws inspiration from the athletic concept of a "redshirt" year, and from the University of Colorado Boulder's GoldShirt program [12], to offer students additional time and resources to prepare for the rigor of STEM curricula. STARS was created in response to persistent equity gaps in engineering education, where students from low-income, first-generation, and historically minoritized backgrounds face systemic barriers to persistence and degree completion. Our recent redesign is also being driven by increasing challenges such as a decline in math proficiency over the last 10 years [15], making our work more difficult as we try to fill in greater gaps. By offering targeted academic support, community building, and skill development, the program seeks to mitigate these challenges and foster inclusive pathways into STEM.

What distinguishes STARS is its comprehensive, collaborative approach that integrates academic departments, student support services, and industry partners. This includes partnerships with units such as mathematics and chemistry, as well as advising and career development offices. Through these connections, STARS offers workshops, tutoring, and skill-building seminars alongside mentoring opportunities with faculty, staff, and professionals. The program emphasizes that success in STEM extends beyond technical proficiency, requiring a foundation of academic strategies, personal resilience, and leadership skills to thrive in demanding degree pathways.

Over the past thirteen years, STARS has evolved to meet changing student needs and institutional priorities. In Autumn 2023, at the beginning of the tenth year, the STARS program entered a period of significant structural and curricular transformation aimed at strengthening student preparation and improving long-term outcomes. Over the past three years, these changes have focused on enhancing academic readiness and strengthening student support. The summer bridge program underwent a major redesign in 2024 to emphasize mathematics readiness, accurate course placement, and executive functioning. Former programming focused on campus wayfinding and community with a smaller portion dedicated to exposing students to STEM curriculum. However, national and institutional concerns about students' math proficiency and overall college readiness resulted in a push to shift the bridge curriculum to emphasize academic topics and development of university skills. The revised bridge curriculum doubled the length of instruction from two weeks to four, incorporated a new algebra-focused curriculum, and implemented weekly assessments to monitor student progress (for more details on the summer bridge redesign, see our prior paper at [7]). The math placement process was also

overhauled to better align students with the appropriate starting point in the university's math sequence, leveraging interdisciplinary partnerships with departments such as mathematics and chemistry to strengthen support. These enhancements were designed to improve math preparedness and ensure accurate course placement for students entering their first term.

Advising structures also shifted in response to the increasing size of the STARS cohorts. An additional STARS advisor was added to the team to accommodate a new assigned advisor model, and staff were identified as liaisons to particular campus units to increase interdepartmental partnerships. Large R1 institutions can be difficult for students to navigate, especially given the large population that resources serve. STARS began reinforcing the idea of a "support team" for students that allowed staff to quickly activate a network of cross-campus interventions for individuals as soon as concerns are raised. These changes reflect a strategic effort to adapt and innovate in response to student needs and institutional priorities, ensuring that STARS continues to serve as a robust model for inclusive engineering education.

Current Program Structure

Our current program structure is built around three components that directly support students, each of which are further detailed below: (1) summer bridge, (2) academic advising, and (3) supplemental workshops.

Summer Bridge Component

The STARS experience begins with a summer bridge program designed to ease the transition to college and strengthen academic foundations. The current, four-week curriculum focuses on targeted algebra and pre-calculus content, with weekly assessments to monitor student progress. Our goal is for students to enter their first term with a solid foundation in mathematics. In addition to academic preparation, the bridge program fosters community building and introduces students to campus resources, setting the stage for a supportive first-year experience. At the end of the summer bridge program, students are placed into the appropriate math course for the autumn quarter.

Academic Advising Component

Academic advising is a cornerstone of the STARS program, providing individualized guidance throughout the two-year experience. Advising support evolves as students progress: first-year students focus on navigating the transition to college, addressing challenges such as time management, imposter syndrome, and building resilience within a large research institution. In the second year, advising shifts toward major placement, professional development, and planning for life after STARS. Common advising topics include degree planning, campus involvement, academic difficulty, housing and financial aid concerns, career exploration, and accessing resources or accommodations.

To ensure accountability and timely intervention, STARS adopted an intensive advising model in Winter 2025 through its continuation policy, with additional modifications to be implemented starting Autumn 2026. All students begin in good standing and must maintain a minimum grade of 2.0 (equivalent to a C) in STEM courses (e.g., math, chemistry, physics) and earn credit in all credit/no-credit courses, including STARS workshops. Students who fall below these benchmarks enter a structured support process:

- **Good Academic Standing:** One required advising meeting per quarter and the co-development of a success plan.
- **Academic Warning:** Three required meetings (at the beginning, middle, and end of quarter) plus weekly tutoring and the co-development of a success plan.
- **Escalated Warning:** Bi-weekly advising meetings (five total) plus weekly tutoring.

This proactive approach ensures frequent touchpoints between students and advisors, allowing challenges to be addressed as they arise. Under the new model, advisors spend a minimum of three hours per quarter with students on academic warning and five hours with those on escalated warning, reflecting STARS' commitment to holistic and responsive support.

Supplemental Workshop Component

The third pillar of STARS is a series of supplemental workshops designed to reinforce learning in key STEM courses, including the calculus, chemistry, physics, and programming sequences. These workshops are taught by full-time staff members, called Engineering Education Specialists, and instructors from the Engineering Academic Support Center and the Paul G. Allen School of Computer Science & Engineering. Workshops provide structured opportunities for active learning, problem-solving, and skill development aligned with students' enrolled courses. Innovative instructional approaches, such as teaching mathematical concepts through hands-on engineering based on the Wright State model [16], have been introduced to accelerate learning and foster interdisciplinary thinking.

Our Engineering Education Specialists and instructors possess extensive knowledge in the subjects for which they host workshops and often have backgrounds in teaching. Collaboration between instructors and advisors is central to STARS' holistic approach. Instructors primarily address academic content, but they also play a critical role in identifying non-academic concerns, such as attendance issues or mental health challenges. To facilitate communication, STARS uses a "Student Success Alert" system that allows instructors to flag concerns for the advising team. Advisors then follow up with students and provide appropriate support, while maintaining student privacy in updates to instructors. Regular meetings between advisors and instructors further strengthen this partnership, ensuring that academic and personal challenges are addressed

in a coordinated manner. This integrated model reflects STARS' commitment to supporting the whole student academically, personally, and professionally.

Program and Student Funding

STARS is currently funded through a mixture of university and private funds. To support students through their five years of education, STARS prioritizes scholarship funds for students with the highest need. This often results in most funds going to students pursuing a fifth year of school. The program also supports students with financial aid petitions, and it is rare that students graduate from STARS and UW with significant debt.

Methods

This paper draws on data collected over the full 13-year history of the STARS program. While historical data provide important context for long-term impact, the primary focus of our analysis is on the most recent three years (2022–2025), following the program's structural and curricular redesign. Data sources include student surveys and program records, organized around the program's three core components (i.e., summer bridge, academic advising, and supplemental workshops) as well as overall program-level outcomes.

To evaluate the redesigned summer bridge program, we administered surveys to incoming STARS students at the conclusion of the bridge experience. Survey items captured students' perceptions of the program's effectiveness, confidence in their math preparedness, and satisfaction with the math placement process. Additional questions assessed whether students believed they were placed into the appropriate math course and their confidence in succeeding in that course. Responses were analyzed using descriptive statistics and thematic coding for open-ended items. More details and results of the summer bridge redesign are available in our prior paper [7].

Advising data were collected through program records documenting scheduled advising appointments per quarter for all STARS participants. We also tracked the number of students in each continuation policy category (i.e., good standing, academic warning, and escalated warning) following the implementation of the intensive advising model in Winter 2025. These data were used to examine patterns in advising engagement and identify correlations between advising intensity and academic outcomes.

To assess the impact of supplemental workshops, we collected mid-quarter survey feedback from students enrolled in STARS workshops. Survey items focused on perceived usefulness of the workshops, their contribution to understanding course material, and overall satisfaction. Quantitative responses were analyzed for trends across quarters, while qualitative feedback provided insight into student experiences and areas for improvement, although full analysis remains in progress.

Finally, we examined program-level retention and graduation rates for each cohort to evaluate long-term impact. Because students who recently entered after the redesign have not yet graduated, these metrics will continue to be tracked to assess whether program modifications contributed to improved persistence and degree completion.

Preliminary Results

In this section, we present preliminary results from the STARS program's recent redesign, focusing on outcomes related to academic advising engagement, supplemental workshop participation and feedback, and cohort-level retention and graduation rates. Most findings reflect data from cohorts entering after the Autumn 2023 structural and curricular changes, while retention and graduation analyses draw on all cohorts in the 13-year history of the program. Preliminary results from the redesigned summer bridge component have been reported previously and are available in our prior work [7].

Cohort Characteristics

Any student who applies to UW and indicates engineering or computer science as their first-choice major is considered for STARS. Students are selected as good candidates for STARS by the UW Office of Admissions based on a variety of criteria which include both an academic and personal qualities assessment. STARS students are incredibly talented and often graduate from high school at the top of their class. However, their admissions materials indicate that they would benefit from additional resources to support their success at an R1 institution.

Participants in our program are typically first generation (~85%) and low-income students (~68%). Additionally, students in the program often find themselves working part-time to provide for their families or working at their family-owned businesses, as caretakers for younger siblings or aging family members and sometimes their parents, or having to commute for long hours due to family obligations or for cultural reasons. Most recently, at the start of the 2025-2026 academic year, STARS was providing support for 114 students. The incoming class (cohort 13) had 61 students with 79% identified as low-income, 89% first-generation, and 100% affiliated with the UW's Office of Minority Affairs and Diversity.

Academic Advising

Advising engagement increased gradually across AY 2024–25 (see Table 1), rising from 157 appointments in Autumn 2024, to 162 in Winter 2025 and 164 in Spring 2025 (+4.5%). Following the adoption of the intensive advising model in Winter 2025, appointments rose substantially in Autumn 2025 to 223, a 36.0% increase over the prior term. These trends align with the program's shift toward more frequent, proactive touchpoints under the updated continuation policy.

When analyzing the trends of students on academic warning and escalated warning (see Table 1), we see that the beginning-of-term counts peaked in Winter 2025, coinciding with the rollout of the intensive advising model. This peak was followed by strong movement into good standing (7 in Winter; 9 in Spring) and structured escalations from academic warning to escalated warning (5 in Winter; 6 in Spring). Dismissals were frequently accompanied by approved appeals (e.g., 5 of 6 dismissals in Winter), which maintained student engagement under increased support. These trends suggest the intensive advising model improved timely interventions and transparent pathways through the continuation policy.

Table 1: Academic Warning & Escalated Warning Numbers by Term

Status (Number of students who…)		**AU 24**	**WI 25**	**SP 25**
Start of term	Were on academic warning at start of term	4	11	9
	Were on escalated warning at start of term	3	7	8
End of term	Moved to good standing at end of term	0	7	9
	Moved from academic warning to escalated warning at end of term	4	5	6
	Dismissed at end of term	3	6	2
End of term decision	Dismissal appeals (all approved)	1	5	1
	Students who chose to pursue another major	2	2	1
	Students who chose to leave the university	0	1	0

Supplemental Workshops

On our mid-quarter feedback surveys, we asked the students to respond to the following questions on a 5-point Likert-style scale: (Q1) I feel like I am doing well in the paired UW class that this workshop supports, (Q2) The workshops assist my understanding of the UW course material, (Q3) The workshop time is used well, (Q4) The instructor has a good grasp of the content, (Q5) I feel comfortable asking questions during workshop. The combined student response rates from Winter 2025, Spring 2025, and Autumn 2025 are shown in Figure 1.

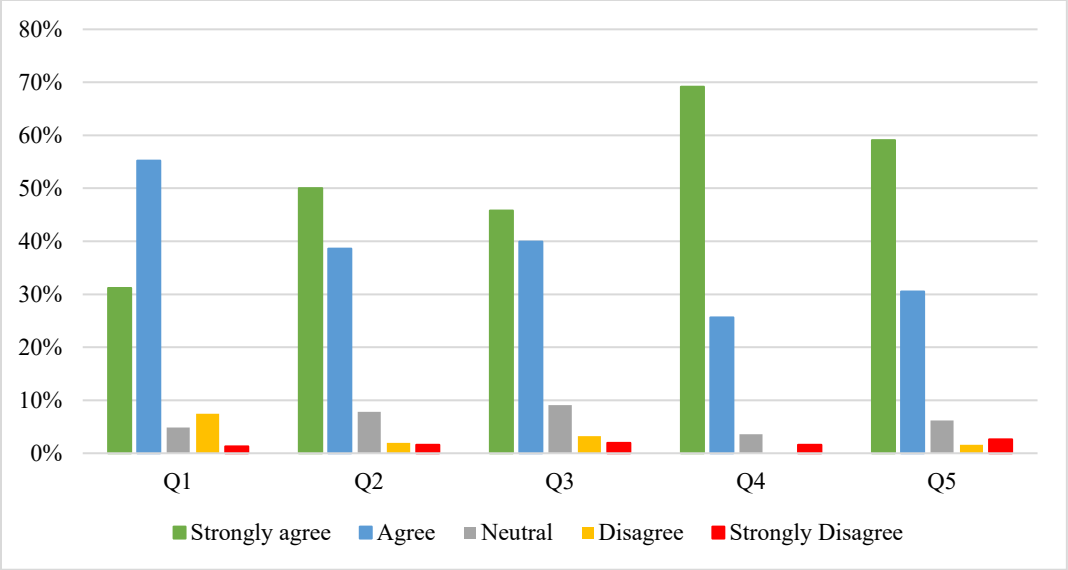

Figure 1: Student Mid-Quarter Workshop Feedback

Students reported strongly positive perceptions of the supplemental workshops. A majority of respondents either agreed or strongly agreed with all five statements, with the strongest endorsement for the workshop instructors' content expertise (Q4: 95% agreement) and students' comfort asking questions (Q5: 90%). Students also reported that workshops effectively supported their understanding of course material (Q2: 89%) and that workshop time was used well (Q3: 86%). Notably, 86% of students felt they were doing well in their paired university course (Q1), suggesting that the workshops may contribute to students' confidence and perceived academic progress. Rates of disagreement across all items were very low (0–7%), indicating consistently positive student experiences with the workshop structure and instructional support.

Retention and Graduation Rates

Across 12 cohorts, STARS has served 392 students with consistently high first-year retention (average 96%) and strong second-year retention (average 82%). Graduation rates for completed cohorts average 78%, with notable improvement over time, reflecting program maturation and enhanced support structures. Cohorts entering after 2020 show nearly perfect first-year retention and second-year retention, though graduation data are not yet complete. These trends suggest that recent structural and curricular redesigns, including the summer bridge enhancements, are contributing to sustained retention and improved long-term outcomes. Table 2 shows retention and graduation rates by cohort.

Table 2: Retention and Graduation Rates by Cohort

Cohort	Year Started	# Students	Year 1 Retention	Year 2 Retention	Graduation Rate
1	2013	29	97%	72%	59%
2	2014	32	97%	88%	75%
3	2015	29	93%	76%	69%
4	2016	38	100%	89%	86%
5	2017	51	94%	73%	73%
6	2018	40	88%	78%	65%
7	2019	30	97%	70%	50%*
8	2020	29	100%	100%	TBD
9	2021	30	93%	90%	TBD
10	2022	24	100%	100%	TBD
11	2023	30	100%	87%	TBD
12	2024	40	90%	TBD	TBD
Total	**2013-2024**	**392**	**95%**	**83%**	**78%**
* Incomplete at the time of data collection					

Conclusion and Next Steps

As this work-in-progress demonstrates, data collection and analysis for the redesigned STARS program is ongoing, particularly for cohorts entering after the Autumn 2023 implementation of structural and curricular changes. Although long-term impacts on persistence, graduation, and engineering degree completion are not yet known, preliminary findings indicate promising improvements across several dimensions, including early retention patterns, academic advising engagement, workshop satisfaction, and students' perceived preparedness for university STEM coursework.

Our next steps include continued longitudinal tracking of redesigned cohorts, deeper analysis of the relationship between specific program components and student outcomes, and integration of qualitative data to better understand students' lived experiences within the new model. As additional cohorts progress through the redesigned pathway, we aim to build a more complete picture of the program's impact and refine the STARS model to further promote access, success, and equity in engineering education.

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