Engineering Educators Bringing the World Together
2025 ASEE Annual Conference & Exposition
Palais des congrès de Montréal, Montréal, QC • June 22–25, 2025 ASEE
Paper ID #48800

Increasing Access to Engineering Through 6-12 Summer Camps on the University Campus and Dual Enrollment Programs in High School Settings (Evaluation, Diversity)

Mrs. Maricruz Zepeda - Wilson, The University of Arizona, College of Engineering

Maricruz Zepeda-Wilson is the Assistant Director for High School Outreach and Educational Programs in the College of Engineering at the University of Arizona. She holds a Bachelor's degree in Psychology and a Master's degree in Teaching and Teacher Education from the University of Arizona. As a former K-12 teacher, she focuses her efforts on increasing access to STEM for all, and increasing self-efficacy through those programs for pre-college students.

Mrs. Cori Dennis, The University of Arizona, College of Engineering

With over 20 years of experience in education, Cori is a dedicated leader specializing in special education, educational leadership, and inclusive program development. She holds a Master of Education in Educational Leadership from Northern Arizona University and has completed extensive graduate-level coursework in special education at Towson University.

Cori currently serves as Coordinator of High School Outreach and Summer Programs for the College of Engineering at the University of Arizona. In this role, she leads strategic STEM initiatives, directs the Summer Engineering Academy, and builds partnerships that expand access and opportunity for underrepresented students.

Throughout her career, Cori has remained committed to equity, access, and student-centered innovation. Her leadership emphasizes collaboration, data-informed decisions, and fostering meaningful educational opportunities for all learners.

Increasing Access to Engineering through Dual Enrollment Programs in High School Settings and Summer Camps for Grades 6-12 on the University of Arizona Campus (Evaluation, Diversity)

Abstract

The University of Arizona's College of Engineering (COE) aims to increase access to and improve diversity in engineering education through targeted outreach and programmatic initiatives. Programmatic initiatives include Summer Engineering Academy (SEA) a summer camp that focus on students in grades 6 through 12 and Engineering 102 in High School (ENGR 102HS) a dual enrollment introductory course targeted towards high school juniors and seniors. Outreach efforts are implemented to gain relationships with community partners, engage students from diverse backgrounds, and support middle and high school students with interests in STEM. Collaboration with Pima Community College (PCC) in Tucson has provided funding opportunities for disadvantaged youth to attend SEA. Partnerships with industry connections support local and nationwide participants. SEA has undergone notable adaptations, including adaptations to the programs in 2021 and 2022 resulting from pandemic-related restrictions leading to long-term changes. Since its cancellation in 2020, programming transitioned from an exclusively virtual program to a mixed-modality program, and most recently, to an exclusively in-person program. Overnight programs, reintroduced in 2024, provide opportunities for participants to engage in, and create a like-minded community. Thirty percent of overnight program seats have been reserved to address DEI goals of serving underrepresented participants from across the city, state, and nation. These participants attend camp at little to no cost through partnerships and sponsorships. Furthering efforts to increase access to engineering, ENGR 102HS offers high school juniors and seniors the opportunity to earn college credit while participating in an introductory engineering course on their high school campus led by a qualified high school instructor. These environments provide a space conducive to the students' exploration of engineering disciplines. Their established connection to faculty, environment, and peers provides a safer space in which students can build a stronger engineering identity and transition to college. Tuition for these students is reduced and need-based tuition grants are available. In contrast, SEA participants engage in engineering concepts and are introduced to corresponding careers through hands-on exploration led by faculty and graduate students. For both groups, participation fosters interest, self-efficacy, and individual engineering identity [10]. As a result of the high school SEA's success, the college was asked to collaborate on a middle school camp with Cummings Aerospace, a local engineering firm. Through this camp, middle school students engage in a weeklong robotics exploration program. Participants of the middle school program attend schools considered to have a high population of students from low-income households. For many of the participants, it is their first exposure to a college campus. The program is free, and students are provided with meals and snacks. This paper highlights the impact of these programs on broadening participation in engineering, particularly among underrepresented groups, and considers their effectiveness in enhancing students' self-efficacy as engineers.

Introduction

As a land grant university [1] and Hispanic Serving Institution (HSI), The University of Arizona aims to serve a diverse student population and to engage the community in programs that increase awareness and access to post-secondary programs. The College of Engineering (COE)'s long-running dual enrollment and summer camp programs, Engineering 102 in High School (ENGR 102HS) and Summer Engineering Academy (SEA), focus on pre-college access to engineering with the goal of inspiring students to pursue Science, Technology, Engineering and Math (STEM) careers after high school.

In this paper, we examine ENGR 102HS and SEA. We evaluate the programs' long-standing practices and programmatic adaptations that have been implemented, especially during and after the pandemic. We consider the impacts of these adaptations on participation, enrollment, self-efficacy, and the pursuit of post-secondary education.

Engineering 102 in High School

ENGR 102HS was first offered in the fall of 2008. In its inaugural year, the program launched at Hamilton High School in Chandler, Arizona with twenty students completing the course for college credit. It was planned to expand the program to more schools and districts in subsequent years. The course would be facilitated by vetted high school instructors leveraging their effective classroom management in the high school setting, ability to address high-level content with high school students, and the sense of familiarity it would provide to the students.

Instructors are vetted by the college to ensure they are qualified to teach ENGR 102HS. Qualified instructors become Designated Campus Colleagues (DCCs) with access to the necessary university systems to effectively teach the course. The course would consist of a core curriculum equivalent to that of Engineering 102 (ENGR 102), the core curriculum of the introductory engineering course on the University of Arizona campus.

Since 2008, the course has grown to nearly 40 high school campuses. This includes campuses from Southern and Central Arizona and one in California. In the 2024-2025 academic year, over 400 students enrolled in The University of Arizona as non-degree-seeking students and participated in ENGR 102HS for college credit. Both the number of participating school sites and students enrolled to receive college credit increased by approximately 11% over the previous academic year. To provide students with a meaningful experience, program goals include to:

- Demonstrate how engineers use math and science to help people in a variety of global, economic, environmental, and cultural settings
- Increase high school students' belief in their ability to pursue and succeed in the engineering profession
- Offer students an inside look at the college through campus visits and lab tours
- Award three units of required coursework to high school students upon successful completion of the course
- Significantly reduced tuition rate for non-degree seeking high school students

On the high school campus, students attend class for approximately 275 minutes (about 9 hours) a week compared to 100 minutes (about 2.5 hours) a week. ENGR 102HS is a year-long course

at all but three participating high schools, which offer it as a semester-long course. During the additional contact minutes, high school students work on assignments typically assigned as homework in the university setting. For ENGR 102HS, there is an expectation that each site supplements the curriculum with engineering projects and challenges beyond the core curriculum. DCCs choose supplemental projects such as Engineering Projects in Community Service (EPICS) [2], a design and build competition such as Racing the Sun [3], or an experiment presented at the annual summer workshop for ENGR 102HS instructors. Alternatively, the DCC may opt to design engineering experiments and experiences for students. Because of additional contact minutes and project involvement, students enrolled in ENGR 102HS earn three credit hours as compared to those on campus who earn two.

Summer Engineering Academy

SEA has been running on the University of Arizona campus for over thirty years. Initially, it consisted of lectures led by faculty members and a civil engineering challenge. Starting in Summer 1999, the program was redesigned to address student needs as indicated by feedback received from participant surveys. The program has since grown from a three-session program with one single-day event for younger high school students and two overnight programs for juniors and seniors to a seven-session program each summer themed around engineering grand challenges. Each session runs for a week operating as a day camp or an overnight camp. In the summer of 2023, a partnership with Cummings Aerospace, a local engineering firm, introduced middle school students to SEA with a summer camp focused on robotics and programming. SEA aims to inspire and educate students about engineering through hands-on activities, collaborative projects, and exposure to various engineering disciplines. SEA runs from June through July and attracts students from across the country in grades six through twelve from various demographic backgrounds, including historically marginalized communities.

In Summer 2024, SEA recorded peak enrollment with 287 participants. Previously, the record for enrollment was 237 participants in the Summer 2022, which was the first year to offer in-person camps after the pandemic. Middle school camp enrollment also increased in its second year with 105 participants in 2024 compared to 40 in 2023. A decrease in enrollment for Summer 2023 resulted from the elimination of virtual programming which allowed for increased capacity (see Figure 1).

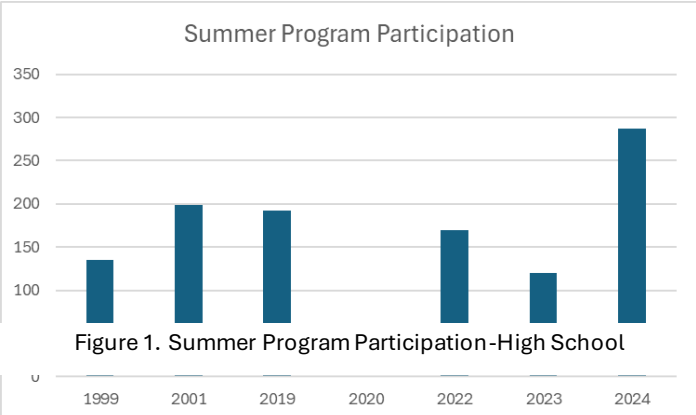

Figure 1. Summer Program Participation-High School

SEA's vision is to provide a summer experience where students explore engineering concepts not taught in the classroom while building their self-efficacy as engineers. In hopes of leading them to a pursuit of post-secondary education, SEA aims to support their ability to solve the problems of tomorrow and to make our communities healthier, happier, stronger, and more efficient. This vision is supported by the program's objectives:

- Introduce students to fundamental engineering concepts
- Promote teamwork and collaboration among participants

- Provide practical experience through projects and workshops
- Ignite interest in STEM careers

Increasing access

The College of Engineering has long sought to bring college-level courses to high school campuses across the state. ENGR 102HS has seen consistent growth in site participation and student enrollment through district recruitment and networking efforts. To expand the program's reach, several strategic processes have been implemented throughout the program's existence. More recently, a stronger focus has been engaging schools in historically marginalized communities. This effort is supported by Arizona Senate Bill 1717, an incentive program that financially benefits schools, students, and teachers at public and charter schools for participating in dual enrollment programs [4]. Although recruitment efforts are more focused, we do not exclude any high school campus from offering the course if a qualified instructor is available, and if the program proves successful on the hosting campus.

Some of the strategies employed for increasing access to the program include transferrable credit, high school campus instructors, instructor summer workshop, reduced tuition and tuition grants, targeted recruitment, and campus engagement.

Transferrable credit, instructors, and summer workshop: From the initiation of ENGR 102HS, key elements included transferrable credit and DCCs who work full-time on participating high school campuses. The three credit hours earned by students after successful completion of the course transfer to any public university in Arizona and to most out-of-state institutions. Depending on the chosen major and institution, how the credit transfers, as a general elective, towards the degree, or in some other form, varies. Some institutions request to evaluate the course syllabus before awarding credit for the course. These institutions will generally receive both the university syllabus for the on-campus course and the unique syllabus from the hosting school site. Offering transferable credit ensures that students who attend these institutions do not have to worry about the financial value of the course. Acknowledging that credit may not transfer to a small number of out-of-state institutions or may transfer as elective credit allows students and their parents or guardians to make informed decisions about their enrollment as university credit-seeking students.

Designating campus colleagues who have qualifications to teach on the university campus, but teach on the high school campus, allows for a greater likelihood that students will enroll in the course. The on-campus sections of the course remove the need for transportation to a local college, therefore increasing accessibility. Students can work with a familiar group of peers and campus faculty, allowing for a more seamless transition to college coursework.

All new DCCs must attend an annual summer workshop to be trained in the course's core curriculum. In the first year of the program, only one DCC offered the course on a high school campus, therefore a summer workshop was not required. The sole DCC worked on a seed grant team to develop and launch the dual enrollment program. The following year, four new public and one private school joined the cohort adding five new DCCs. That summer, DCCs were provided with jump drives containing documents that outlined the program and provided the necessary curriculum, but they did not attend a summer workshop. An additional seven public

and one private school joined the program in the third year. As a result, in 2010, the college initiated a summer workshop for DCCs that continues to be held annually.

Time	Monday, July 8, 2024	Time	Tuesday, July 9, 2024
8:15-8:45	Teacher Check-in	8:00-8:30	Solar Oven Discussion and Excel review
8:45-9:00	Welcome	8:30-11:00	Excel/Modeling
9:00-9:15	Intro: What is the dual enrollment program	11:00-12:00	Build Solar Oven
9:15-9:45	Dual enrollment-On-Campus Team Building Activity; Login to LMS	12:00-1:00	Lunch
9:45-10:00	Break	1:00-2:00	Build Solar Oven
10:00-12:00	Design and Build Solar Tracker	2:00-4:00	Test Solar Ovens
12:00-1:00	Lunch	4:00-5:00	Solar Oven "Aftermath" Discussion
1:00-3:00	Solar Tracker Polishing & Complete Catstudio Online Module again & Start printing parts for Solar Tracker-Take Soft Break as Needed	5:30-?	Dinner at hosting resort
3:00-5:00	DOE Paper Helicopters Scope and Sequence	Post-Dinner	Hospitality Suite Social
5:30-?	Dinner at a local eatery		
Post-Dinner - ?	New Teacher Welcome Hospitality Suite		

Figure 2. Sample New Instructor Schedule

The annual summer workshop has expanded from three to four days. DCCs are housed at a local resort or hotel with lunch and dinner provided. A formal banquet to acknowledge accomplishments from the previous academic year is held on the evening of the third day followed by a social to build community among the DCCs and the program's administration. The first two days are dedicated to new DCCs and those who would like or need a review of the core curriculum (see Figure 2). During this time, DCCs learn about and engage in two required projects: solar ovens and solar trackers. They also learn about 3-D printer certification for students through the university's maker spaces and about design of experiments (DOE) for their classes. The final two days run conference-style. Faculty from the college and DCCs host workshops on experiments that can supplement the course. All attending DCCs receive professional development hours towards the state's continuing education requirements and presenting DCCs receive a small stipend for their time. The summer workshop provides the opportunity for DCCs to engage with the content they will teach and build community. Each DCC is paired with a campus faculty partner that provides a connection to the university and the main campus course. The DCCs can gain ideas and insights from their partners and share their successes.

Tuition and recruitment: Dual enrollment courses in the state through community colleges are often offered at no cost. However, the College of Engineering charges tuition of $496, which includes the $50 application fee and $26.50 mandatory fees assessed by the university. This is a significant reduction in tuition for a three-credit undergraduate course. As of Fall 2024, three units of undergraduate credit plus fees on the university campus total $1,989 (see Table 1) [5]. Tuition and fees for dual enrollment students are reduced by approximately 75%. For non-resident, traditional students, the same number of units amounts to $5,634 (see Table 2) [5], meaning non-resident ENGR 102HS students are paying roughly 9% of the standard undergraduate tuition rate.

In the spring of 2022, the college started offering need-based tuition assistance to remove the financial barrier for students who could not afford the reduced tuition rate. Students are referred for tuition assistance by their instructors who are familiar with students' needs. The application for assistance is simple to avoid introducing an additional barrier for applying students. Aside from minimal financial and demographic information, the application only asks two questions

related to the reasoning for enrolling in the course. Each response has a maximum length of 200 words with no minimum requirement. Most students who apply receive $396 in assistance and are asked to pay only $100 for the three units of credit.

Table 1. In-state undergraduate tuition and fees

Guaranteed Tuition & Fees

Units	Tuition	College Fees	Fees	Total
1 unit	$507.00	$75.00	$113.50	$695.50
2 units	$1,014.00	$150.00	$178.50	$1,342.50
3 units	$1,521.00	$225.00	$243.50	$1,989.50

Table 2. Non-resident undergraduate tuition and fees

Guaranteed Tuition & Fees

Units	Tuition	College Fees	Fees	Total
1 unit	$1,689.00	$108.00	$113.50	$1,910.50
2 units	$3,378.00	$216.00	$178.50	$3,772.50
3 units	$5,067.00	$324.00	$243.50	$5,634.50

The introduction of tuition assistance, along with Arizona Senate Bill 1717 [4], and reduced tuition rates have strengthened our targeted recruitment efforts. We have greater leverage in serving schools and districts with high populations of low-income students as defined by the Teacher Cancellation Low Income (TLCI) Directory [6]. The college highlights the benefits of reduced tuition for students, financial benefits to the school and students through state support, and school ratings on GreatSchools.org [7], as well as other state rating systems.

Engagement: DCCs are encouraged to visit the university campus with their students regardless of dual enrollment status. Twice each semester, the outreach and recruitment teams organize tours of labs and other engineering-related spaces. During the visit, students and DCCs engage with student ambassadors who lead tours and participate in student panels. Visitors can ask questions about majors and the student experience in the college. Often an information session addressing admissions requirements and the application process will also take place. Students visiting with an ENGR 102HS dual enrollment class are offered lunch at no cost. During the lunch session, a formal student panel is conducted in which engineering ambassadors share why they chose their engineering discipline and the university. A question-and-answer session is included as part of the panel. DCCs are invited to attend the college's senior capstone event, Craig M. Berge Design Day, each May. During this visit, students engage with seniors who participated in solving a real-life engineering problem posed by a sponsor with some of these projects leading to patents. Tours are not conducted during this event because of the large scope of projects to explore.

If DCCs are unable to visit the campus with their students, they are welcome to request a visit to their campus by student ambassadors, a member of the outreach team, or a departmental partner. Some of our most active partners for these requests include the Materials Science and Engineering department and the School of Mining and Mineral Resources. The outreach and recruitment teams regularly attend college and career days on high school campuses. Engaging participating schools with site visits to or from the college allows the college to nurture a sense of belonging for students, and DCCs. DCCs are given personalized attention for their classes during visits to strengthen relationships with them and their students. Students enrolled in dual credit may be more likely to attend the university because of a sense of familiarity and belonging. Those who are not enrolled as dual enrollment students may also begin to build a sense of identity in post-secondary education through the college's site visits.

Summer Engineering Academy

Increasing access to summer camps on a college campus has involved several strategies to increase inclusivity, affordability, and engagement for a broader range of students and community members. Strategic processes for increasing accessibility include reduced registration fees, local and national industry partnerships, collaboration with other campus programs, day and overnight camp options, hands-on projects, and targeted recruitment in under-resourced communities.

Reduced Registration Fees: By offering a reduced cost of summer programming, it ensures access to camp programs from all socioeconomic backgrounds. Summer program fees are significantly less than competitive programs from other state universities. This enables participants the opportunity to attend summer programs and not be impacted by financial need. SEA also has needs-based waivers that cover part of the camp fees, making it affordable for participants who may otherwise be unable to afford the summer program.

Local and national industry partners: Industry partnerships provide financial support for camp programs, registration fee waivers, or resources for special events, such as planned field trips. Local companies also donate goods and services, such as equipment, supplies, and facilities to enhance camp experience. Collaboration with industry partners develops relationships that encourage specialized programming that align with current trends and skills needed in the engineering workforce. Past partners include Caterpillar, BOSCH, NueroTinker, Cummings Aerospace just to name a few.

Collaboration with other campus programs: Collaborating with campus programs for a camp can significantly enhance the program's impact and reach. Working with the Campus Recreation Center, the Main Library, Native American Science and Engineering Program (NASEP), and student groups such as TRiO associated with Pima Community College to design camp curricula that promote inclusivity, cultural awareness, and social justice. The summer program integrates topics related to current challenges in society, environment, and technology into camp activities. Campus partners assist in outreach efforts to attract a wide range of participants, ensuring representation from various backgrounds including those from under-resourced communities.

Day and overnight camp options: Providing day and overnight camp options ensures a greater opportunity for access that meets the needs of participants. Because overnight camps tend to be more expensive and require participants to remain on campus overnight, day camps provide the

opportunity for participants to attend camps at a lower cost and return home at the end of each day. Both camp options are themed around an Engineering Grand Challenge [8] which provides participants with the opportunity to choose the program that best meets their interests in engineering. Throughout Summer Engineering Academy, participants engage in curricula provided by current engineering faculty, staff, or students, which increases their exposure to various engineering disciplines offered at the University of Arizona.

Hands-on projects: Hands-on projects and presentations are essential for engaging students and reinforcing learning, and they are a staple in SEA. These hands-on projects not only expose participants to valuable engineering concepts but also enhance teamwork, communication, and presentation skills—key components of any engineering career.

Targeted recruitment: Targeted recruitment for SEA involves strategic planning and outreach to attract a diverse and motivated group of participants. Throughout the school year, we collaborate with schools, teachers, and students across Arizona who express interests in summer programs focused on STEM. Strategic recruitment strategies include partnerships with local and state schools to inform students about registration fee waivers, identifying outreach foci such as age groups, interests indicators (e.g., STEM), and under-resourced communities, marketing materials that highlight the benefits and unique aspects of camps, as well as maintaining engagement with camp alumni through newsletters and personalized communications throughout the academic year.

Conclusion

Dual Enrollment

Since 2008, student enrollment in ENGR 102HS has increased year over year (see Table 3). In the 2024-2025 academic year enrollment trended towards 420 students. Four hundred students enrolled for the fall semester, with three sections operating in the spring for another 15 students. From Fall 2021 through Fall 2024, the program saw a growth of 15%. Of the students participating in the dual enrollment program, the number matriculating to the university after high school has more than doubled and represents approximately 11% of incoming first-year students to the college in fall 2024.

The number of schools participating in the program has fluctuated (see Table 3). This appears problematic at first. However, fewer DCCs have served more students through ENGR 102HS. In the 2024-2025 academic year, 37 schools and 38 DCCs remained active in the program.

Table 3. Dual Credit Enrollment and College Matriculation

Academic Year	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
Enrollment	21	82	197	295	303	301	317	291	316	289	301	365	278	368	374	395
Matriculated	5	25	38	51	54	42	61	42	45	51	46	42	42	43	NA	88
High Schools	1	6	14	20	22	29	38	35	37	37	34	34	31	30	28	32
***School Districts**	1	5 +1	8+2	13+2	14+4	16+4	20+5	20+6	21+6	21+6	19+6	19+6	17+8	17+8	13+8	15+10

*The first number indicates the number of public-school districts. The second number indicates the number of private schools

schools

When we examine underrepresented communities, we consider gender and ethnicity. There has been a minimal increase in the number of female students participating in the course (see figure 2). While we would like to see a greater number of female students enrolling in the program, we are excited to see that the number has remained consistent. The percentage of female students in the dual enrollment program is similar to that on the University of Arizona Campus, and others, who study engineering [9].

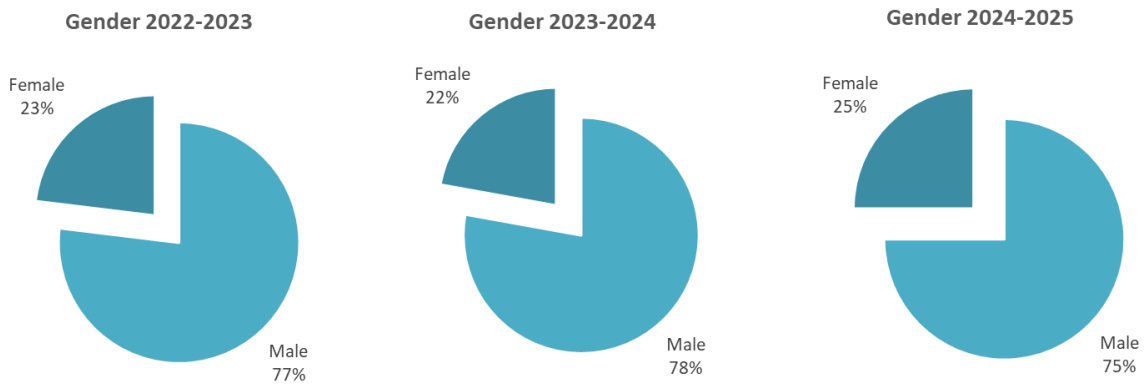

Figure 2. Enrollment percentages by gender in the dual enrollment program

Upon examination of participation as it relates to ethnicity, a trend was disovered. Starting the Fall 2022 through the Fall 2024, the number of students choosing not to report their ethnicity increased (see figure 3). Because we are situated near the Mexican border, it begs to question if recent changes in laws concerning immigration may have influenced this choice. We have seen a decline in reporting for all ethnic groups, including those identifying as White, except international students. This also makes us wonder if students from all ethnicities worry about current political environment, or if they do not report this information for privacy purposes.

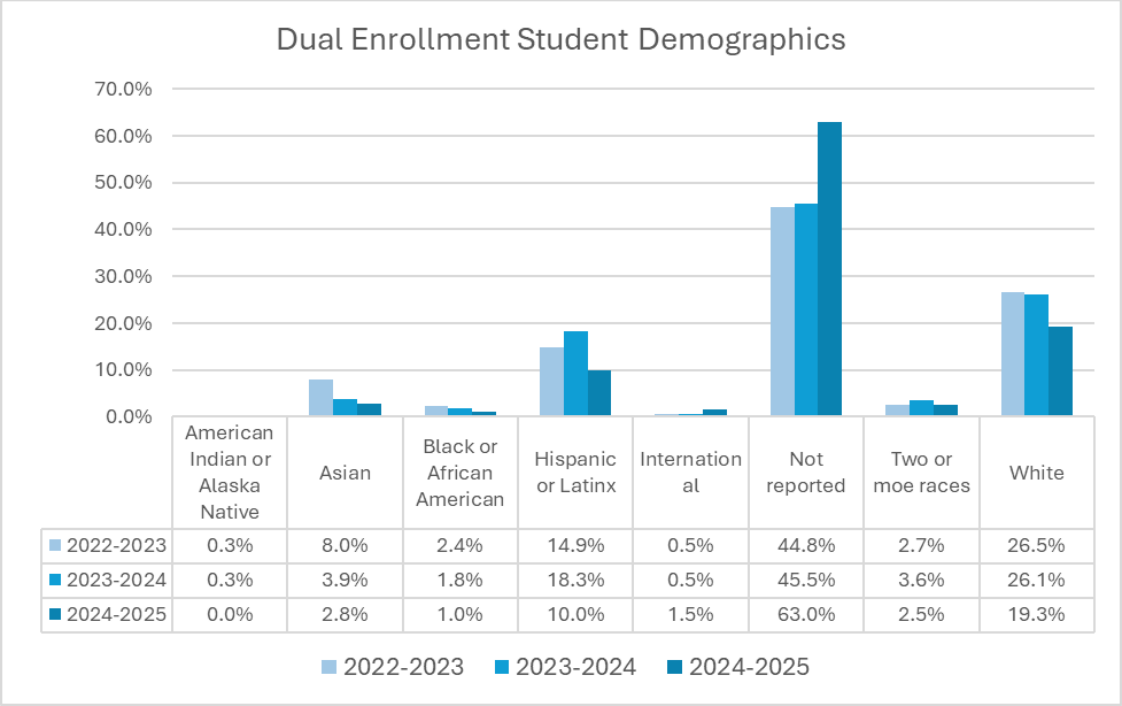

Figure 3. Ethnicity of dual enrollment students

Finally, as we consider the goal of increasing high school students' belief in their ability to pursue and succeed in the engineering profession, we examine student responses to one of the questions posed on the course survey. Students were asked about the impact taking ENGR 102HS had on their interest in becoming an engineer. When comparing the academic year 2019-2020 to the academic year 2023-2024, we can see that there has been an increase in the number of students stating that their interest in engineering either did not change or has increased (see Table 2). Meanwhile, the number of students who display a decrease in interest appears to remain steady over the past three survey distributions.

Table 4. Dual enrollment student survey response: self-concept

How was your interest in becoming an engineer affected by the dual enrollment course?									
Academic Year	15–16 n=363	16–17 n=324	17–18 n=400	18–19 n=330	19–20 n=128	20-21 n=288	21-22 n=272	22-23 n=305	23-24 n=319
increased significantly	31.9%	24.2%	22.1%	23.9%	21.1%	18.5%	23.9%	26.5%	27.4%
increased somewhat	40.7%	41.1%	41.3%	41.8%	42.2%	43.7%	35.3%	41.83%	42.3%
did not change	20.5%	24.2%	29.6%	27.9%	26.6%	30.8%	32.0%	21.9%	21.1%
decreased somewhat	5.5%	9.0%	5.7%	5.5%	7.8%	5.6%	6.6%	8.5%	6.9%
decreased significantly	1.9%	1.5%	1.2%	0.9%	2.3%	1.4%	2.2%	1.31%	2.2%

Summer Programs

This long-running high school summer program continues to provide access to engineering majors offered at the University of Arizona. The summer program prides itself in offering future engineering students the opportunity to build an identity as college-bound engineering students [10]. Summer programs continue to grow in popularity due to accessibility to middle and high school students and because the programming and curriculum is meaningful and engaging.

As observed in Table 6, in 2023 there was a decrease in enrollment which can be attributed directly related to virtual programming and day-camp restrictions. This decline in seats available resulted in adaptations to programming and how camp offerings. When social distancing restrictions were lifted, in-person programming capacity increased. At the same time, virtual programs were no longer offered leading to a decrease in overall capacity.

Table 5. Modality of SEA

SEA Modality						
Year	Cancelled	Virtual	Day In-person	Overnight In-person	Cummings MS	Notes
2019				x		
2020	x					
2021		x				
2022		x	x			Days at SEA single days & Each week virtual (multi-day)
2023		x	x		x	Days at SEA 4-days & Two weeks virtual
2024			x	x	x	
2025			x	x	x	

Table 6. Number of seats filled

Year	Number of Seats filled
2019	250
2020	-
2021	200
2022	286
2023	120 + 40
2024	287 + 105
2025	204 + 105 (registrations as of April 2025)

Due to the popularity of the day-camp programs, residential camps were reintroduced in Summer 2024, and the capacity for day-camp options was increased. Day-camp programs, previously capped at 20 participants, were set to a75 seat capacity. Overnight camps, previously set at 50

participants, were set to a 40 participants due to the nuances of the programming and staffing requirements.

Middle school programs also saw an increase in registration. Program collaborations continued with Cummings Aerospace to ensure additional seats were available for middle school students. While at first adding more seats appeared as a daunting task, during the second year registration process, the registration met capacity within 24 hours. Programming was modified and adjusted to accommodate the 105 participants. Students who were not initially able to register were placed on a waitlist and were eventually accepted into the program. Consistent daily attendance suggests that students were engaged and excited to participate in the robotics engineering concepts they were learning.

Not only has participant enrollment increased in the middle and high school summer programs during the 2024 season, but the student population has become more diverse. As observed in Figures 4 and 5, there has been an increase in the number of participants from underrepresented groups participating in the summer programs compared to the 2023 season. This may be attributable to the expansion of the camp offering beyond participant from just one school in 2023, to schools from various districts and areas in Tucson.

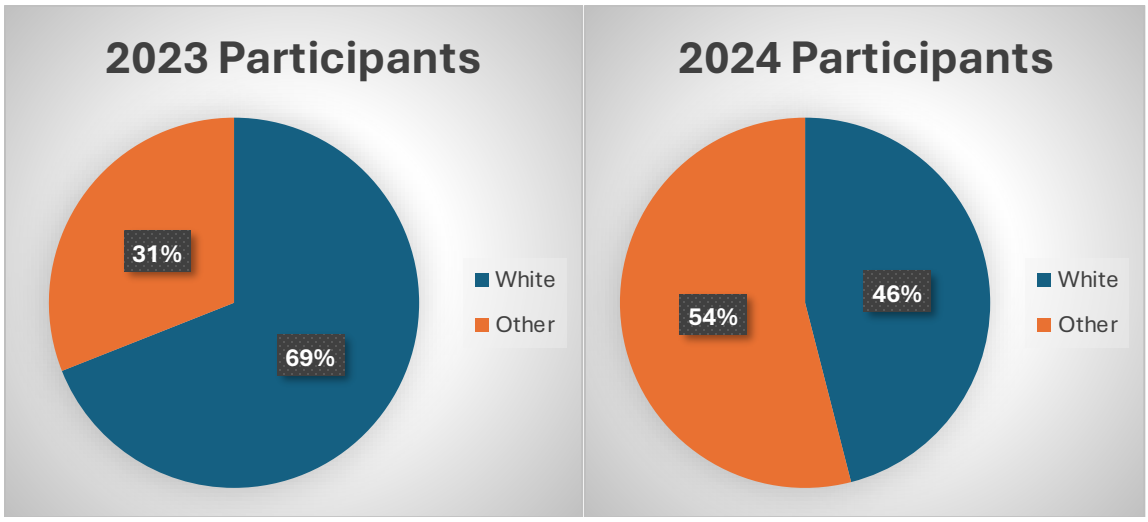

Figure 4 High School Summer Program Participant Demographics

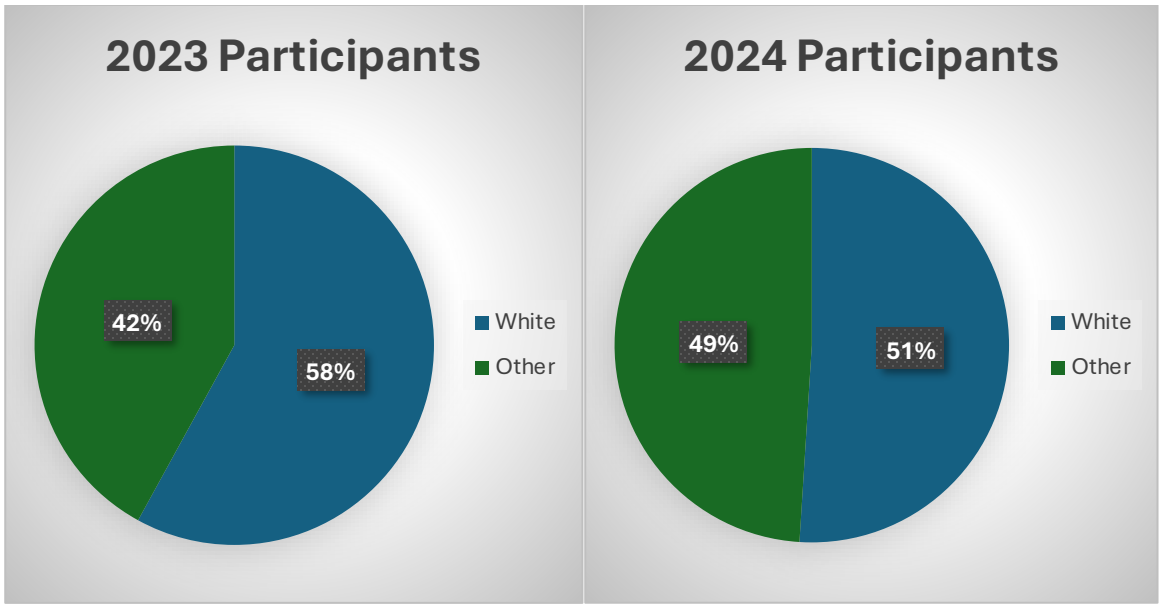

Figure 5 Middle School Summer Program Participant Demographics

In addition to making summer programs accessible to a diverse population, SEA aims to increase the number of first-generation students who participate in camp (Figure 6). By increasing the percentage of first-generation attendees, the program can better serve as a pathway into STEM for post-secondary education. In this way, we can assist and encourage students who have the goal of being the first in their families to complete a college degree. The summer program seeks to offer more registration fee waivers to those who apply to increase the number of first-generation participants.

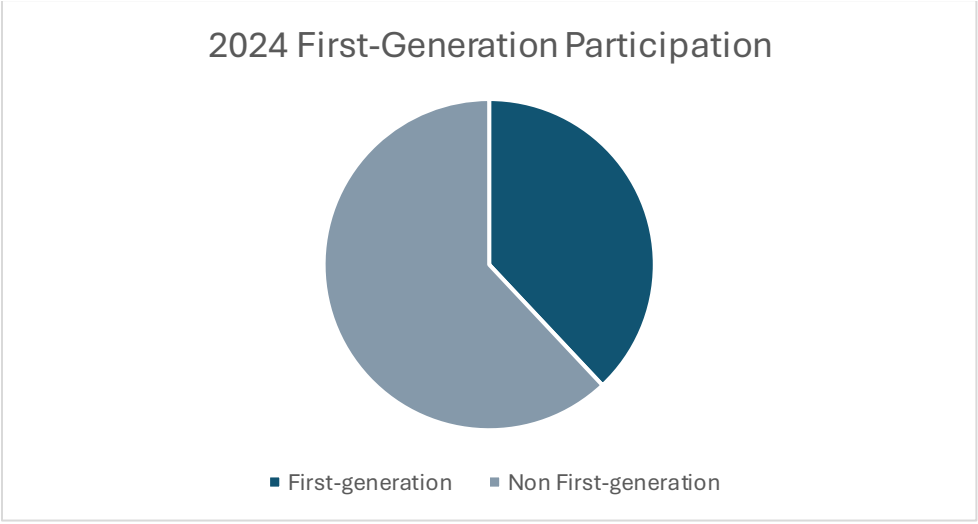

Figure 6 First-Generation Participation

Through the engineering pathway, the summer programs provide students with exposure to content and hands-on programming that initiates or strengthens participants' engineering identity. SEA is designed to support participants' self-efficacy [10] in engineering through hands-on projects, direct access to the college faculty and staff, and the ability to be surrounded by like-minded peers with an interest in engineering. Participants who have attended SEA have

indicated that they are either more interested, or maintain about the same level of interest, in pursuing a career in engineering based on post-program surveys. (Figure 7).

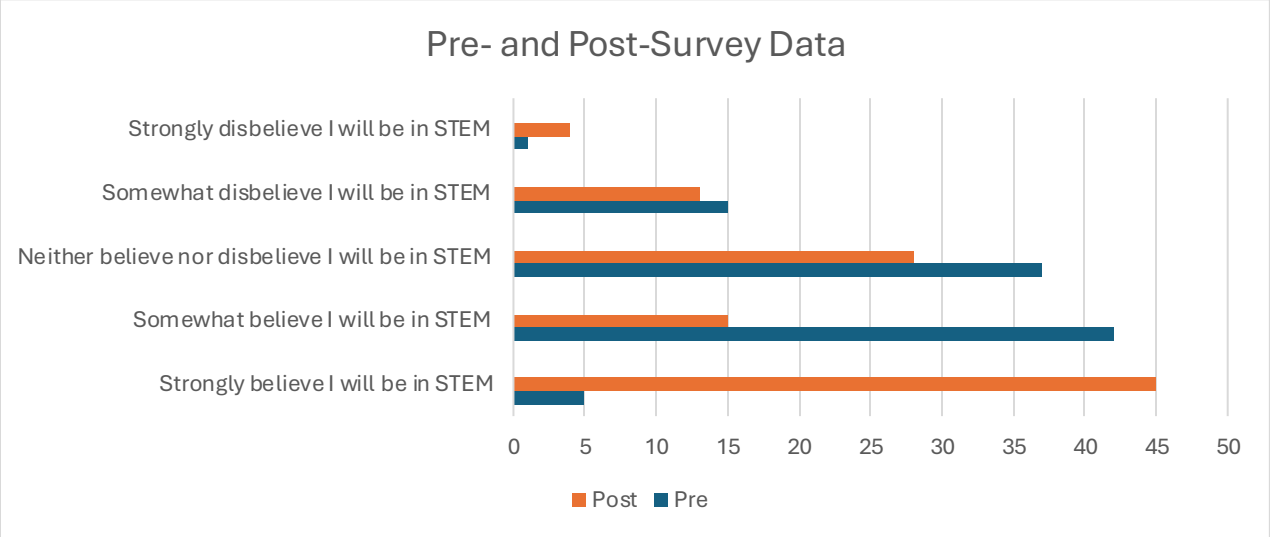

Figure 7 2024 Summer Program Pre- and Post-camp Career Survey

While participants reflect on their interest in pursuing a career in engineering, what is more relevant is their engineering self-efficacy [10]. Participants often believe they can pursue a career in engineering or STEM more than they did before attending the summer camp. Participants were surveyed about their belief in their abilities to attain a career in engineering or STEM. We examine participant response in a pre-participation and post-participation survey on the belief in their abilities (Figure 8). The outcome indicates that participants are more confident in their ability to pursue an engineering or STEM career after attending SEA indicating a higher self-efficacy [10] in engineering because of their participation.

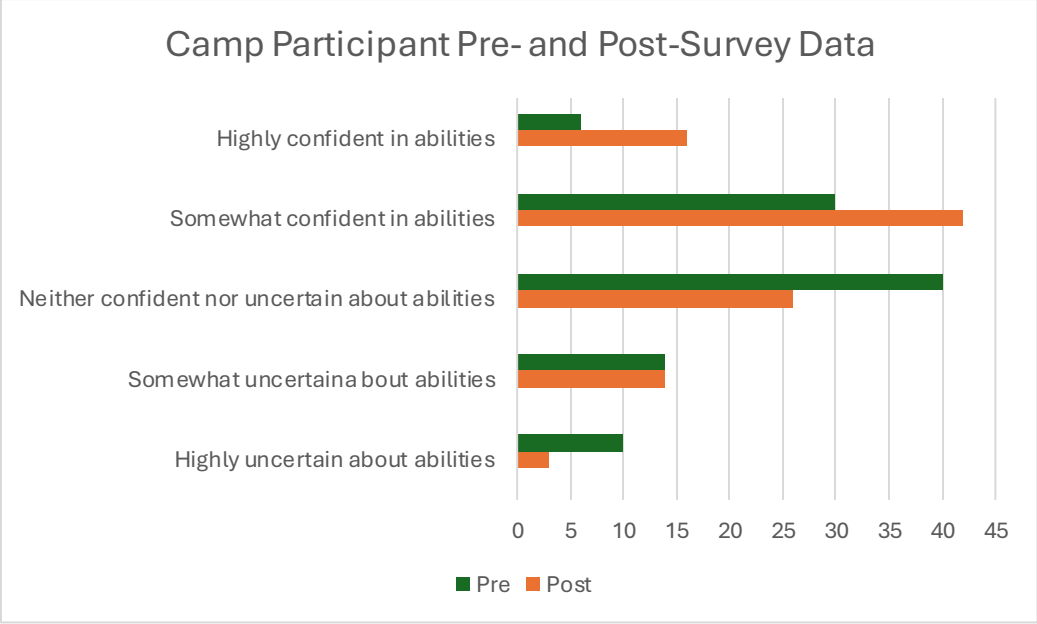

Figure 8 2024 Participant Self-Efficacy Survey

Next Steps

Dual Enrollment

Growth: While we are excited about program growth, we acknowledge that we hope to expand beyond our current offerings and geographic reach. One such consideration is how we might meet the goals of growing beyond Southern Arizona into Northern Arizona, or in rural communities. We would also like to consider what impact we might have at a national level. Some opportunities have recently presented themselves organically. We have been asked by two out-of-state high school instructors to collaborate in building a similar program at their sites without being identified as dual enrollment sites. We are in the preliminary stage of exploring this option, but we consider the broader impact on students through collaborations with high schools and other post-secondary institutions outside of Arizona and how those collaborations can impact the evolution of ENGR 102HS. Because the program is mostly self-sustaining through tuition dollars, collaboration with other institutions could open an opportunity for stronger financial stability and sustainability. By offering other institutions and individuals the opportunity to join our summer workshop, or other professional development opportunities, for a fee, we may be able to decrease cost of enrollment for students, offer a greater number of tuitions grants, or provide more supplies for our cooperating school sites. Finally, by extension, these partnerships would allow us to engage a larger number of high school students in engineering so that they may start building self-concept [10] even if they are not enrolled in a dual enrollment course through the University of Arizona.

Increasing Diversity: While we are not disappointed with the number of females participating in the program, we aim to further engage females in engineering and STEM. The majority of our engineering ambassadors (student representatives of the college) are female, and they attend many of our recruiting events, exposing high school students to female engineers. It may be fruitful to have those same students visit the science and math classrooms of the schools offering the course to talk about their experience in the college and how those experiences have impacted their career choice(s). We will continue to promote the program to all students while providing connections to the female engineering student population.

Because of the decline in ethnicity reporting, it is difficult to know how diverse the program truly is when it comes to ethnicity. However, we continue to market and recruit teachers, schools, and districts in as many cities and neighborhoods as possible to continue serving students from all demographic groups and backgrounds.

One consideration we have not addressed when distributing the course survey is socioeconomic status. While this can be a sensitive topic, it can provide valuable information when considering how to better serve our students and provide leverage in seeking financial support. In the past, the program has garnered grants and industry partnerships to financially support the teacher workshop and student financial needs. These funding opportunities have waned. As we move forward, we will apply for DCC and student support grants and work towards industry partnerships.

Summer workshop: Historically, the first two days of the summer workshop are led by one of our main campus faculty instructors. This summer, it will be led by two of our DCCs. This change was made because of college faculty availability and the positive feedback received from first-year DCCs upon interaction with veteran DCCs during last year's summer workshop. This

opportunity, and others like it, allow us to give DCCs ownership of the program and to value their expertise. By providing more opportunities for DCCs to own the course that they teach, we hope to increase teacher retention and program success.

Summer Engineering Academy

The Summer Engineering Academy impacts various students from diverse ages, regions, and demographics. Moving forward, the summer program will continue to expand as a recruitment and outreach program by recruiting intentionally from strong partner middle and high schools; and expanding reach to new areas and districts, continuing to raise funds for registration fee waivers, securing new corporate partners to raise funds for curriculum, supplies, and registration fee waivers, identifying and pursuing grants that align with SEA's mission and vision, increasing the number of first-generation students who attend SEA, and increasing the number of participants from under-resourced communities who attend SEA.

Summer 2025 the summer programs will continue hosting two weeks of overnight programs, five weeks of day-camp programs, and a one-week middle school program. Overnight and middle school programs continue to grow in popularity as registrations are already at capacity with waitlist status as of April. Day camps are not as popular. One suspected reason for this is that there may be too many options to choose from. An evaluation of Summer 2025's final registration numbers and feedback will assist in determining next summer's programming needs.

Overall, we are excited about both programs' growth. We acknowledge there may be gaps in both programs' reach and seek ways to address them. We look to gather useful feedback from our participants and cooperating partners so that we may evaluate the programs' impact on STEM engagement for students, and to use the findings to improve and evolve these offerings.