

Streamlining the Path from Community College to Engineering Degree Completion

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The LINK scholarship program at the University of South Alabama supports students transferring to the College of Engineering, primarily from community colleges in the Gulf Coast region. Supported by the NSF S-STEM program, the project “Linking Community College Students to Engineering” offers funding to academically talented students of low income and having demonstrated financial need. The University of South Alabama is a public institution and has reciprocity agreements that grant in-state tuition to students from coastal counties in Mississippi and the Florida panhandle. While the LINK scholarship is not limited to students transferring from specified institutions, the majority of our transfer students come from four institutions in coastal Alabama, Florida, and Mississippi. Award criteria include an assessment of student academic performance, especially in mathematics, chemistry, and physics courses. To be eligible for the scholarship, there must be a path to graduation in three academic years, with preference given to students who have a two-year pathway. Academic performance in the community college is also evaluated more broadly based on grade point average, with a minimum eligibility requirement of 3.0.

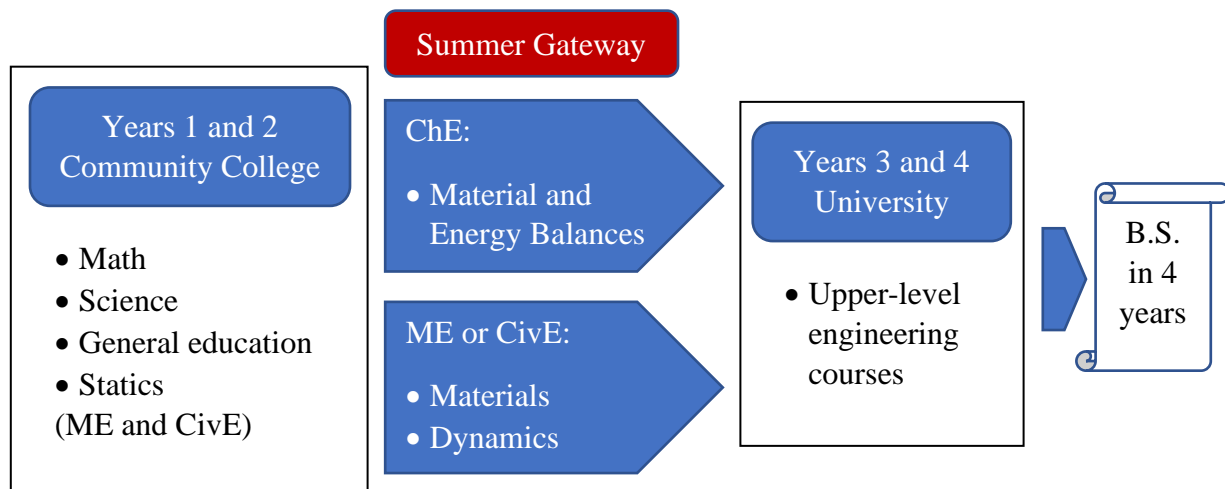
This project is the second S-STEM project to fund the LINK scholarship. The first project was funded from 2011 to 2016 and offered two-year scholarships to transfer students. A lesson learned in that project was that most transfer students to our engineering programs required three years to graduate post-transfer, even if they had already spent two or more years enrolled at their respective community colleges and completed an associate’s degree. The reason for this extended time to degree completion is that each curriculum has one or two sophomore-level engineering courses that are not usually available at the community colleges. Because these gateway courses are pre-requisites for the third-year curricula which operate on an annual schedule, new transfer students were not ready to join the third-year cohort in the fall.

A pathway to a bachelor’s degree through community college is an accessible opportunity for financially challenged students and is seen as a means of achieving a more diverse engineering workforce.[1] Reducing time to graduation is a common institutional objective in higher education, but it has specific economic importance for low-income transfer students to engineering colleges. The post-transfer financial impacts can occur in several ways. If students have completed most general education courses in community college, they may not have sufficient degree-required courses to fill a full-time schedule for three years, and thus receive reduced financial aid packages. To maintain full-time student status for financial reasons, they may have to enroll in, and pay for, additional courses. Less immediate, but perhaps more important in the long term, students who must delay graduation also postpone professional engineering employment and its associated compensation. A major goal of the current project is to reduce time to graduation for transfer students, especially those who have completed, or almost completed, an associate’s degree at the community college level.

One possible way to shorten average graduation time for transfer engineering students is major curricular redesign to remove those second-year prerequisite courses. This would likely have a negative impact on the quality of the curriculum for “native” students. Another strategy is to invest significantly to increase instructional staffing to accommodate teaching upper-level engineering courses every semester, which is often not tenable. Our approach is instead to intervene through advising prior to transfer to ensure that students know what to expect and how to prepare. To accomplish this intervention, we are focused on building relationships with community college faculty and advisors, providing them with resources to offer students informed guidance in the year before they transfer. Ensuring that those who advise students before transfer are knowledgeable on the post-transfer curricular requirements is critical to facilitating their post-transfer success. After transferring, student support services are provided to encourage integration of new transfer students into the College of Engineering community, as a sense of belonging is integral to promoting academic and professional success.[2]

Communicating degree pathways

For three of our degree programs, chemical, civil, and mechanical engineering, we have identified courses that can be accomplished in the summer prior to full-time transfer, shown below. If a student is well-advised at the community college level, the first two years can cover all of the pre-requisite courses for moving into the upper-level engineering courses. In the second summer, students can then complete the gateway courses such they join the third-year cohort in the fall and progress toward a four-year degree completion.



This is a fairly straightforward message, but we find that it has been largely missed. Students who are made aware of the need for summer courses are generally willing to take them, so the crucial factor is that they are *made aware*. Given that, their faculty and advisors at the community college are an essential link in the process, and building collaboration instills buy-in that ensures the message is conveyed. We have learned from those faculty that even students

transferring to other universities appreciate the message on gateway courses as they find that similar pre-requisite courses exist in other programs as well. This likely does not surprise the engineering educator, but it is not common knowledge among community college faculty.

Dissemination of the curricular information needed is accomplished through three primary channels. First, an annual meeting is held that brings together community college faculty and advisors with College of Engineering faculty, advisors, and administrators. Also included are representatives from offices that serve new transfer students, including transfer admissions and financial aid. These meetings have promoted an atmosphere of collaboration centered on the recognition of our common definition of student success: completion of the bachelor's degree in engineering. While building camaraderie and strengthening partnership is a long-term goal of these gatherings, the key immediate objective is to convey an awareness of the critical importance of the gateway courses in our curriculum.

In addition to those meetings, a mechanism of communication and resource sharing is a site on our learning management system to which the community college faculty and advisors are invited. Modules posted there contain complete curriculum sheets for all of our engineering degree programs, tailored for each feeder community college such that the first two years match their course numbers. The site enables easy access and updates to this information, and allows faculty at the community colleges to advise students along the same first- and second-year pathways that students enrolled in the university programs follow. Information on transfer scholarships, particularly the USA LINK program, are included here as well. Contact information for specific faculty members in each degree program who have expertise advising transfer students is also posted.

A final means of communication is directly to the students through Pathway USA, an institution-wide program that offers pre-transfer advice at partner community colleges. Students who are enrolled in the program can visit with University of South Alabama transfer advisors on a regular basis on their respective campuses. We employ both the LMS site and our annual meetings as platforms to inform the faculty about this resource so that they can in turn encourage their students to take advantage of it. Students who enroll in Pathway USA more than a year before transfer are most likely to benefit from the program.

Potential curriculum challenges

In designing the transfer curriculum sheets, other potential challenges and opportunities came to light. One is that some community colleges are unable to offer even the prerequisites to the gateway courses identified; the pre-requisite course in statics is a prime example. Still, early awareness that it is needed increases the likelihood that students will find other means to complete it, whether by an online course or by transferring a semester earlier.

Another challenge we found was that curricula that have more basic science courses in the first two years (for example, the chemistry courses in the chemical engineering curriculum) delay

some of the general education courses, like history or literature, to later in the program. Students who transfer with all of those general education courses completed might find themselves in their final year with insufficient credits to fill a full-time course schedule, resulting in a reduction of financial aid due to the change in student status. Still, those courses are required by the community colleges for an associate's degree, which is a critical part of their success metrics and has implications on their funding in performance-based environments. Here, a potential solution lies in reverse-transfer articulation agreements, which enable credits taken post-transfer to be credited toward associate's degree completion. Once again, success in implementing that solution requires a trusting relationship with community college faculty, because it involves their advising students to transfer before the A.S. degree requirements are met.

Now in the second year of our efforts, we are seeing effects in some programs. The most significant change thus far has been in transfer student status in the chemical engineering program. In the past academic year, 40% of transfers to chemical engineering enrolled in the summer material and energy balances course and were able to join the junior cohort in the fall, compared to 17% in the prior year. In civil engineering, 22% had completed prerequisites for junior courses, up from 13% the prior year. In mechanical engineering, there is much room for improvement – no new transfer students were prepared to enter the third-year cohort; only one had been in the prior year. The difference between programs is a topic for future investigation. It should be noted that overall new transfer enrollment was down 50% this year, which is attributed to the effects of the pandemic.

Easing the transition to ensure student success

The aim of the work on communicating curricular pathways is to ensure that students have a streamlined path to graduation after transferring, but of course that does not necessarily make the transfer to a new university easy. Strategies employed by the LINK scholarship program focus on integration of new transfer students into the College of Engineering culture and on professional planning and skill development. We recognize that extracurricular involvement and leadership experience while an engineering student are important aspects in professional development, but that a two-year timeline makes them difficult to achieve without intentionality.

Efforts to integrate new transfers include a zero-credit (no cost) seminar that serves to familiarize students with the college and university environment and resources. Resumes are written, evaluated, and edited, and visits from the career services offices make sure that students are aware of support services that are offered to help them find internships and post-graduation employment. During their first semester, the scholars meet repeatedly with their advisors to map out a plan to graduation that includes not only coursework but also professional benchmarks. These include joining student organizations, acting in leadership positions (not necessarily elected), and applying for employment. It is important for students to realize that the job application cycle begins only one year after transfer for students on a two-year post-transfer degree plan.

A further purpose of the seminar is cohort building, and activities are incorporated to promote interaction between the students, such as building and launching soda bottle rockets. In the future, those activities will include outreach events for high school and community college students; this year the pandemic has paused those efforts. In addition to strengthening the transfer cohort, we endeavor to help students find connections with others in their academic majors, both through peer leaders in the seminar and peer partners in their classes, with introductory meetings held with the advisors. The peer partners have been especially helpful in “plugging in” the new transfers to student-to-student communication pathways, i.e. social media applications, so that they are informed about informal study groups, included in discussions and made aware of other opportunities as they are available.

Future directions

Over the course of the project, we plan to investigate transfer student perception of the relative effects of the seminar, peer leaders, peer partners, and faculty advisors on their professional identity and sense of belonging in the college. This year, that study has been inhibited by the limitation in personal interactions due to the pandemic. Still, anecdotal evidence suggests two ways that the students who are most integrated have built connections. One is by taking a summer class and meeting classmates in a smaller online class. The other is by having multiple classes with another student in the LINK cohort. This knowledge will be useful to the advisors going forward into the last three years of the project, hopefully in a more interactive, in-person environment.

- [1] N. R. Council, *Enhancing the community college pathway to engineering careers*. National Academies Press, 2006.
- [2] C. T. Flaga, "The Process of Transition for Community College Transfer Students," *Community College Journal of Research and Practice*, vol. 30, no. 1, pp. 3-19, 2006/01/01 2006, doi: 10.1080/10668920500248845.