

Engineering Academy (EA) Design and Operation

Randy Brooks, Shana Shaw, LaTasha Starr

Engineering Academies
Texas A&M University

Abstract

An Engineering Academy (EA) is a cooperative agreement between a four-year engineering college and a two-year college designed to reach the students that regularly encounter challenges transitioning to the four-year college directly after high school. The students spend up to two years co-enrolled at both the two-year school and the four-year school and attend classes on the two-year school campus taught by the two-year school's professors. The students also attend an engineering course on the two-year campus taught in-person by a professor from the four-year school. [1] [2]

The EA concept was initiated in Fall 2015 with a MoU (Memorandum of Understanding) between Texas A&M University and Blinn College. Unique transition articulation agreements are established for each EA to best support transfer of student course credits to include a reverse articulation agreement such that students may transfer four-year school course credit to the two-year school in order to meet the requirements for their Associates Degree.

The four-year school professor tailors the course to include many elements of the four-year school in their course. This will include traditions, history, special activities, and events. The students are also transported to campus by bus three times each semester to engage with their EA peers from other schools as well as those EA students who have already transitioned.

The design brings the same course that is taught on the four-year campus to the two-year campus for those students needing to stay home to help the family or interested in a reduced-cost alternative to the full four-year campus experience.

The purpose of this paper is to briefly explore the history and design of the Engineering Academy, share the strategies enacted to ensure that the students connect with the four-year school, document current Engineering Academy professor perspectives on the EA initiative, and highlight details regarding Engineering Academy operation to include enrollment levels, retention, and demographic breakouts.

The paper will conclude with a projection of the Engineering Academy future to include expansion, enhancement, and consideration for expanding beyond engineering.

Introduction

The Engineering Academy opportunity appeared as one of many options related to a 2012 Texas A&M University initiative to increase the number of engineering students graduated in the state to address the projected shortage of engineers in the coming decades. The first students were enrolled in Fall 2015 and the initiative reach and enrollment continues to grow with over 2,000 students having now begun their journey through this program.

The challenge for some students interested in attending college is the need to move to the college location and the funding needed for housing, board, and tuition.

The Engineering Academy model allows students to stay local and take courses at a two-year school while also enrolled in the four-year school engineering program. The students then transition (not a transfer as they are already enrolled) to the four-year school main campus after two years of saving money on housing, board, and tuition at the two-year institution.

Challenge

Many students exit high school critical to family existence to include caretaking and income. While beginning college on their own in a new place is stressful on the student, often the family is scrambling as well as they attempt to fill the void left by the student departure.

In many cases, the student is asked to delay their collegiate careers until solutions for their absence can be implemented, or they begin school part-time at the local Two-Year college.

Both cases are very challenging for the student academically as the critical thinking skills developed in their regular engagement in an advanced learning classroom decline the longer they are removed from that space.

Course options in the digital/online space may slow this decline, yet degree-level products comparable to being a full-time student in-person at a four-year institution are not widely available and tend to be very specialized toward particular topics.

Two-year institutions are adept at addressing this student challenge as part of their primary service scheme. They have made great strides in developing a credit transfer program that allows students to complete their foundational studies at the two-year school and then apply to complete the next-level degree at a four-year school.

The challenge with engineering programs is that the majors available for transferring into are often limited so the students must pursue what is available.

Design

The goals of the Engineering Academy Design are to:

- Provide a lower cost option on the path to a B.S in engineering,
- Allow students to stay home to help early-on in their collegiate career,
- Be mutually beneficial for two-year and four-year schools,
- Ensure student is immersed in culture, including supports, of both schools,
- Provide learning and engagement levels commensurate with full four-year experience,
- Realize student benefits from unique experiences with on-site four-year school faculty.

The administrative teams for the two-year and four-year school set the foundation early with an agreement detailing course relationships between the two schools. This will largely mirror the existing transfer agreement yet may be more detailed and tailored to engineering specifics.

To most effectively manage registration, tracks with related two-year and four-year courses are often jointly developed to guide students through their registration in both systems.

Students attend all courses on the two-year campus and thus have the opportunity to engage in the activities at those schools. Students are also transported to the four-year school main campus for six diverse activities to ensure that they are included in the four-year campus culture as well.

These six events are:

- Tour the campus and meet the support team,
- Department Information Saturday,
- Football tailgate and game,
- Engineering Career Fair,
- Baseball game tailgate and game,
- Project Engineering Showcase.

The instructional team also delivers a weeklong pre-course session in a virtual environment prior to classes starting in the Fall that introduces students to what a transition to college entails, time management techniques, and what skills should be developed in order to set themselves up for success. [3]

The administrative team on campus continues to host events for those students that have transitioned to ensure that the EA cohort relationships are maintained and connected with the students' growing network.

A driving metric to consider is retention as most of the EA students would not have attended Texas A&M, or maybe not even taken college courses, without the EA option. Table 1 contains the % of total students and 1-year retention rates by demographic for the past 5 years. [4]

Cohort	Total Students	Total Ret.	Other	Other Ret.	Hispanic	Hispanic Ret.	Black	Black Ret.	Asian	Asian Ret.	White	White Ret.
2021CS	4,047	94.0%	6%	92.4%	24%	93.5%	2%	97.8%	19%	93.8%	49%	94.3%
2021EA	284				28%		8%					
2020CS	4,111	93.7%	6%	94.8%	23%	91.7%	3%	93.7%	16%	95.4%	52%	94.0%
2020EA	322	71%			39%		5%					
2019CS	3,599	94.9%	6%	94.1%	26%	94.7%	2%	94.1%	15%	95.6%	51%	94.0%
2019EA	276											
2018CS	4,088	93.2%	7%	94.8%	24%	90.8%	3%	89.7%	15%	96.6%	51%	93.4%
2018EA												
2017CS	3,860	91.7%	6%	90.0%	25%	89.2%	3%	90.8%	13%	94.6%	53%	92.5%
2017EA												

Table 1. Retention Rates and Volumes by Demographic

Perspectives

The initial start of the EA semester can be confounding for the students as they learn to manage two different email accounts, two different school calendars and events, and two different LMS platforms.

The benefits reaped are:

- Up to four semesters with the same four-year course professor (creating a known),
- Reduced tuition and housing costs,
- A cohort traveling through the same classes together,
- Connection maintained as helper at home,
- Academic and welfare support available from two different organizations.

Zoom has brought the students the ability to connect with peers from other EAs, main campus, or even each other. There are also many student programs on the main campus that bring a Zoom aspect to their regular meetings.

The four-year professor on the two-year campus is the instructor for all four-year course lectures as well as guiding the lab time.

All first-year engineering students at the four-year school take the same engineering courses which simplifies the courseload for the four-year professor on the two-year campus. The current 4 semester flow is:

- Computational Thinking
- Engineering Mechanics
- Engineering Electricity/Magnetism
- Engineering Economics

The professors have the freedom to tailor their course content to be more inclusive of what their students bring to the course. The professors also teach the lab sections, which are taught by Teaching Assistants on main campus, which provides the professor with a different perspective on student engagement with the curriculum materials and physical student practices.

Following are some professor observations regarding their EA experiences:

“The professor actually prefers teaching at the EA due to the increased diversity among the students. A much larger age range, mix of socio-economic status, and family status can be seen in the EA two-year school as compared to the four-year school.”

“Helping to fill the shortage of engineers in Texas is a daunting task and the EA program helps to bring the idea of a bachelor’s degree in engineering into a reality that many of the EA students never considered as a possible scenario if not for the EA.”

“As an alternate pathway with the threefold goal of increased access, affordability and completion we can see the progress and growth of the program with newly added academies and a student count that is 7.5+% of the undergraduate engineering population.”

“We like to tell our students that they are Aggies from day one and spend resources on the freshmen to help them feel that way. One concern I have is that those students who remain for their third/fourth semester do not get that same love.”

“The EA is a rewarding experience for both the professor and the students because of the close-knit community that is formed with each new cohort. Professors have the privilege of connecting with students early in their college careers and helping them to develop both academically and professionally.”

“The unique experience of togetherness encountered at the EA, creates a sense of accountability and expectation that is unique to the level of familiarity that the EA produces from both a student and faculty perspective.”

“As an engineering academies professor, I experience different challenges and opportunities with the engineering academies students than a professor on the main campus. For example, engineering academies students commute to the local community college campuses, often have part-time jobs, live at home, and have family responsibilities conversely different than their peers located at the main campus.”

“The EA is largely populated with students that experience ‘imposter syndrome’ as the EA design is not a common scheme, and most students in their situation would not be attending a 4-year school. It is rewarding to help develop these students and see them feel accepted by the time they complete their EA course sequence.”

“Students in the EA have the opportunity to work with the same faculty member and other cohort students over two to four semesters, creating a strong cohort bond.”

Future

Refinements to the deployment model have created a design that is well-structured for new launches. The current program involves 7 two-year schools with 3+ currently in discussions regarding details of potential launch on their two-year campuses.

Explorations are underway to expand this design beyond engineering. A key to the engineering implementation is the common curriculum for the first three semesters. Without such a structure in place, the four-year school administration team will need to develop a palette of courses for academy students to select that is supportable by a four-year faculty member. This palette also needs to reasonably support some variety in the students’ degree plans. This variety may be in the form of expanded use of the two-year school’s offerings.

References

1. Engineering an Alternative Path. (2019, May 13). Texas A&M Foundation. <https://www.txamfoundation.com/News/Engineering-an-Alternative-Path.aspx>,
2. Texas A&M Engineering Academies Engineering Bachelors Programs. (2022, February 11). Texas A&M Engineering Academies. <https://tamuengineeringacademies.org/programs>
3. Brooks, R. (2022, August), *Work-in-Progress: Designing Pre-Course Sessions to Enhance Student Preparation* Paper presented at 2022 ASEE Annual Conference & Exposition, Minneapolis, MN. <https://strategy.asee.org/41589>
4. Student Retention and Graduation Goal. (2022, February 11). Texas A&M Accountability. <https://accountability.tamu.edu/All-Metrics/Strategic-Plan-2020-2025-Metrics/Student-Retention-and-Graduation>

RANDY BROOKS

Professor Brooks currently serves as the Texas A&M Professor at the Blinn College-Brenham Engineering Academy.

SHANA SHAW

Professor Shaw currently serves as the Texas A&M Professor at the Austin Community College Engineering Academy.

LaTASHA STARR

Professor Starr currently serves as the Texas A&M Professor at the Dallas College Engineering Academy.