

Board 267: Engineering a Transfer Friendly Experience with Alternative Pathways to Excellence

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Engineering a Transfer Friendly Experience with Alternative Pathways to Excellence

Abstract:

The Alternative Pathways to Excellence (APEX) program is an NSF funded S-STEM Track 2 project that seeks to strengthen efforts to recruit and retain STEM transfer students by integrating financial, academic, and practical supports.

The APEX program provides student support services, formal and informal mentoring, curricular and co-curricular supports, and cohort building activities all formulated to create accessible pathways into engineering careers for a population of academically talented students with low income and high unmet financial need.

Introduction:

The Alternate Pathways to Excellence: Engineering a Transfer-Friendly Experience (APEX) Program, is a six-year NSF S-STEM Track 2 program, which began in January 2022. The program is designed to increase recruitment, retention, graduation, and STEM job placement of low-income, academically talented students with demonstrated unmet financial need in the School of Engineering B.S. programs. Through APEX, the School of Engineering has opened a pipeline for low-income, academically talented students who begin their engineering education at a local community college. The APEX program recognizes that community college students need pathways into four-year STEM programs that offer streamlined credit transfer, are affordable and accessible, and provide specialized support to ensure their success.

The APEX program is designed to follow evidence-based practices to support transfer students' acclimatization and success in the engineering program, including cohort-building, mentoring and connections with internships. It has been shown that combining multiple strategies by developing cohorts to engage transfer students in STEM learning communities and using bridge programs and other holistic, targeted supports has proven to be an effective approach [1]. A cohort-based summer course and year-round activities organized through APEX support transfer students' acclimatization and success at UST [2]. The cohort learning model, combined with scholarship support, has been shown to have the potential to overcome the challenges of limited connection to peers and institutions that transfer students often encounter [2].

The APEX program also includes a focus on providing formal and informal opportunities for transfer students to engage with faculty and other students. Mentoring is a proven practice for supporting low-income STEM students' retention and has especially been shown to benefit community college transfer students [3]. Comprehensive mentoring has been shown to help students navigate the curriculum, the co-curriculum, and the "hidden curriculum" – the "unwritten, often unspoken norms, values, expectations, behaviors, codes of conduct" that are "not transparent or accessible to all students." [4] In engineering, the hidden curriculum includes professional socialization, processes of developing self-efficacy, navigation of internships, professional ethics, and numerous other domains that may be implicitly addressed during

foundational courses but can be navigationally frustrating or undervalued experiences for transfer students [5]. Mentoring supports transfer students by establishing trust, building relationships, and developing interconnectedness with faculty and peers. APEX scholars receive formal and informal mentoring from faculty, industry, peer mentors and each other.

Several research questions are posed in this work, which guide data collection. The team seeks to examine: (1) how well APEX recruitment strategies contribute to increasing the number of low-income and underrepresented minority students who transfer into UST's engineering programs; and (2) the extent to which retention efforts (mentoring, APEX success series, internships, research, summer enhancement experiences) are most beneficial to retaining transfer students. Importantly, the team also seeks to build cultural acumen and therefore investigate the role of enhanced diversity, equity, and inclusion practices in engineering faculty, peer, and industry mentoring. Overall, the program seeks to contribute to the knowledge base about how four-year STEM programs can create academic environments in which transfer students are retained and thrive.

Through a monthly "APEX Success Series" event, students are provided with an opportunity for self-reflection. The current work is focused on the results from the first cohort, in the first year of the program. Data is therefore limited, so the current work focuses on the methodology of the learning reflection, and preliminary data collected from the five students enrolled in the first year of the program.

Methods:

APEX Success series events so far have included a resume writing workshop, a session on student clubs and professional societies, and a panel discussion on undergraduate research. The fall orientation event centered around hands-on activities in the campus student makerspace working with 3D printers. A Canvas site has been set up so that students can access materials and handouts for each of these sessions. For each meeting, an assignment is posted with "micro-lessons," on such topics as growth mindset, metacognition, self-determination and neuroplasticity. These microlessons are available on the KEEN Engineering Unleashed card "Under Construction: Learning Framework"[6].

Each meeting assignment also contains a self-reflection assignment. Key to reflection is feedback on perceived situational motivation based on Deci and Ryan's self-determination theory [7]. Self-determination theory delineates psychological well-being reflected in psychological needs of autonomy, competence and relatedness. The Authors' extended previous findings based on Stolk et al's visualization of situational motivation and basic learning needs [8]. This work included vetted situational and basic needs metrics with graphs which allows for easy comparisons.

The instructions for the motivation and reflection "assignment" included the following:

These questions ask about your competence, connectedness & autonomy (3 basic learning needs) and your motivation (a key "ingredient" for learning). The next sheet in this document provides you with graphical feedback that you can visually compare from

point to point through the semester. How you understand learning is important since the need for acquiring new knowledge will continue through your career.

- *What are your greatest challenges to success right now in your program?*
- *What elements of your program currently inspire you and make you feel supported?*
- *What activities in the APEX Success Series make you feel supported? Are there activities that may be improved? Are there activities that do not provide support?*

Results:

Five students were granted APEX scholarships; four students regularly attended the APEX monthly cohort building sessions. These four students completed IRB consent which are reflected in this data.

Student motivation and basic learning needs are reflected back to students numerically and graphically. Responses are exceptionally high for basic psychological learning needs, autonomy, relatedness and competence as summarized here:

	average	std dev	min	max
Autonomy	6.5	0.7	5.2	7.0
Relatedness	6.2	0.8	4.9	7.0
Competence	6.6	0.7	5.3	7.0

The comparatively lower relatedness basic need is of special interest given the goals of growing community within the cohort. Micro group dynamics seem at play in participants observed socialization. This dynamic is one which the full team will continue to explore.

The situational motivation is exceptionally high. Indeed, the most consistent responder responded with low amotivation, low external regulation responses coupled with the high identified regulation, high intrinsic motivation responses as typified by Stolk et al as Type 1 in cluster profile analysis. Type 1 High Identified Regulation (IR) and Intrinsic Motivation (IM), and low External Regulation (ER) and Amotivation (A) levels is a "truly autonomous" or "self-determined" response, which indicates engagement in learning for reasons of personal interest/fun/enjoyment, as well as value, importance, and utility. Students in this cluster are generally very happy [9].



Figure 1: Stolk et al's Type 1

On average the motivation response most closely aligned with Stolk’s Type 3 response, which has a positive balance of autonomous versus controlled motivations, but it reflects overall lower motivational intensity. This “moderately autonomous” response type may indicate a student who is positively, but more passively, engaged in activities.



Figure 2: Stolk et al’s Type 3

Reflection questions provided insight into the quantitative data. The first reflection question, “what are your greatest challenges to success right now in program”, elicited responses clustered on time management as well as English as a second language challenge. Responses to this reflection question were consistent across the semester.

The second reflection question, “what elements of your program currently inspire you and make you feel supported”, early semester responses were focused on support from people in their lives including parents, spouse, advisors, and siblings. Late semester responses to this question shifted to career opportunities and positive grades. However, personal relationships still strongly underpinned their dreams and aspirations.

The third reflection question, “what activities in the APEX Success Series make you feel supported? Are there activities that may be improved? Are there activities that do not provide support?”, led to responses highlighting the need for more connection between and among the APEX scholars as well as the opportunity to learn from others outside of the APEX community.

Conclusions:

In the first year of the APEX program, scholarship recipients have received support not only through scholarship funding but also through formal and informal mentoring, cohort building, and programming to elucidate the “hidden curriculum” in higher education. Data was collected from APEX scholars through self-reflection to better understand situational motivation in the first cohort of students. In this small sample size, situational motivation was overall very high. Through these responses, connection between and among the APEX scholars and outside the APEX community has been identified as a key feature contributing to student support.

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