Just-in-Time Support: An Evidence-Based Academic-Student Affairs Partnership to Enable Engineering Student Success

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Abstract

The current generation of engineering students enters college with very different experiences and expectations than students 15-20 years ago. As expectations on the college experience continue to rise, students believe they must not only excel in their academics, but they must also have a great internship, a life-changing international experience, be the leader of a student organization, and so on. It is worth asking: in what ways does the current generation of engineering students experience academic and personal stress in college, and how does this impact the ways in which institutions provision student support services?

This paper reports on an evidence-based practice in a mid-sized engineering school within a large East Coast public, four-year university. This partnership responds to students who need different kinds of support and expertise as they confront both personal and academic challenges during the engineering studies. The initiative is composed of a unique collaboration between academic personnel [mainly the Associate Dean for Undergraduate Programs (ADUP), but also including rank and file faculty] and an Engineering Associate Dean of Students (EADoS) holding a PhD in Higher Education. The EADoS was embedded in the engineering school, physically collocated with the engineering undergraduate office, and served only engineering students (as compared to student affairs generalists from the Dean of Students Office). The EADoS engages with the ADUP, engineering faculty, and other staff as appropriate to provide just-in-time support and crisis management for engineering students experiencing all manner academic and personal challenges. In this paper, we report student academic outcomes data from the nearly 300 students we served over the past three academic years, with a particular focus on student outcomes achieved under the partnership model as compared to pre-partnership student outcomes. In addition to aggregate results across all students, we focus specifically on women and women of color in our analysis, and examine the differential positive impacts of the partnerships on these two important sub-populations in engineering.

Our findings illustrate three key points. First, the engineering program's rigor, pace, rhythm, and general expectations place unique stresses on students that non-engineering students may not experience. Second, the EADoS's physical location and cross-training in engineering-specific issues is crucial to provisioning effective just-in-time support; we conclude that physical location and membership in the engineering school community both matter tremendously when provisioning support services. Third, we describe how student affairs expertise merges with engineering academic expertise to provide a comprehensive, holistic set of support services for the student; this approach yields better academic outcomes for students and moves them along a productive path to graduation at a higher rate than pre-partnership students. The results of this study illustrate the power and potential of close student affairs-academic partnerships for supporting engineering students.

Introduction

Academic institutions make enormous investments in student services including new dorms, athletic facilities, student health, cultural programming, the Greek system, student government,

and the like. These investments make the university more attractive to students and parents, and they can certainly make the holistic education of young adults more rich and effective. The unglamorous but nonetheless critical side of student affairs, however, revolves around supporting students in need. Intervention with students in difficult circumstances has long been a part of the university's mission, dating to the origins of residential colleges in which students and faculty lived and learned together in very close proximity. Modern universities provision support services to students in medical, personal, financial, and legal contexts, all of which require expertise and resources to deliver. These services can be perceived as "extra", diverting precious financial, space, and other resources to non-academic functions. But in truth, the university *in loco parentis* must set up a safe and nurturing environment for learning and support students as they emerge into fully engaged, adult citizens of the world.

This paper explores specific interventions for students in difficult circumstances—how students access them, how they are organized, who provisions them, and what outcomes students achieve. This evidence-based practice stems from a pilot program at our institution during academic year 2013-2014 in which a new student affairs-academic (SAA) partnership was created to support engineering students in need. In this paper, we focus specifically on student use of support services and their academic outcomes by demographic factors: academic major, gender, and race. The results suggest that this SAA partnership has provided specific positive benefits to women in the engineering school, with a powerful improvement in outcomes for African American women in particular.

The setting for this evidence-based practice

The institution. Our public, mid-Atlantic institution enrolls approximately 16,000 undergraduate students and is classified as "highly selective" in undergraduate admission. The university offers a comprehensive set of academic majors for undergraduates, as well as a rich and varied selection of co- and extra-curricular activities. The undergraduate population is about 54% female, 6% African-American, 5.6% Hispanic, and 6% international students. Students are drawn from all 50 states and over 100 countries. The four-year graduation rate from the institution is over 85%, while the six-year graduation rate is over 90%.

The institution organizes its student support services through the Office of the Dean of Students (ODOS), and uses a fairly centralize model to provision services. ODOS is located at the geographic heart of campus, away from the engineering precinct, and staffed with 7 full-time professionals whose advanced degrees are in higher education (PhD) or law (JD). Associate Deans of Students (ADoS) within ODOS provide compassionate support for students in all manner of difficult circumstances: family issues, financial difficulties, motivational problems, relationship struggles, grieving and bereavement, and so forth. While the main ODOS office does engage in programs for different student populations (transfer students, athletes, etc.), as well as provide programming for in-coming and current students (through the residence halls and Greek system), the *main focus of this research* is the routine provision of support to students in need.

The engineering school. The engineering school consists of approximately 2,700 full-time undergraduate students who matriculate into a common first year program ("engineering undeclared"). After their first year, students enter into one of the 10 undergraduate majors

offered by the engineering school. Entry into a major is a competitive process, mostly based upon GPA, and 10-15% of students each year do not gain entry into their first-choice major due to space limitations in the major. All undergraduate students have a faculty advisor who supervises course selection and generally serves as an advocate for the student. Beyond course advising, however, student support services within engineering are fairly centralized. The undergraduate office (UGO) handles a tremendous amount of walk-in service to students with questions both large and small. The UGO staff—two registrars--process transfer credit, provide routine advice, answer any and all student records questions, and support the entire student lifecycle from freshman orientation through graduation. The UGO is known among students as the central office where questions will be answered, accurately, and in a timely way.

The UGO also supports students in various kinds of academic difficulties, and in turn these challenges often stem from the kinds of personal struggles mentioned above. As such, the UGO staff frequently work with ODOS staff, student health, the residence halls, etc. to support students and give them the information and support they need. In a given academic year, the UGO supports a huge number of students; some of the support services are provisioned quickly (issues are handled in a matter of minutes or hours), while others require more sustained interventions (measured in days or weeks). The national numbers speak for themselves: almost 30% of college-aged students report being depressed to the point of impaired functioning[1] (which means perhaps 0.3 x 2700 = 810 students in engineering at our institution), over 20% report using marijuana at least monthly[2] (about 540 engineers), about 1 in 150 have autism spectrum disorders[3] (about 18 engineering students), and we could go on to include students who are suicidal, who come from very difficult personal circumstances, and so forth. The point is that within any large population of students, there will always be a population in need of some combination of personal and academic support, and the numbers are much, much larger than most faculty expect. The UGO supports hundreds of students every year in a wide variety of ways.

Student support services: the genesis for this research. This research stems from a change in operating procedures in the UGO in engineering at our institution. Prior to the Fall 2013 semester, engineering school students in need of just-in-time support had to visit the engineering undergraduate office to access academic advice and support, *plus* the central ODOS to access personal support. We recognized several challenges in this arrangement, some of which related to our organizational structure, and others related to the physical layout of our campus.

- *Students went to two different places to access support services and advice*. Engineering students could come to the UGO for academic advice and support, but personal support services were provisioned in ODOS. This means students must get advice from at least two different people (who have different background, training, expertise, and perspectives on supporting students), then integrate that advice into an action plan.
- *Students in a difficult circumstance are not always good at integrating and acting on advice.* The UGO staff discovered that students often did not follow up with ODOS (which was always part of our advice), or if they did, subsequent follow-up with the UGO or ODOS was lacking. Students struggled to manage and act on the on-going conversations across the UGO and ODOS offices, especially when they are in a compromised state due to their circumstances.

- *ODOS was not near the engineering precinct.* The ODOS offices are centrally located on our campus, but the engineering precinct is located near the periphery of campus. Moreover, engineering students do not frequent the central part of campus on a routine basis, as most of their classes are located within the engineering school. Coffee shops and eating establishments are also available in or nearby the engineering school. The physical location of ODOS was another barrier to students accessing their services.

We developed a new SAA partnership in Fall 2013 to overcome these and other challenges. In brief, the partnership involved an Associate Dean of Students from ODOS *being physically and permanently co-located within the engineering precinct*, in the office across the hall from the UGO. This Engineering Associate Dean of Students (EADoS) was cross-trained in the engineering school curriculum and fully embedded in the engineering school community. She was easily accessible to students, able to engage with faculty in both planned and serendipitous ways, learned the rhythm of engineering school life and the particular stressors engineering students experience, and generally came to understand the full context of the engineering school. For instance, throughout the academic year cycle, different majors have different pressure points at different times (see the Results section for examples), and the EADoS was able to understand and gain experience with these circumstances by working with engineering students across different majors. As such, *the EADoS was able to apply her deep knowledge of student support services, approaches, and resources to the specific context of students in the engineering school.*

In practice, the EADoS worked on a daily basis with the ADUP to develop strategies to support students, meet with students together, and generally ensure that students are treated holistically, with due attention to both the academic and personal elements of their situation. That the EADoS assigned to engineering during this pilot was a woman seems to have offered many benefits to engineering school students, as described later. This position was co-funded by the Dean of engineering and the Vice President for Student Affairs at the university. The EADoS office location and capabilities for support were advertised several times throughout the semester via email to all students, as well as targeted emails to specific subsets of students such as first year students transitioning from high school to college life and work. We also elevated the EADoS profile with the faculty so that they understood her availability for referrals, and we encouraged faculty to contact her directly about students of concern. This direct relationship between the EADoS and faculty helped bridge the academic and student affairs cultures and normalized such relationships within the engineering school. The cultural gap between the two communities has been identified as a potential pitfall of SAA partnerships[4].

This paper describes the outcomes of the one-year pilot of this partnership, and focuses specifically on some of the observations about students in need, and the academic outcomes they achieved, as compared to pre-partnership experiences. *The results and discussion focus on two specific sub-population within the engineering school*: women, and African American women. Both of these populations were much better served by the partnership arrangement than they were by the prior organization of support services. Before we discuss methodologies and results, it is important to understand student affairs organizations and culture, as well as the literature on SAA partnerships.

Review of relevant literature

Student affairs organizations. Organizational structures for student support services in universities have been studied for many years, and tend to be updated periodically as new generations of students (and parents) arrive on campus with new expectations about support services. The structural model for these services is highly centralized within ODOS at our institution. ODOS oversees student programming as well as residence life, Greek life, and other core services; they also provide routine support to students in need. The overall variety in student affairs organizational models is staggering[5], and our institution fits neatly into Manning et al.'s "administrative-centered traditional" model, specifically the "functional silo" model. As Manning et al. point out, this model for student affairs is quite centralized and has its strength in the quality and professionalism of the experts on staff, as well as the relative clarity of mission and responsibility. There is no ambiguity about the roles ODOS plays on our campus. This model, despite its awful-sounding and jargony name, serves our campus quite well in no small part due to the passion and compassion of the student affairs professionals within.

Student affairs-academic partnerships. SAA partnerships have been widely studied[6]–[9], and their potential value for student development and learning seems beyond doubt. But the execution of such partnerships can be plagued by a variety of pitfalls[4], including cultural differences between academic and student affairs disciplines[10], rewards systems in play for each partner, unhealthy asymmetry to the partnership (i.e., the academic partner being "in charge", with the student affairs partner relegated to a supporting role), and very different definitions of "academic success". This last item is echoed strongly by Connor[11], who contends that academic faculty confine "academic success" to a classroom setting, while student affairs professionals view "academic success" as including the "holistic self" (p. 106) and encompassing all manner of in- and out-of-class experiences. Philpott & Strange's case study[6] brings this to light using ethnographic tools, where the faculty are described as thinkers and the student affairs partners characterized as doers. The general conclusion from the literature is that such partnerships can be valuable for students, and that closer collaboration among academic and student affairs personnel represents a more modern approach to provisioning student services. But *equality of the partnership is critical*, and un-balanced partnerships in which one partner (typically, the academic partner) assumes the dominant role are less likely to positively impact student outcomes. The partnership described in this paper resulted from what Kezar calls a "structural" change[8], in that we radically shifted the paradigm at our institution by decentralizing ODOS personnel and location to better serve engineering students.

Academic outcomes for students. Missing from the current literature is a balanced discussion about student academic outcomes, and the impact of student affairs organizations (both within and outside the context of partnerships with academic affairs) on those outcomes. Part of this stems from the differential definition of "success" between the academic and student affairs communities[6], [11], but part of it results from the lack of an agreed-upon measurement of success. One class of literature uses instruments like the National Survey of Student Engagement (NSSE) as a proxy for success, arguing that higher NSSE scores suggest a strong and nurturing campus environment that allows students to flourish in all dimensions of their experience[12]. Other studies in this class use ethnographic methods (interviews, observations) to extract and describe the underlying value of partnerships from the entirety of available observations[13]. A second class of literature uses highly subjective assessments of success

collected via surveys of participants. For instance, Kezar[14] reports on a national survey that asked chief student affairs officers their perception of success of academic-student affairs partnerships on their campus, how those partnerships were initiated and nurtured, and what obstacles they faced. From these data, Kezar joins others in promoting both best practices and identifying obstacles to successful partnerships[4], [12], [13]. *None of these explicitly looks at student progress to graduation as a success metric for student affairs operations or for SAA partnerships*. Taken together, these two classes of literature point to the crucial need for better reporting of *student academic outcomes* as one metric for success in delivering student services or creating and sustaining new SAA partnerships.

Study participants, data collection, and methodology

Participants. This study includes 297 students, almost all from the engineering school, at our institution. These subjects were mainly actively enrolled students, although at some points during our engagement with them they may have been suspended, withdrawn, or otherwise on leave from the university. Data was collected from these subjects from August 2011 through May 2014, for a total of three full academic years. This population engaged with the UGO staff because they were experiencing some combination of personal and/or academic distress, and needed sustained support from the UGO and perhaps broader university resources to help them resolve their problem. *These students experienced a period of serious vulnerability, when their personal and academic issues together jeopardized their continuing progress toward graduation*. The duration of active support ranged from days to weeks, depending upon the severity of the situation. When appropriate, students were of course referred to other university offices including student health or counseling services. The UGO supported many more than the 297 participants in this study, but the majority of them were facing issues that could be resolved quite quickly.

Data collection. Data were compiled from the detailed hand-written notes of staff meetings at which student situations were discussed. One component of weekly staff meetings among the UGO staff focused on students in distress, creating a support plan, executing that plan, and continually monitoring student personal and academic health throughout. This vignette (a composite story fabricated from several real-life cases) illustrates the kind of situation discussed in UGO staff meetings and represented in the data presented here.

> ***Jeremy***
> *Jeremy had only been on campus for a few weeks when the news arrived: his mother died after a long battle with cancer. Jeremy and his mother had been close, and despite her long battle with illness, the news was still devastating to Jeremy. It negatively impacted his relationships with his roommates and girlfriend, and adversely affected his academics. His father lived on the other side of the country, and Jeremy was completely unfamiliar with his options and available support resources. He needed sustained support over a period of weeks from a range of university offices: the counseling center to support him while grieving, the UGO to communicate with his instructors and help manage his academic workload, and the financial aid office because of the change in his family situation. Jeremy was committed to the idea of finishing the semester*

rather than withdrawing, and needed help navigating this complex, emotional situation.

We did not collect data about how students entered into the UGO support system. However, our experience has been that a large portion of students are identified by one or more of their instructors who notice a negative trend in academic performance or who have talked to students and actively refer them to the UGO for help. We estimate that at least 80% of students enter into the UGO support system by this mechanism. The remaining students self-identify as needing help and contact the UGO on their own volition, and in many cases they have been urged by peers to access either UGO support services, counseling center resources, or other on-campus options.

Data content and definition of academic outcomes. Data used in this study include student demographics such as gender and academic major and the dates on which their case was discussed in the weekly UGO staff meeting. *Students only appeared on the UGO staff meeting agenda if their case was active and un-resolved, with the student required continued intervention from us; once the student's situation stabilized, they were removed from the agenda*. The data also include student academic outcomes for the semesters during which they were supported by the UGO staff, as well as their "current" academic outcome (as of July 2014).

Possible academic outcomes include those that keep the student on a positive path to graduation (active, active but on probation, graduated, or transferred), as well as those that interrupt their progress toward graduation (suspended or withdrawn). Using these outcomes, we can more directly target the specific, tangible achievements of students we supported. *These specific academic outcomes are preferable to other measures (e.g. NSSE) because they target the fundamental, specific goal that all college students value: progress toward graduation*. These data do not include details about a student's individual situation or causal data about how/why they appeared on the agenda for an UGO staff meeting. The data only indicate if/when we discussed their case in our weekly staff meeting, and their presence on the agenda indicates that we were actively working with them to help stabilize their situation.

Methodology. The data were analyzed quantitatively using three student cohorts based upon when and over what duration they accessed support from the UGO:

- Cohort 1 ($n_1 = 152$): students supported by the UGO entirely before the partnership was initiated (i.e., prior to Fall 2013)
- Cohort 2 ($n_2 = 114$): students supported by the UGO entirely after the partnership was initiated (i.e., during or after Fall 2013)
- Cohort 3 ($n_3 = 31$): students supported by the UGO before the partnership was initiated, but who continued to be supported after the partnership was initiated

As a practical matter, almost all of the Cohort 3 students represent very difficult cases that extend over a very long period of time. These cases also span the two support service structures. Since this research focuses on the role of the SAA partnership in student academic outcomes, we will focus our analysis on Cohorts 1 and 2 only.

Data for the cohorts are parsed by a number of different factors, including: number of semesters before graduation of our first contact with a student, academic major, gender, race, and status as either a first-year admit or a transfer student to the school of engineering. These data were compiled into a master spreadsheet, de-identified of any personal identifying information of the participants, and analyzed using R[15]. We analyze the data using basic trend and visual /graphical analysis, and we use descriptive and other statistics as appropriate.

Graduation date for each student was derived from our student information system, and it is important to mention that there is some uncertainty with this parameter. First, for students who have not yet graduated, we have only an *estimated* graduation date; this estimate is calculated based upon the student's semester of first enrollment, assuming an 8-semester path to graduation. For students whose graduation is delayed due to taking time away from school for personal or medical reasons, their graduation date is updated with a new estimate, but again this estimate can be error-prone for the reasons stated previously. There is a small subset of students in our dataset for whom graduation itself is in doubt, and these are students who have taken an extended break from their academics (typically 2 or more semesters) but are expected to return at some future date. In these cases, the estimated graduation date in our student information system is truly a bit of a guess based upon professional experience and the stated intentions of the student (which of course may be different than what actually happens). There are also a few students in the dataset who will never graduate because they have been expelled from the university for academic reasons, in a manner consistent with the stated academic standards and policies of the school. In those cases, we use the date their graduation was expected before expulsion.

We examine interior metrics derived from the master dataset as follows. We used the actual or expected graduation data, plus our data of when we were in contact with students, to establish the *semester of first contact*. This parameter establishes when in their academic career they first needed our help. We also compile academic outcome data by cohort, in order to examine how different cohorts respond to the services we provided under the two different organizational models described here. We examine the data by both gender and race. Finally, we parse the data by academic major.

EADoS training in engineering school issues. Upon joining the engineering school, the EADoS underwent both formal and informal training in engineering school policies, curriculum, protocol, and the unwritten but critical mores and rhythm of the school and its students. The *formal* portion of the training involved many meetings with the ADUP and critical review of the engineering school advising manual. It also included many three-way meetings with students involving the student, the EADoS and the ADUP in the room at the same time, discussing a student's case from both academic and student affairs angles. The *informal* training occurred via interactions with faculty in the engineering school, unplanned meetings and discussions with UGO staff, and informal interactions with students. This informal training also illuminated the particular pressure points within the engineering school experience: the timing of homework and exams, the laboratory experiences, and the general rhythm of when academic stress runs at its highest level. We correlate these experiences with some of the by-major results presented later.

Results and discussion

Motivation for the data presented here. Our dataset is rich with respect to the students we have supported over the years: 297 students who experienced a wide range of challenges. The dataset analysis continues, and the results presented here are a small sliver of the overall data analysis completed so far. We have seen some very promising trends in student outcomes across a range of different variables. Our on-going analysis considers students grouped by student *individual factors* (academic major, gender, or race), but we also examine student outcomes by *process variables* (how often we worked with them, for how long, over what period of time, and so forth). As such, we are attempting to understand how the operation, structure, and personnel of the UGO under the SAA partnership impacted the academic success of students in general, as well as across individual factors.

This SAA partnership was not motivated by a need to serve students in any particular group better; instead, it was motivated by a need to serve all students who entered the UGO support system better, and to help them achieve better outcomes. We did not design the partnership to 'target' students in any particular group for special treatment or increased recruitment into the UGO system. We welcomed all students to the support system, regardless of how they entered into the system (i.e., whether the student self-identified as needing support, or was referred by an instructor, or encouraged by a friend, or if we were contacted by a concerned parent).

It is important to understand that we are not attempting to engage in any modeling of why students need support, what prior experiences shape the kinds of support they need, how they react to specific personal or academic stressors that trigger the need for support, or any other motivational type questions. For instance, individual students have different decision making processes for when and how to seek support, and from whom to seek it (i.e., from the institution, or from peers, or from family, or from others within the student's personal network). In addition, instructors all have different individual thresholds for when they decide to refer a student to the UGO (or other university resources) for support. Our dataset does not permit any analysis of these kinds of issues. We are instead examining the academic outcomes of students who enter into the UGO support system, by whatever mechanism, and contextualizing those outcomes within the SAA partnership organization, personnel, and specific actions.

With that as context, the results we present here are some of the early quantitative outcomes from our on-going analysis. The first set of results tells an explanatory story of how/when students from different academic majors enter into the UGO support system. Of interest here is the connection between academic stressors experienced in different academic programs, and the need to support students as they manage those stressors. The second set of results present a promising story of how two groups of students in particular—women overall, and African-American women—seem to have achieved much better academic outcomes within the SAA partnership model than they did under our previous UGO support model. While this SAA partnership model was not developed with this outcome in mind (we sought to improve support for all students), we nonetheless believe that reporting results for these specific student groups provides value to the community, especially when we contextual those results with details of the organization of the SAA partnership and the specific activities of the key person in the partnership (the EADoS). A more comprehensive presentation of results across many more variables is currently in preparation.

Context for student support: the university ecosystem of resources. It is also worth mentioning that throughout the time period of this dataset, the major change in the student support network on campus was the creation of this SAA partnership for engineering students. Otherwise, the other support resources remained largely the same on our campus throughout the time period covered by this dataset. Part of the work of the UGO was to connect students to other university resources as appropriate, including: student health, counseling services, learning needs office, student legal services, the central ODOS offices, the university ombuds, and others. Specific sub-groups of students also have other university resources available, including: services and support groups for first-generation students, women's programs, services for African-American students, the LGBTQ center, and so forth. Our job in the UGO was to support students as well as we could with our expertise, and to refer students to these partner offices and resources as appropriate.

Summary of the dataset by personal demographics. We start by looking at aggregate data across all three cohorts, and comparing the profile of the students we served with the profile of the engineering school as a whole, broken down by different demographic variables. Because our dataset includes students whose expected/actual graduation dates span Fall 2011 through Spring 2017, and because enrollments continually fluctuate, we cannot uniquely specify engineering school population characteristics at the moment in time when we interacted with a particular student. In the following analysis, we use the Fall 2013 engineering school dataset to capture overall demographics in engineering; this is obtained from publically-available data on the university's website. We chose Fall 2013 because it is the most recent data available that falls within the period of our data collection. Historical data for the college of engineering reveal reasonably stable enrollment demographics profiles over the relevant period of time (i.e., about 31% women, about 4-6% African American, 14-16% Asian, and 59-61% white), despite an overall increase in enrolled engineering undergraduates.

Women make up 31.3% of students in our dataset, and about 31.2% of engineering students as a whole. The engineering school is composed of students who are mainly first-time, first-year admits, rather than transfer students (our dataset: about 94%; the college of engineering: about 94%). The consistency of these numbers between our dataset and the college of engineering population as a whole is not surprising, but two other factors do show some differences.

African-American students are over-represented in our dataset (13.5% African American students; college of engineering: 4.2%). Asian students compose a slightly higher percentage of our dataset (16.5%) than the engineering school population (15.7%). White students are under-represented in our dataset (52.9% of the dataset, compared to 60.5% in the engineering school as a whole). This difference between African-American and white students may not be unexpected, given the disparity in graduation rates: the six-year graduation rate for African-American students from the university is 86%, while for white students it is 95%. These graduation rates are for students who start at the university and eventually earn an undergraduate degree (not necessarily engineering) of any kind from the university (these data are available on the university website). Graduation rates for students who start in engineering and earn an engineering degree in six years are estimated to be about 15-20 percentage points lower for both groups of students. The difference in rate of progress toward the degree could be one reason why

African American students appear in our dataset at a higher rate than their prevalence in the engineering population.

Students served, parsed by academic major. Student demographics by major are shown in **Table 1**, and it is clear that a few majors are over-represented in our dataset as compared to engineering undergraduate population as a whole. *We list the majors as Major A, B, C,… to protect the identity of the faculty and staff within those majors*. In particular, Major A students appear in our dataset about 30% more than their prevalence in the overall population, and Major E students at a rate nearly double their representation in the overall population. It is not clear why Major A students would be over-represented in our dataset. However, Major E tends to attract both very academically talented students and those who struggle, and the UGO served about 1 in 5 students from Major E during the time period covered in our dataset. The talented students are attracted to the flexibility and research-intensive experience within the major. The academically less-talented students sometimes end up in Major E because they cannot gain acceptance into the major of their first choice due to their poor academic performance. Because Major E has a higher proportion of academically struggling students than other majors do, it is expected that we would see more of them in our dataset than their representation in the engineering school population as a whole.

We also calculated the average semester of first contact for students, with the results shown in the last column of the table. As expected, undeclared students seek support during their first year (only freshmen are "undeclared"), while many other majors tend to seek support in their second year. This is undoubtedly associated with the so-called sophomore slump[16], [17] and is a time of serious academic stress for students enrolled in challenging foundational courses in their major. Our Major J is quite small and filled with academically talented students, so it may not be surprising that there are few of them in our dataset and that their contact with us usually happens later in their career when the stresses of capstone experiences and the post-graduation job search really take hold. The Major C curriculum has a particularly stressful course in the 6th semester that helps skew its average semester of first contact into the junior year, rather than the sophomore year. The Major F program has a rigorous and stressful lab sequence in the junior year that challenges students quite seriously and shifts their average semester of first contact into the junior year as well. This data allows us to connect specific curricular activities to the support services we provide, which in turn helps us to understand specific stressors for students in different majors at different periods of their academic careers.

Cohort analysis: what outcomes did students achieve? The primary goal of this pilot SAA partnership was to serve engineering students better—more promptly, with better follow-up, with greater diversity of skills, leveraging the expertise of professionals with different backgrounds, and of course to help students achieve better academic outcomes. Across many demographic categories, the outcomes achieved by students in the different Cohorts were similar or improved, and we present a few notable examples next.

Table 1. Summary of student population by academic program: in the college of engineering, in the dataset analyzed here, and the average semester of first contact for each. Percentage column in our dataset does not total 100% due to rounding.

Academic program	*In engineering*		*In our dataset*		*Average semester of first contact*
	number	*percent*	*number*	*percent*	
Undeclared*	700	26.4	63	21.2	2nd
Major A	300	11.3	45	15.2	4th
Major B	240	9.0	34	11.4	3rd
Major C	270	10.2	26	8.8	5th
Major D	210	7.9	21	7.1	4th
Major E	90	3.4	21	7.1	4th
Major F	270	10.2	20	6.7	6th
Major G	135	5.1	18	6.1	4th
Major H	150	5.7	16	5.1	4th
Major I	195	7.4	13	4.4	4th
Major J	90	3.4	12	4.0	7th
Other**	--	--	8	2.7	--

* ”Undeclared” is not an academic major, it is an academic program; students cannot graduate with a degree in “undeclared”. It is the classification given to freshmen students before they are accepted into a major. The others on the table are all academic majors.
** “Other” includes students who were not engineering students but for some reason needed UGO help. For instance, students who were attempting to transfer into engineering.

Our data show that *women as a group were better served by the partnership model* than by the previous arrangement. We are absolutely not suggesting that women need more help to be successful, or that they are somehow less capable than men of handling difficult personal and academic circumstances. We are instead observing that *of the women we supported in the UGO*, those who experienced the SAA partnership model achieved better outcomes. Cohort 1 ($n_{female,1}$ = 47) had just 72.3% of women achieve an outcome that kept them on the path to graduation in their first semester of contact with the UGO, while Cohort 2 ($n_{female,2}$ = 36) had 94.5% achieve a positive academic outcome. We attribute this to several key features of the partnership. ***First***, we believe that the EADoS being a woman, while the ADUP was a man, played a significant role in the comfort of female students spending time in the UGO system. Female students in difficult personal circumstances might feel more comfortable talking to a professional who is a woman, rather than a man. ***Second***, this particular female professional, the EADoS, is a full and active member of the engineering school community whose office is located centrally within the engineering school—despite not being trained as an engineer. As such, she is both a confidante and role model for female engineering students; they can interact with a powerful, dynamic, professional woman who understands their challenges as a female engineering student.

We believe the improved outcomes among Cohort 2 women are related to a parameter we call initial contact density (ICD). ICD characterizes the frequency of contact within the first *N* weeks after a student’s first interaction with the UGO staff, and in general a higher ICD is better

because it indicates activity and follow-up with the student. ICD is defined as the number of weeks the student appears on the UGO staff meeting agenda in the first *N* weeks after and including their first appearance, divided by the number of weeks *N*. Based upon our professional experience, we have chosen $N = 10$ weeks. ICD is therefore bounded by $0.1 \leq \text{ICD} \leq 1.0$. Many students have low ICD (0.2 or below) because their issue has a lifecycle that only lasts a few weeks; for instance, a student may have a reasonably short-term medical issue such as a serious flu, and these issues have a timeline on the order of a few weeks. But other students have much longer timelines for addressing their issues, so consistent follow-up in those first *N* weeks is critical. Under the EADoS arrangement, students could visit with her frequently because she was *resident in the engineering school*, and *easily accessible* as part of the students' normal routine. Students did not have to go far across campus to see her, and these unplanned drop-ins played a critical role in the EADoS's ability to serve students.

The average ICD for Cohort 2 female students was about twice that of Cohort 1 female students (0.385 vs. 0.195), and the *female ICD for Cohort 2 was more than 20% higher than for Cohort 2 as a whole*. This is an important result, and we are confident that this increased ICD helped some of our female students who would have achieved a bad outcome (withdrawal or suspension), shift to the more positive outcomes of "active" or "active, on probation". **Table 2** summarizes this data and shows the dramatic shift in semester outcomes for women in this study.

Table 2. Academic outcomes during first semester of contact with the UGO--female engineering students from the cohorts before the partnership (Cohort 1) and after (Cohort 2).

Academic outcome	*Percentage of cohort achieving outcome*	
	Cohort 1 ($n_{female,1} = 47$)	Cohort 2 ($n_{female,2} = 36$)
Active	63.8	80.6
Withdrawn	12.8	5.6
Suspended	14.9	0
Graduated	0	0
Transferred	0	2.8
Active, on probation	8.5	11.1

Next we focus specifically on African American women, who similarly saw better academic outcomes under the SAA partnership than they saw prior to its initiation. The populations are small, but the evidence remains promising: there were 12 African American women in Cohort 1, and 7 in Cohort 2. African American women in Cohort 1 had positive outcomes in the semester of first contact in just 50.0% of cases, while those in Cohort 2 saw 85.6% positive outcomes. This is a more than 70% increase in the number of positive academic outcomes experienced for this population in the engineering school. The average African American female ICD went from 0.18 for Cohort 1 to 0.51 for Cohort 2, a 280% increase in ICD that surely helped improve academic outcomes for these students. In addition, the Cohort 2 average ICD of 0.51 for African American women was nearly 60% higher than for Cohort 2 as a whole. The improvement in both academic outcomes and interior metrics like ICD could certainly be related to a role-model type intervention against stereotype threat[18] in which all women, and particularly African American women, view the EADoS (who is white) as a professional role model within the engineering school. The EADoS is easily accessible in the engineering school precinct, a full member of the

engineering community, compassionate and well trained in student support interventions, and welcoming.

Discussion: what specifically did the EADoS do? It is worth asking what the EADoS specifically was able to do for Cohort 2 students overall, that the ADUP could not do for Cohort 1 students. In addition to planned meetings with students and the ADUP, the EADoS was also available for unplanned interactions and support of students. The frequency of contact with students was, we believe, crucial to the success of the SAA partnership.

1. Proximity and availability. Remember that the ADUP was a tenured faculty member, with all the responsibilities implied by that rank. In addition to teaching and research responsibilities, the overall administration of the UGO placed serious demands on the ADUP's available time. The EADoS was available to students more often, and had a complementary but different expertise than the ADUP. Moreover, the EADoS was available in a convenient way, near the usual paths traveled by engineering students, as compared to the ADoS in the ODOS central office (which was located across campus from the engineering buildings). We observed many cases of students stopping in to see the EADoS multiple times per week, for a quick and unplanned "check-in", during which the EADoS could impart a supportive word, make an assessment of how the student was doing, and generally exhibit greater and more consistent care for the student. For all students in the study, this proximity and availability was undoubtedly a key factor in their ability to achieve a positive academic outcome.
2. Different expertise, but cross-trained. The EADoS's physical presence in engineering, her experience in supporting of only engineering students, and the intentional training she received upon joining the UGO all combined to give her fabulous tools to support students. She understood the rhythm and typical pressure points experienced by engineering students at the institution (see also Table 1), yet she was trained in the rigors of the student affairs field. She helped students with all manner of academic and personal help, including dispensing advice, encouraging communication with other university offices, time management, academic deadline management, and so forth. Her application of all those skills in the specific context of the engineering school, to the holistic benefit of its students, was only achievable because she was embedded within the engineering school community and became a part of it.

It is not an exaggeration to say that from the standpoint of supporting students in need, the UGO transformed from an academic organization that communicated with ODOS to dispense student affairs support (for Cohort 1 students), to *a student affairs organization with strong academic expertise (for Cohort 2 students)*. This holistic treatment of Cohort 2 students was only achievable by breaking the dominant paradigm at the institution and decentralizing the location of student support services.

Conclusions

This paper reports on an evidence-based practice for supporting engineering students in distress. The origins of the research were related to serving all students better, and helping them achieve better academic outcomes. Here we report on the improvements for two specific sub-populations in engineering: women as a whole, and African American women, both of which seem to have

been differentially impacted in very positive ways by the intervention we have developed. We were also able to sensibly tie student demand for support services to specific academic environmental factors within academic majors in the engineering school (**Table 1**). We attribute the success of this SAA partnership to several key factors. ***First***, the EADoS was physically located within the engineering school complex and was a full member of the community. Her office was conveniently located near the engineering UGO, and she spent a great deal of time meeting with engineering students and collaborating with the ADUP on their cases. ***Second***, the EADoS learned about the specific stressors experienced by engineering school students, and could bring her student affairs training to bear in a discipline-specific way. Her cross training in engineering school curriculum and policy made her an effective advocate and support resource for students whose expertise validated her as a member of the engineering school. ***Third***, her frequent collaboration with the ADUP addressed one of the key challenges faced by students in distress: access to information and synthesis of that information into an actionable plan. The true partnership element of this model provided students with a balanced treatment of their options, not privileging the academic partner over the student affairs partner, and the result was a more holistic treatment of students in need of support. This pilot program illustrates a promising evidence-based practice for supporting engineering students, and suggests both operational details and outcomes metrics (such as the initial contact density) useful for evaluating success.

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