The Implementation and Preliminary Impact of Intrusive Advising and an Academic Peer-Mentoring Program for Engineering Students

Mary Vesper, M.S. and Emily Dringenberg, Ph.D.
Kansas State University

Abstract

To increase retention, the College of Engineering at Kansas State University created an Academic Success Center (ASC) focused on providing multiple services for all engineering students. A new position, ASC Advisor, was created specifically to support at-risk engineering students. The ASC Advisor designed and implemented a brand new academic peer mentoring program called Building Excellent Engineers (BEE) to address and meet the needs of engineering students who struggle academically. Participants in the BEE program, showed evidence of academic success in terms of increased retention rates, as compared to the college and university. Our preliminary analysis of this program suggests that academic peer mentoring paired with intrusive advising can be a useful tool to support and retain at-risk engineering students. Future implementation of the program will focus on developing more comprehensive strategies for identifying at-risk students during their first year.

Keywords

at-risk students, peer mentoring, intrusive advising, retention, undergraduate engineering

Introduction

Generating more engineering graduates within the United States is critical to maintaining the economic competitiveness of our nation\(^1\). The failure of U.S. post-secondary education to prepare a sufficient technical workforce has even been referred to as a “quiet crisis”\(^2\). In addition to preparing a nation of college-ready K-12 students and recruiting a diverse pool of candidates to begin a Bachelor’s degree in engineering, retaining undergraduate engineering students plays a crucial role in working towards the goal of educating engineers prepared to contribute to our nation’s innovation needs. Many on-going efforts are made nationwide to retain students including the following: first-year programs, revised curricula, tutoring, or undergraduate research. Despite institutional programming, engineering programs lose approximately 40 percent of their undergraduate students\(^3\). This work reports on the use of an academic peer mentoring program in collaboration with intrusive advising as a method of improving retention in the College of Engineering (CoE) at Kansas State University (KSU).

Background

In 2014, KSU enrolled a total of 20,327 undergraduates, and of those, 17% (3,503) students were enrolled in the CoE\(^4\). In 2014, the CoE granted 531 undergraduate degrees\(^5\). As a new retention effort within the CoE, the Academic Success Center (ASC) was created. One of the new positions created within this center, was an academic advisor charged with designing interventions to support the needs of at-risk engineering students and aid in retention efforts for
the college. The newly hired academic advisor (and first author of this paper) brought a unique perspective of not only a background in education at all levels, but also experience working with at-risk populations in various areas. This advisor developed an Academic Peer Mentoring program, called Building Excellent Engineers (BEE), specifically designed to meet the needs of at-risk populations which could be generalized and adapted for use by numerous colleges and universities. This paper reports on the design, implementation, and preliminary impact of this program within the CoE at KSU.

Literature Review

To provide a framework for the development and implementation of the BEE program described in this paper, relevant literature related to at-risk students, academic advising, intrusive advising and peer mentoring is summarized.

At-risk

Students entering college come from various backgrounds and with varying degrees of preparedness. Those who are deemed underprepared, are often tagged with the label of “at-risk.” The term at-risk can represent a myriad of factors that may contribute to a student’s difficulty succeeding in college. For example, students may lack basic academic skills required in a post-secondary educational setting. Other factors may include having a disability or lacking motivation or study skills.

According to a publication by the National Center for Learning Disabilities, written by Cortiella and Horowitz, students with disabilities at mild levels in the categories of Attention Deficit and Hyperactivity Disorder, Asperger’s and Learning Disabilities, are more likely to meet admission requirements and attend a secondary educational institution than in previous years. Despite at-risk population’s growing numbers, Cortiella and Horowitz reported that only 24% of students with diagnosed learning disabilities attending a four-year university will graduate from that institution. It should be noted that dropout rates reported in this study varied greatly by ethnic group, with Black and Hispanic students having a much higher dropout rate than Caucasian students, and more males (66%) were identified as having a learning disability than females. While a learning disability cannot be “cured,” students with learning disabilities can learn and achieve their potential, given assistance through interventions, support programs and compensating strategies.

In addition to individuals with documented learning disabilities, students with high intellect fail to get diagnosed with a disability because they have exceptional compensatory skills to get through high school. When they reach college, their compensatory skills can become maxed out, or they have not developed the executive decision making skills needed to strategically manage their schedule. At this point, high functioning students often encounter academic difficulties and do not understand why what they have done in the past is not working anymore. As increasing numbers of at-risk students enter college each year, institutions need to be prepared to support these individuals with various programs.

As described by Strayhorn, “Every student wants to succeed, but unfortunately far too many enroll without the academic preparation required to succeed or they enroll and struggle to access...
the resources, information, and advice that enables their success at our institutions” (p. 57). Strayhorn surmised that academic advisors who connect students with the resources they need are often met with successful outcomes. One possible aspect of a collegiate-level support system to retain students who are or are not identified as at-risk is through academic advising.

**Academic Advising**

University level academic advising plays a significant role in providing services and accommodations for at-risk students. For the student with learning disabilities, academic advising can make the difference between academic success or failure. In a 1997 study, at the University of North Carolina-Charlotte, students with disabilities who received services, saw their grade point average (GPA) increase, but their average GPA was higher than the students with disabilities who declined services. Young-Jones, Burt, Dixon and Hawthorne evaluated academic advising based on student needs, expectations and successes and found that academic advising significantly contributed to student success. Pope reports that academic support services, such as advising, tutorials and study skills workshops were most important in developing successful students.

The major role of the academic advisor is to design a support program for the student, so that he/she can independently use all of the resources at the university, make academic progress, and graduate. If the academic advisor is not sufficiently trained to meet the needs of all students, then failure of the support program is likely. The National Academic Advising Association promotes that “academic advising is at the core of student success” at the college level (para 1). Unfortunately, many of the specific needs of at-risk students are not fulfilled in a typical advising model that students experience in a university setting. A need for more comprehensive support can be observed in the many instances of academic probation and low retention rates among students.

Typical university advising ratios are approximately 1:300, whereas other specific programs, like athletic advising, has ratios as few as 1:9 for football and 1:4 for basketball. If similar emphasis for advising occurred within the university as it does with athletic departments, more colleges may experience a rise in student success. Additional academic advisors with specialized training need to be employed to meet the demands of students who require intensive individual attention to succeed. While traditional college academic advising provides support for the student, at-risk students can benefit from a more individualized, intrusive advising experience.

**Intrusive Advising**

According to Noel & Levitz as reported in Earl’s article, more than one-third of first year college students drop out. In an effort to improve these numbers, support services in the form of intrusive advising was created. Intrusive advising combines prescriptive and developmental strategies when working with students. In prescriptive advising, the advisor merely makes a “diagnosis” and prescribes a solution to the problem the student has, much like a doctor/patient relationship. Technology could be used in place of an advisor to relay specific information, such as courses to take or websites to access. In developmental advising, the advisor works collaboratively with the student. The advisor actively listens to the needs of the students, then responds with advice and multiple possible solutions for the student to choose from. Crookston
described the developmental advising model as one where the responsibility is shared between the advisor and student, which fosters student growth.

According to He and Hutson\textsuperscript{20}, intrusive advising should begin early in the semester with the advisor developing a relationship with the student, assisting the student when obstacles arise, and helping connect the student to the university. This model also requires frequent communication\textsuperscript{20}. Similarly, Earl\textsuperscript{17} suggests intrusive advising techniques include identifying at-risk students and motivating them to succeed through “self-evaluation, learned study skills, and learned involvement in campus life” (p.30). The intrusive advising theory is an intentional intervention that takes a proactive approach to motivate students to get assistance\textsuperscript{17}.

Intrusive advising can provide at-risk students with more personalized attention while tending to the student’s holistic developmental needs. At-risk students are better served by a more interactive approach to their advising experience. In addition to intrusive academic advising with a professional, students can also benefit from academic peer mentoring.

Peer Mentoring

Reinarz and White\textsuperscript{21} found that students require varying levels of advising and mentoring throughout their college experience. Many peer mentoring programs are designed to assist students to successfully navigate their way through college\textsuperscript{22}. While there are several positive outcomes related to mentoring, good peer mentoring depends on the right fit between mentor and mentee and can assist a student’s navigation and transition to the collegiate environment\textsuperscript{23}. Students often feel more comfortable working with peers than a professor or professional advisor. The mentor/mentee relationship is usually structured with an experienced and more knowledgeable peer (mentor) who works and develops a relationship with the mentee\textsuperscript{26}.

Since its documented beginnings in 1990, peer mentoring has continued to have positive effects on the persistence of students through secondary education. For example, Jacobi’s\textsuperscript{24} extensive research on peer mentoring found it increased grade point averages of college students, which aids in retention and enriches the undergraduate experience. Baker and Griffin\textsuperscript{25} have also identified positive impacts on students from underrepresented, diverse backgrounds.

In conclusion, the new ASC academic advising position at KSU provided an opportunity to specifically serve at-risk undergraduate engineering students. The ASC academic advisor designed and implemented the BEE program, which utilized an intrusive advising model in addition to an academic peer mentoring program, and is described in detail next.

BEE Program Framework

The BEE academic peer mentor program is primarily based on Tinto’s 1987 study\textsuperscript{14} that identified measures to produce successful students in college. Setting expectations, providing advice and support, and involvement of the student in his/her own learning are core principles of the BEE program, which reflect Tinto’s framework\textsuperscript{14}. Tinto\textsuperscript{27} summarized that universities must get more involved with student retention. As a higher percentage of first generation, underrepresented populations and students from low income backgrounds apply for admission to secondary institutions; successful institutional academic supports must be established.
Mission

The mission of the BEE Program is to assist at-risk engineering students by focusing on developing a foundation for academic success and life skills. The program connects students with various resources on campus to provide maximum support for the students in their academic, personal and career development. The goal of the program is to foster an environment that would enable academic growth to develop independent learners into successful engineers through academic peer mentoring and intrusive advising strategies.

Overview

The BEE program distinguishes itself from other peer mentoring programs because it serves primarily as an academic intervention. More traditional peer mentoring programs focus on social integration. The BEE program, while social by nature of meeting with a peer and/or an advisor, revolves around academic success. The goals and objectives of the BEE program focus on setting up the mentee with positive academic supports. Because all of the BEE participants have been identified as at-risk, the program’s focus is to give the mentee specific tools to become more academically successful as they progress through the engineering curriculum.

The primary services of the BEE program are as follows:

1. Intrusive and developmental advising
2. Study skills and strategies
3. Test taking skills and strategies
4. Professor communication
5. Note taking strategies
6. Organizational skills
7. Weekly, monthly and semester schedule calendars
8. Time management skills
9. Goal setting

Many of the services provided by the BEE program to support at-risk engineering students could benefit all engineering students. Paulsen and Sayeski\textsuperscript{28} identified time management, study habits, self-management, and note taking skills as having a positive effect on the success for students with and without disabilities.

BEE Program Implementation

In an attempt to achieve the aforementioned mission, the BEE program was implemented as described in the following section.

Mentees

For the first semester of implementation (Fall 2015), the initial criteria for participation in the BEE program included all students within the CoE who were on academic warning based on their cumulative GPA. In order to reduce the pool of candidates to a reasonable number, the criteria was narrowed to include second year freshmen and third year sophomores who were on academic warning with a cumulative GPA at 2.0 or below. The BEE director reached out to all
of these students via email describing the opportunity to participate as well as the structure of the BEE program. Some of the students were hesitant to accept the parameters of the program, but after they understood the student-centered goals and objectives, they were relieved to have the personalized assistance. Students who responded met with the director to discuss their academic history and current academic needs. Those who failed to make contact with the director after three weeks into the semester were considered “non-participants” in the program. These non-participants were still academically tracked and reported.

The BEE director used the initial meetings with interested, at-risk students to better understand their needs and place them in one of two cohorts. The first cohort was comprised of students who showed a pattern of consistently low academic performance. For example, these students had often failed a course, and then retook the course with minimal improvement, such as replacing an F with a D. Such a pattern often suggests that students need multi-faceted academic intervention in order to establish productive academic behavior. Consequently, this first cohort was required to meet with an academic peer mentor twice per week for one hour each session to work on academic tasks in addition to meeting with the BEE director every three weeks for intrusive advising.

The second cohort was grouped based on the director’s recognition of a different pattern—their grade replacements were more drastic, such as retaking a class and replacing an F with a B. This demonstrated that they had the cognitive ability to be successful with their current skill set, but they were not able to do so consistently. For these cases, the assigned intervention was emphasis on and accountability for recognizing their own patterns with a focus on productive behaviors and utilization of campus resources. This cohort did not receive any academic peer mentoring, and was only required to meet with the BEE director every three weeks for intrusive advising.

**Mentors**

Peer mentors for the BEE Program applied via paper application, and they had follow-up one-on-one interviews with the BEE director. Mentors were recruited from the College of Engineering; these applicants brought content expertise within the engineering curriculum. Mentors were also recruited from the College of Education to bring their knowledge of current practices in study skills and strategies, as well as strong organizational skills.

Once hired, the mentors received training by the BEE director. In addition to initial training, mentors received two supplemental training sessions later in the semester. Points of interest for the majority of the trainings included:

1. Mentor/mentee expectations
2. Review of mentor handbook
3. The learning cycle
4. Time management
5. Various study skills
6. Learning styles inventory
7. Access to various resources on campus
With a complete roster of mentees and mentors for the BEE program, the director worked to match the participants appropriately.

*Mentor/Mentee Pairing*

The peer mentors from the College of Engineering were paired with mentees who were taking primarily engineering courses, and could focus on both course content and time management. Mentors from the College of Education were paired with lower level students who were taking primarily general education courses, and these pairs focused heavily on organization, study strategies, and time management.

The BEE director individually paired the mentors and mentees based on the needs of the at-risk students and the strengths of the mentors. There was no specific algorithm for the pairings other than the director’s experience and judgement. Both the mentor and mentee understood that if any conflicts arose, the director would make adjustments as necessary. During the first year of implementation, only one pairing conflict occurred, and it was resolved quickly.

The BEE director also considered the following factors when matching mentors and mentees:

1) Major (pair mentees/mentors within same major)  
2) Similar coursework (pair a mentor who has taken economics with a mentee currently taking economics)  
3) Background and age (pair a non-traditional mentee with an upper-level mentor)

**BEE Program Results**

The BEE Program was able to support a range of at-risk students. The breakdown of mentee participants by ethnicity, gender and first-generation status are shown below in Figures 1-6. In both semesters of the program implementation, students of color were overrepresented in the program as compared to the CoE. In contrast, women were underrepresented in the program as compared to the CoE, which averages about 16% women. The participation of first-generation students in the BEE program varied between semesters.

![Figures 1 & 2. Participants by Ethnicity](image-url)
According to Kansas State University\textsuperscript{29}, the university-wide, first-year retention rate for Fall 2014 to Spring 2015 was 83.4%. Specifically, within the CoE, this retention measure was 85.2%. During the initial launch of the BEE program in Fall 2015, 98\% of participants were retained at the university and 89\% of participants were retained within the CoE. The BEE program did contain students beyond their first year, who are included in these retention rates. The second semester of implementation, Spring 2016, 97\% of the BEE participants were retained at the university and a 93\% within the CoE. As a preliminary representation of the impact of the BEE program, we also include a comparison of the students who participated in the BEE program and students who were non-participants. The non-participants were those students who were eligible to receive support, but failed to respond to the call for participation and did not receive the additional support. The preliminary results are summarized in Tables 1 and 2.

<table>
<thead>
<tr>
<th>Table 1: Fall 2015 BEE Program Impact</th>
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<tr>
<td>Participants</td>
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<tr>
<td>Retained at University</td>
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<tr>
<td>Retained in CoE</td>
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<tr>
<td>Dismissed from University</td>
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<td>Change in semester GPA (term)</td>
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<td>Change in semester GPA (cumulative)</td>
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In addition to looking at the impact of the BEE program as a whole on students’ GPAs, we also stratified the data based on the cohort that students belonged to. These cohorts were described above—the first cohort received intrusive academic advising paired with academic peer mentoring, while the second cohort received intrusive academic advising only. The comparisons of these cohorts are shown in Figures 7 and 8. With a smaller cohort in the Fall, intrusive advising alone was shown to be just as effective or more effective when correlated with studnets’ GPAs as compared to intrusive advising supplemented with academic peer mentoring. However, when the size of the cohort grew in the Spring, more significant increases in student GPAs were more strongly correlated with the cohort who received both intrusive advising and academic peer mentoring. One speculation for this pattern is the time limitation of a single advisor with an increase in students—likely employing student mentors improved the individualized attention provided by the program to support and retain each student.

Future Implementation

To extend the preliminary implementation and analysis of the BEE program, additional data on the demographics of participants as well as their experiences (e.g. frequency of meetings with a mentor) will be collected. With a larger data sample, we hope to perform a regression analysis to identify some of the most impactful aspects of the BEE program when considering student retention, which can then be generalized to other colleges or universities. KSU is currently piloting a campus-wide online tutoring system, and the BEE director will be utilizing the new system, which will allow her to collect more data related to the mentor-mentee meetings. For example, mentors will be able to enter the duration of their meeting as well as notes about what they worked on, which will provide a richer understanding of the BEE program and its effectiveness.
Within the CoE, additional administrative changes will impact the future implementation of the BEE program. For the first time, engineering students will be admitted based on ACT requirements. With the revised engineering admission standards, an incoming student with an ACT score of 21 or below will not be admitted directly to the CoE. Students who meet the academic requirements with a 24 or higher ACT score will be allowed to declare a major within any department in CoE. The students who arrive with an ACT score of 21, 22, or 23, will be required to begin their undergraduate studies in the General Engineering program before matriculating into a degree program\textsuperscript{30}. As a result, the BEE program will shift its focus to incoming first year students who are in the General Engineering program.

Throughout the implementation of the academic peer mentoring program, the director realized that it was difficult to define “at-risk” for the engineering student population. Being at-risk failed to fit into the neat definition of all students who have a low ACT score or low GPA. Not all of the at-risk students had visible and easily identifiable deficiencies. Often times some of the brightest students struggled academically because of other non-visible issues. Therefore further adaptation of the BEE program will be a revised strategy for identifying at-risk students including students who may identify with any of the following:

1. First generation
2. Military affiliated
3. Racial/ethnic minority
4. Impacted by a documented or undocumented disability
5. Displaying risky academic behavior

As retention efforts continue to evolve, a program to focus on sophomores may be developed. We are encouraged by the initial positive impact of the BEE program. The implementation of the BEE program will continue to be revised and iterated upon for improvement in an on-going effort to support and retain all of the students who choose to pursue an engineering degree at KSU.

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Mary Vesper, M.S.
Mary Vesper is an Academic Advisor at Kansas State University in the Engineering Dean’s Office. Mary holds a M.S. in Special Education from Nova Southeastern University and a B.S. in Exercise and Sport Sciences from University of Florida. She has completed all Ph.D. coursework in Education at Florida State University. She has worked as an Educational Diagnostician, and as a Learning Specialist developing academic retention programs for at-risk student athletes. She has over 10 years of teaching and coaching experience at all levels within regular and special education in the public school system. Her concentration and passion has been to assist at-risk students with proactive measures for successful completion of their academic goals.

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Emily Dringenberg, Ph.D.
Emily Dringenberg is a General Engineering Instructor within the Engineering Dean’s Office at Kansas State University. She received her B.S. in Mechanical Engineering from Kansas State in 2008. She then taught high school math and engineering in inner-city Atlanta via Teach for America before returning to graduate school. Dringenberg holds a M.S. in Industrial Engineering and a Ph.D. in Engineering Education, both from Purdue University. Her teaching and research interests include how students learn ill-structured problem solving, student beliefs and mindsets, and inclusive engineering culture.