

Student Satisfaction with Information Provided by Academic Advisors

Kyra L. Sutton Chetan Sankar

Auburn University

Introduction

The retention of engineering students is important because the costs of retaining current students are less than the expense of recruiting new students into the program (Haag, Hubele, Garcia, & McBeath, 2007). Further, it has been estimated that less than one half of the students who began engineering programs in the United States will earn an engineering degree (Doolen & Long, 2007). Moreover, the attrition rate is highest for college students during their freshman year (Tinto, 1975). Previous research has shown that engineering student attrition is related to one of four reasons: (a) Academic and Career Advising; (b) Faculty; (c) Engineering Structure, Curriculum, and Culture; and (d) High School Preparation (Haag et al., 2007, p. 929).

Poor academic advising (e.g. misinformation reported related to required courses and appropriate sequencing of courses needed to complete degree requirements), and a general lack of career counseling (where awareness of career opportunities is a critical factor, especially in maintaining student interest in the major) were two critical factors that students consistently report as major detractions from pursuing an engineering program/degree (Haag et al., 2007). Specific to the engineering faculty, most students complained of experiencing language barriers during their interactions with international teaching assistants and faculty. Also, students did not deem the faculty approachable when they asked for assistance with coursework (Haag et al., 2007). Apprehensions related to the culture of engineering programs included the competitive learning environment that is present in science, technology, engineering, and mathematics (STEM) majors. Students also complained that they did not have adequate preparation in their math and science classes in high school. Although research has focused on redesigning engineering curricula, a new curriculum with poor student retention cannot be deemed successful (Jain, Shanahan, & Roe, 2009). Curricula must be redesigned with the key supporting components of a strong curriculum, including well-designed academic programs, dedicated faculty, and strong support services (Jain et al., 2009).

Concerns related to the retention of engineering students are not unique to universities. Corporations are also concerned about the shortage of talent prevalent amongst engineering students and other potential employees seeking technical jobs (e.g., computer science majors). While hiring foreign students who complete their degrees in the United States was once an option for employers, the overall pool of foreign students is declining, as foreign subcontracting has created opportunities for the foreign students to work in engineering and highly technical positions in their home countries (Jain et al., 2009). Therefore, identifying factors that will sustain the retention of engineering students is not only timely, but also vital to universities whose responsibilities include training and preparing the future workforce.

Research on academic advising in engineering is sparse in the literature (Hunter & White, 2007). However, it is clear that academic advising is an important component of a student's overall experience within engineering colleges. For example, Metzner (1989) demonstrated that academic advising has an indirect effect on student retention through increased student satisfaction, higher grades, and fewer intentions to leave the university. Alternatively, based on a case study conducted at the University of Wisconsin-Madison, Woolston (2002) reported that while student satisfaction with undergraduate education was high, satisfaction with advising was much lower. The negative perceptions that students held towards the advisors in Woolston's 2002 study was found to be caused by a gap between what the students wanted to discuss with their advisors, and what was actually discussed. More recently, Jain et al. (2009) found that poor academic advising was a key factor that contributed to the high student attrition in engineering programs. Haag et al., (2007) reported the results of a national study in which 53% of all engineering students complained about inadequate academic advising. The specific facets of inadequate advising included: (a) the advisors provided inaccurate information about course requirements, and (b) the advisors did not share information about special programs, sources of financial help, and

Abstract

The retention of engineering students is important because more than half of the students who begin engineering programs in the United States will not earn an engineering degree. A literature review showed the importance of academic advising in retaining students in engineering programs. Therefore, the goal of this study is to identify the level of satisfaction students have with the information provided by advisors on a variety of matters. A questionnaire was developed to assess a set of factors related to the satisfaction of students towards the services provided by advisors. The questionnaire was administered among pre-engineering students enrolled in an engineering class at a Southeastern university. It was supplemented by a focus group interview. The study demonstrated that the students were most satisfied with core issues such as course-specific information. The students were less satisfied with immediate information provided on questions such as insight into teaching styles of specific instructors, getting paired with mentors, and recommendations of alternative majors. They were reasonably satisfied with longer-term issues such as career opportunities and the provision of tutorial services. Based on these findings, the paper provides suggestions regarding how both academic advisors and faculty can collaborate and better meet the needs of undergraduate engineering students.

Keywords: academic advising; retention; student perceptions; policies; recommendations; engineering education

career opportunities (Haag et al., 2007). Many students complained about not being able to spend enough time with their advisor (McCuen, Gulsah, Gifford, & Srikantiah, 2009) or they perceived that the advisors were too overwhelmed to provide adequate care (Haag et al., 2007). Finally, some students were concerned that advisers planned schedules that required them to complete the program in 4–5 years, which for some students is impossible due to their family and/or work commitments (Varma & Hahn, 2007). Therefore, the research question addressed by this study is: **To what extent are students satisfied with the information provided by advisors on different matters (e.g., course requirements, mentoring, internship and career opportunities)?**

Although there has been a lot of research done in general in the academic advising field related to student perceptions of and satisfaction with academic advising, there has been significantly less research conducted and reported in the engineering education literature regarding student perceptions of academic advising. Further, the research that has been conducted on academic advising within the engineering education field mostly appears in conference proceedings (e.g. Chowdhury & Seif, 2010; Baxter & Yates, 2008; Knox, 2003), where few, if any, future research questions are identified. It is important for current studies to begin to replicate the findings from previous studies, to determine if the academic advising practices that are successful at one institution are applicable to other engineering programs.

Related to the importance of academic advising in the engineering education field, Knox (2003) identified a set of academic advising practices that were successfully implemented within the Chemical Engineering Department at the New Jersey Institute of Technology (NJIT). Specifically, Knox (2003) identified the newly implemented advising practices, and discussed them in respect to student satisfaction, retention, and graduation rates. The practices that were discussed in the Knox (2003) study included: (a) the elimination of multiple advisors (that is, a single advisor was assigned to each undergraduate student); (b) all students are advised within the College of Engineering at NJIT, including freshman students; (c) all students are required to have a meeting with the advisor in person prior to registration, during which the advisor checks the students' progress towards the degree, and a tentative plan is made for the remaining classes the student has to complete; (d) prerequisite checking occurs—that is, dur-

ing the advisement session, prerequisites are checked to ensure the proper course requirements are fulfilled prior to scheduling classes that will be completed in a subsequent semester; (e) follow-up advising occurs, where checks are made on student progress outside of the times that course scheduling takes place (e.g., graduation checks, transfer credit problems); (f) student feedback mechanisms are in place: formal feedback sessions are held each semester and the students provide feedback in person to the department chair; (g) students are given opportunities to find mentors; and (h) career advising is given. A full description of the changes implemented at NJIT can be found in the study (Knox, 2003). Given the success of the academic advising practices at NJIT, Knox (2003) encouraged the implementation of similar advising practices for other engineering departments.

Consistent with Knox's recommendations, this study was conducted among a group of students who are enrolled in an engineering program whereby new changes and policies are continuously being implemented for the purpose of improving the students' experiences. Of the academic advising practices examined in the Knox (2003) study, the following practices are in place at the university where the study was conducted:

- A. All students, including freshman, are advised within the College of Engineering.
- B. Students are required to meet with the advisor prior to enrolling for courses in the next semester.
- C. Prerequisite checking occurs—that is, during the advisement session, prerequisites are checked to ensure the proper course requirements are fulfilled prior to scheduling classes that will be completed in a subsequent semester.
- D. Advisors provide students with suggestions related to mentoring.
- E. Advisors offer career advisement, either directly or through a partnership with the Co-op program that is present within the college of engineering.

In addition, the Knox (2003) study found that students were more satisfied when they were assigned a single advisor. While this policy is also present at the institution at which data was collected, the individuals included in this sample had not yet declared a specific engineering major; rather, they were all pre-engineering students. Once the students complete the pre-engineering courses and enroll in a specific major, a single advisor will be assigned

to each student. Therefore, this study seeks to assess the extent to which students are satisfied with the academic advising process, given that many of the procedures that were found to be successful at NJIT are consistent with the current procedures in place at this university. Finally, we extended the Knox (2003) study, as we measured student satisfaction with specific academic advising factors (e.g., information provided about prerequisites, internship opportunities, mentoring). In comparison, Knox (2003) measured overall satisfaction with the advising process, rather than student reactions to various aspects of the academic advising process (e.g., career advising, mentors, course scheduling).

The next section includes the literature review, whereby we identify the issues that advisors normally address and/or manage as part of the services provided to students. Next, we discuss the methodology adopted to measure the satisfaction of the students with academic advisement. Subsequently, the experimental design, sample and measures are described. Finally, the results from the study are presented, in addition to some of the observations made by the engineering students during various focus group sessions that were conducted at the end of the semester.

The Importance of Academic Advisors in Engineering Colleges

It is important to understand the student's satisfaction with the advisor, because the curriculum of most engineering schools requires students to follow a very structured curriculum where they rely on the guidance of the advisors to structure schedules (Cogdell, 1995). Also, students interact frequently with advisors for a variety of reasons (e.g., change in course schedule, learning about graduation requirements, seeking information on internship opportunities). The purpose of an advisor is: (a) to assist students in forming goals and devising plans for accomplishing those goals, and (b) to enable students to cope with any personal, intellectual, and institutional barriers that hinder the execution of that plan (Varma & Hahn, 2007; Cogdell, 1995). That is, the advisors act as a resource for students as they earn their degrees (Varma & Hahn, 2007).

There are specific circumstances that make academic advising critical in ensuring the success of students in engineering colleges. First, engineering students generally progress from fundamental to advanced courses in a very

structured fashion, and the sequential ordering of classes is essential (Cogdell, 1995). Also, the pace of instruction within the STEM curricula is fast and highly technical and students are expected to master the material very quickly (Varma & Hahn, 2007). Further, engineering students tend to take electives that are clustered around specific career paths, and due to the uniqueness of the elected courses, the courses are not likely to be offered multiple times throughout the year (Levin & Hussey, 2007). Finally, engineering students have previously reported experiencing high levels of uncertainty (due to factors such as pressure to select a major that best meets their interests, feelings of isolation, and competitive classroom climates) and they often rely on their advisors for guidance and support (e.g. McCuen et al., 2009; Levin & Hussey, 2007).

Advisors tend to establish a unique and lasting relationship with students in the early years of their academic career. For example, when students enter their freshman year, the advisors are responsible for helping them select appropriate classes and develop a course schedule. The students will continue to interact with the advisors, at least to schedule classes at the end of each term, and they are likely to discuss any course requirements and/or scheduling challenges they may experience (e.g., having to repeat a course, managing a difficult course load). Therefore, students will likely have regular contact with the advisors over a long period of time, including as they prepare to graduate.

Methodology

In order to address the research question, we developed a questionnaire and conducted focus group interviews with engineering students. Studies that include both focus group data and surveys are one of the leading ways to combine qualitative and quantitative methods (Morgan, 1996). The questionnaire provides the quantitative assessment of student perceptions, whereas the aim of focus group research is to draw conclusions about the participants' views, ideas, or experiences (Hyden & Bulow, 2003).

The questionnaire was developed based on a literature review that identified a set of factors related to student attrition within engineering programs (i.e., Jain et al., 2009; Haag et al., 2007; Hartman & Hartman, 2006; Knox, 2003). In addition, several of the factors included in the survey were consistent with the factors that had been successfully addressed by the advi-

sors at NJIT (i.e. Knox, 2003) such as providing students information on course sequencing including prerequisites, career opportunities, and mentors. Next, those factors were used to create the items included in the questionnaire. Once the initial set of attrition factors was identified, a list of variables that measure the satisfaction with the services of the advisors was created. The list included attrition factors that could be addressed by the advisors. That is, the advisor could reduce or alleviate students' concerns related to those factors, by supplying the students with useful information and suggestions. The factors included in the list were as follows (i.e. Jain et al., 2009; Haag et al., 2007; Hartman & Hartman, 2006; Knox, 2003):

- (1) Inadequate high school preparation in math and science courses
- (2) Improper course sequencing
- (3) Complaints of poor teaching
- (4) Alternative choices for other STEM majors/ Limited knowledge about other science or math-related majors
- (5) Limited knowledge of internship/career opportunities
- (6) Lack of mentors
- (7) Poor academic performance

The questionnaire included nine items based on these factors. The first three questionnaire items addressed inadequate high school preparation and improper course sequencing:

- *I am satisfied with the information that the advisor provides about the courses (e.g., math and science) I should have completed prior to entering college*
- *I am satisfied with the information the advisor provides about the required pre-engineering courses I have to complete*
- *I am satisfied with the information the advisor provides about required courses I have to complete for my major*

The next item was developed based on complaints of poor teaching:

- *I am satisfied with the information the advisor provides about instructors I should take*

The next item was designed to assess information related to alternatives majors. One mission of engineering colleges is to ensure that even if students leave the engineering major, they are still retained in a STEM major:

- *I am satisfied with the information the advisor provides about alternative majors*

The next two items were related to information on internship and career opportunities:

- *I am satisfied with the information the advisor provides about internships (opportunities)*
- *I am satisfied with the information the advisor provides about career opportunities*

Finally, the last item addressed concerns related to support services, specifically mentorship opportunities and tutorial services:

- *I am satisfied with the information the advisor provides about how to get paired with a mentor in my area of interest*
- *I am satisfied with the information the advisor provides about where I can get tutoring*

A 5-point Likert scale was used in the surveys, where a value of 1 indicated "very dissatisfied," a value of 3 indicated "neither satisfied nor dissatisfied," and a value of 5 indicated "very satisfied." In addition, demographic questions were asked of the respondents. A copy of the questionnaire is included in Appendix A.

The questions asked in the focus group included (Hyden & Bulow, 2003):

1. What other kinds of assistance can advisors provide that would be helpful for your success in the program?
2. Think about a good experience that you have had with an advisor in the College of Engineering. Describe why this experience was helpful for you. What were some of the characteristics of the advisor?
3. Think about a bad experience that you have had with an advisor in the College of Engineering. Describe why this experience was frustrating for you. What were some of the characteristics of the advisor? How could they have been more helpful?

Sample

The study was conducted among a group of 15 engineering students. Thirteen of the students were freshman, and two of the students were sophomores. All students were enrolled in the pre-engineering curriculum within the College of Engineering at a Southeastern university, and the mean number of semesters that the students had been enrolled within the College of Engineering was 2.53 semesters. Fourteen of the students were male and one was female. The mean age of the sample was 20.73 years. There are approximately four advisors who work with the pre-engineering students—that is, students in the beginning of their programs. Once the students complete the pre-engineering courses and enroll in a specific

major, a single advisor will be assigned to each student.

Administration of the Questionnaire and Focus Group

The questionnaire shown in Appendix A was administered to the students at the end of the semester. Once the students completed the survey, the researchers conducted a focus group session with them. The focus group discussions were taped and analyzed to come up with qualitative responses that added further depth to the study. The students were divided into two focus groups with each focus group having approximately 7 to 8 participants.

Results

A statistical analysis was performed of the data from the questionnaire and is shown in Table 1. The students indicated a mean above 3.0 on all the questions, indicating that they were moderately satisfied with the information provided by the advisors. Survey respondents reported the highest level of satisfaction with the information provided by the advisors on the following topics: courses that they should have completed prior to college, the identification of pre-engineering courses that have to be completed, and the courses that have to

be completed within their major. The survey respondents reported less satisfaction with the information provided by their advisor on the following topics: suggestions related to how they should seek out a mentor in their field, insight into specific instructors, information provided on internship opportunities, and ideas for other STEM majors the students could pursue.

In addition to completing the survey, the students also participated in focus groups where they provided feedback related to what they liked about the advisors, and any concerns they had about the academic advisors.

Findings

The results were analyzed to identify the issues/factors where students perceived most satisfaction, least satisfaction, and moderate satisfaction. Based on this categorization, the following findings emerged:

- Students perceived the most satisfaction from course-related information provided by advisors (e.g., course sequencing advice and building a course schedule).
- Students perceived the least satisfaction with more immediate matters, including information provided on mentoring, quality of faculty, and internship opportunities.
- Students perceived moderate satisfaction

Survey Item	Mean	Std. Deviation
	Q1: I am satisfied with the information that the advisor provides about the courses (e.g., math and science) I should have completed prior to entering college	3.67
Q2: I am satisfied with the information the advisor provides about required pre-engineering courses I have to complete	3.67	.90
Q3: I am satisfied with the information the advisor provides about instructors I should take	3.07	1.03
Q4: I am satisfied with the information the advisor provides about alternative majors	3.13	.83
Q5: I am satisfied with the information the advisor provides about internship opportunities	3.13	.99
Q6: I am satisfied with the information the advisor provides about career opportunities	3.47	.99
Q7: I am satisfied with the information the advisor provides about how to get paired with a mentor in my area of interest	3.00	.93
Q8: I am satisfied with the information the advisor provides about the required courses I have to complete for my major	3.67	1.11
Q9: I am satisfied with the information the advisor provides about where I can get tutoring	3.53	.83

*Scale: Very Satisfied = 5 to Very Dissatisfied =1

Table 1. Student Satisfaction with advisor

with information made available on longer-term issues such as career opportunities.

Satisfaction with Core Factors

Students were the most satisfied with information provided about courses that they should have completed prior to college (mean of 3.67), the identification of pre-engineering courses they have to complete (mean of 3.67), and the courses they have to complete within their major (mean of 3.67). Most of the specific comments provided during the focus group discussions supported the quantitative results.

- “I like that the advisor provides me with the proper course sequencing and pre-requisites. This is important because I need to identify the appropriate pre-requisites.” **[Course sequencing]**
- “I like that the advisor has knowledge of degree plans. For example, my advisor found an one credit hour class. It’s helpful when advisors have a wide breathe of knowledge about a variety of courses I can take. I want them to do that...to give me suggestions if I don’t know what one or two hour class to take.” **[Course scheduling]**
- “The advisors are a vital part of the program. They keep you on track, they help you get classes, and they get to know info about my interests. They also teach you how to build a schedule.” **[Course scheduling]**
- “My advisor answered questions about how to finish school early. I want to finish the program two years early and he helped me figure out how to do that. He gave me a priority list of classes I have to take and told me which classes are most important.” **[Course sequencing and scheduling]**
- “I had a situation where I was enrolled to take two classes, but they were offered at the same time. My advisor saved a spot for me in the same class but at another time. That helped me out a lot.” **[Course scheduling]**

However, some students expressed concerns about information provided by the advisors on course scheduling and course sequencing. For instance, some students seemed to think that the advisors provided inadequate information related to their course schedules that subsequently resulted in students taking an

impossible combination of courses (in a given semester).

- “My advisor signed me up for a class I had already taken at a previous university.” **[Course scheduling]**
- “I want a completed schedule when I leave my advisor’s office. This doesn’t always happen.” **[Course scheduling]**
- “I need to know if the schedule I have to put together is not ONLY complete, but I need to know if the course combination I selected is reasonable. I want specific feedback and suggestions related to the combination of classes I have selected to take together. I don’t always get that. Instead, I am just told my schedule is approved.” **[Course scheduling]**
- “I get frustrated because I feel like my advisor only gives a cursory look at my schedule. I had to wait in line for a long time to see my advisor, and then they just gave my schedule a quick glance. They did not look at my schedule to see if there were any problems.” **[Course scheduling]**
- “Even though I need to show my advisor my schedule to register for classes, I don’t feel like they really look at it. They only look closely at the schedule if there are any problems with your schedule.” **[Course scheduling]**
- “The advisors give little thought to the combination of classes. I want advice on how NOT to take an impossible course load. Sometimes I leave the advisor’s office with a complete schedule. But the course combination is unreasonable.” **[Course scheduling]**

Overall, students perceived that they obtained the most support from advisors on these core issues that dealt with course scheduling and sequencing.

Dissatisfaction with Immediate Factors

The students were less satisfied with the information provided about suggestions related to how they should seek out a mentor in their field (mean of 3.00), insight into specific instructors (mean of 3.07), recommendations of alternative majors (mean of 3.13), and details about internship opportunities (mean of 3.13). Examples of illustrative comments made during the focus

group that were consistent with the quantitative results included:

- “I want more information related to what the class is like (e.g., specific techniques used to teach material, for example small group discussion, vs. hands-on learning experiences)” **[More information desired about course and/or instructor]**
- “I’d also like to see more course feedback from the students. And I’d like the advisors to let us see the student comments about the instructors in the Engineering school.” **[More information desired about course and/or instructor]**
- “I don’t think I would go to my advisor to find out about mentors. I think I would go to a teacher or something...I really just go to advisors for course or major changes” **[Mentors]**

Moderate Satisfaction with Longer-Term Factors

The students were moderately satisfied with information provided by advisors related to where they can find tutoring services (mean of 3.53) and career opportunities (mean of 3.47). There were no specific comments made during the focus group related to tutorial services. However, the students did remark on their satisfaction with career opportunities that they learned about through the university. Specifically, the students attributed their satisfaction with information provided about career opportunities to the fact that a partnership exists between the cooperative education program (Co-op), and the Engineering Advisement Office within the College of Engineering. That is, the Co-op program works in conjunction with the advisors at this institution, where the advisors must approve any work-related opportunities (e.g., working for course credit, completing an internship) that are identified by the Co-op program for the students (assuming the student is still enrolled at the university). Illustrative comments provided by the students related to their satisfaction with the Co-op program, or their satisfaction with the partnership that exists between the Co-op program and the Engineering Advisors, included:

- “I go to the co-op office to get information about permanent jobs, to get resume help, to learn about interview skills, and maybe to find a mentor.” **[Co-op Program and career opportunities]**

- “The co-op office gives information on career opportunities. And what I like best is that the co-op office reaches out to us. They reach out to use more than the advisors do.” **[Co-op Program and career opportunities]**

- “I like that the advisors and the co-op office work together. They help you make decisions.” **[Partnership between the Co-Op Program and Engineering Advisors]**

- “I like that the advisors have to approve anything that is done by the co-op office; the advisors tell you whether or not the work assignment given to you by the co-op office will work towards earning credits for graduation.” **[Partnership between the Co-Op Program and Engineering Advisors]**

Recommendations to Faculty and Advisors

The study findings lead to several recommendations for faculty members and advisors. We deemed it appropriate to make recommendations for both advisors and faculty, as recently some studies have begun to focus on the collaboration between faculty and support services in increasing the retention of engineering students (Seevers, Knowlton, Pyke, Schrader, & Gardner, 2006). The recommendations included in this section are intended to improve student satisfaction, specifically in relation to the areas in which students were the least satisfied. Subsequently, specific recommendations have been made regarding the following four areas: (a) mentoring opportunities, (b) specific course instructors, (c) alternative majors, and (d) internship opportunities. However, given that our sample included mostly freshman engineering students, the recommendations generally focus on ways to increase the satisfaction (and thereby retention) of students within the first two years of their engineering programs.

Mentoring

First, not all students are interested in being paired with a mentor. Further, among those students that desire a mentor, there is likely variance across the types of mentors students seek. That is, some students are likely to want **professional mentors**, with whom they would be exposed to the type of work that professional engineers perform in their field. Other students may wish to be paired with **research mentors**, with whom they would share similar research

interests. Finally, some students may want peer mentors. That is, students may enjoy “peer” mentoring, which would be provided by senior students within their major (i.e., seniors or graduate students). The role of a peer mentor would be to provide guidance related to course selection, study tips, selecting the appropriate major, etc.

As a result, academic advising offices should develop a survey to administer to students that would identify whether the students wanted a mentor, and the type of mentor(s) that would best suit their needs. The advising office could administer this survey annually, given that the type of mentor(s) a student desires is likely to change. The advisors would then be responsible for finding a mentor best suited to meet the needs of each student who does indeed desire a mentor. Drawing from a model utilized at the university in which the study was conducted, the identification and pairing of students with professional mentors might be a joint effort managed by the Co-op program and the Academic Advising Office within the College of Engineering. The research mentors would most likely be faculty members.

The pairing of students with peer mentors may be a coordinated effort managed by instructors and the academic advising office; instructors could provide the advisors with recommendations of upper-level students (i.e., seniors or graduate students) who performed exceptionally well either in class, on a research project, and/or at an internship. The advisors could then consult with the students recommended by instructors and gauge their interest in participating in a mentoring program. In relation to the idea of peer mentoring, Knox (2003) described the student mentoring programs at NJIT. An informal peer-mentoring program was established, where freshman engineering students are matched with mentors who are in their junior year or above in the engineering program (Knox, 2003). The junior-level students expected to help freshman students address a variety of concerns, including the completion of homework and dealing with difficult roommates (Knox, 2003).

As part of the mentorship program, faculty might build relationships with students who share their research interests and express the desire to join a project. Drawing from Vogt (2008), faculty can facilitate the development of a mentoring relationship with students who have similar research interests by: sharing personal information with the students (maybe during class or during office hours), showing a genuine interest in students, providing opportu-

nities for students to assist with projects (even if it's just a short-term project), and generally being accessible and approachable. The role of faculty in the development of mentoring programs is essential, as the students interact with the instructors frequently. Previous research suggests that instructor approachability greatly impacts student performance and retention in engineering programs (Vogt, 2008).

Specific Course Instructors

Many of the concerns expressed by the students during the focus group were related to how a specific course was taught. That is, the students stated that they desired more information related to specific teaching techniques that are utilized in the class. They also wanted to read the course feedback from students who had taken the class previously. One way to address the concerns of the students is to provide them with more information about each course. Typically, only brief course descriptions are provided about specific courses. The students could also be provided with a more detailed course description that is written either by a faculty member or a teaching assistant. All detailed course descriptions would have the same content, including description of teaching style, type of course (lecture or lab), percentage of time expected to work in small groups, description of assessment tools used in class (e.g., exams, quizzes, homework assignments), and the type of assignments that students will have to complete outside of the classroom.

Providing students with course descriptions is useful, because when students schedule their courses this information will allow the students to select the best instructor for their specific learning styles. For example, students who enjoy learning in teams can read through the course descriptions and select the instructor(s) that incorporate team-learning activities within their courses. The identification of a faculty member who teaches in the student's preferred learning style is important because previous research demonstrates that students learn more when the teaching style used by the instructor matched their personal learning style (McShannon, Hynes, Nirmalakhandan, Venkataramana, Ricketts, Ulery, & Steiner, 2006).

Finally, a procedure that was successfully implemented at NJIT included faculty feedback sessions (Knox, 2003). The purpose of these sessions is for the faculty to discuss the extent to which students are performing successfully in the course, and whether the prerequisites for the course are appropriate and/or redun-

dant (Knox, 2003). Specifically, each faculty member that has taught a course within the current or previous semester is present at the feedback sessions. The focus of the feedback sessions is to determine whether the students are achieving satisfactorily in the course, and what changes may need to be adopted in either the course or its pre- and co-requisites (Knox, 2003). The meetings were found to be successful, mostly due to the notion that it encouraged communication between faculty members and it allowed the faculty members to consider the student feedback given about the courses, including changes that can be made (Knox, 2003). Further, these sessions would ultimately be helpful for the students as discussions of the courses among faculty are likely to reduce redundancies across courses, and faculty members may share “best practices” related to how the material can be taught. That is, during the feedback sessions, there may be a person assigned to take notes during the session. The notes may contain explicit statements related to “how” courses are best taught, and the appropriate prerequisites that should be taken for a given course. If the notes from this session were distributed to students, in some fashion, the students would gain information related to the specific prerequisites that should be taken prior to enrolling in a given course. Further, they would receive information related to various teaching techniques utilized by a given teacher (e.g., some teachers may use group assignments, some teachers may incorporate hands-on-learning techniques). By reading notes related to how each faculty member structures a course, students can then make an informed choice to enroll in the section where instructors teach in a manner consistent with the student’s learning needs.

Alternative Majors

Previous studies that measured retention in engineering programs have found that, for the most part, students do not leave engineering programs because of failing grades (Bernold, Spurlin, & Anson, 2007). Academic ability and/or GPA are often factors that contribute to the attrition of college students (Bernold et al., 2007); however, most students in engineering courses make above average grades in their math and science prerequisite courses. Therefore, engineering students are more likely to leave because they are dissatisfied with the pedagogy within engineering programs (Bernold et al., 2007), or because they are not innately interested in the prerequisite science and

math courses. That is, engineering students are sometimes unable to see a connection between what they learn in the prerequisite classes (e.g., linear algebra, differential equations, and physics), and how these courses prepare them for future careers in engineering (Jain et al., 2009). Simply put, they do not see the connection between the “theory” learned in the prerequisite classes and the “practice” of engineering. For example, a future mechanical engineering may think, “How does learning about differential equations help me diagnose why a car engine is malfunctioning?” As such, there are a significant number of students who excel in and enjoy math and science courses, but they do not want to stay in engineering colleges. Faculty and advisors may be able to help retain STEM students by identifying other majors they can pursue that coincide with a specific interest in either math or science, outside of engineering programs.

One way to identify other STEM majors that students could pursue would be to create a tracking system. This tracking system would capture the student’s major, grades, and enrollment status within the engineering college. Based on the students’ performance in their prerequisite math and/or science classes, the advisor and instructor on record (i.e., the instructors in which the students completed math and/or science courses and received above average marks) might work together to make recommendations related to other STEM majors students may pursue, should they become less interested in pursuing an engineering degree.

For example, a student may share with his/her advisor that he/she is interested in switching majors. The advisor would then be responsible for compiling a profile on the student that would include classes completed, grades earned, and course instructors. Next, the advisor would consult the course instructor(s) in courses the student performed well in (i.e., C or above) and ask for recommendations related to STEM majors the student may pursue outside of the engineering school. The instructors would give recommendations, and the advisor and the student would review the recommendations made by the instructors and determine two or more options of additional majors. For instance, a student who has performed well in the prerequisite math courses might be advised to pursue a major in mathematics with a specialization in actuarial science, operations research, or statistics. Alternatively, a student who performed well in the prerequisite science classes might be advised to select a program

of study in forensic science, chemistry, zoology, or botany. In this manner, the advisors and the instructors work together to retain students who perform well in science and math courses, but have less interest in pursuing an engineering degree.

Internship Opportunities

Obtaining internship opportunities is important to the retention of engineering students because it gives them an opportunity to apply theory to solve real-world problems. Further, it gives students the opportunities to gain confidence in their abilities and work outside of the classroom. Seevers et al., (2006) made several suggestions related to how internships should be correctly designed for engineering students. Woolston (2002) stated that students want advice about broader areas such as finding a job after college and identifying career areas that match their skills, abilities, and interests. However, students most often received advice on course-related information such as what classes were required for a certain degree, or information about the general prerequisites they had to complete prior to starting classes within their major.

Drawing from these two papers (Seevers et al., 2006; Woolston, 2002) it is important that at least two steps are completed to ensure that engineering students gain useful information and suggestions about internship opportunities. First, the engineering college must establish relationships with companies that are willing to accept interns, especially interns who would be freshmen and sophomores in engineering colleges, as they are viewed as having fewer skills than more senior level engineering students (Seevers et al., 2006). Next, the engineering colleges should determine which of the current students want to participate in internship programs.

Advisors can work along with either a Co-op program or the university career services center to identify potential companies that are within commuting distance of the campus (Seevers et al., 2006). In doing so, the advisors are identifying a pool of potential employers that may be interested in hiring student interns. After the initial groups of companies are identified, faculty may then consult company representatives and share information about the engineering program, including the type of training students receive from coursework. It may even be helpful for the faculty to visit the corporations in person to give a presentation related to the structure of the engineering programs. Included in the pre-

sentation, the faculty member would be responsible for providing an overview of the course content (how the courses are structured, what material is taught within a variety of courses), in addition to providing the corporation with a background of the specific skills and knowledge the students learn in the pre-engineering/ major courses.

The information provided by the faculty member would give the corporation a sense of the types of skills that the students have gained which, in turn, would allow the organization to begin determining the types of internship positions that would best meet the students' current skill level and experience. That is, the corporation could begin to match the skills of the student with the requirements of a specific job. The companies could then conduct interviews and offer internship positions to the students who have the skills that best meet the requirements of the job.

Consistent with this idea, a newly created faculty position, "Associate Chair for Graduate Studies and Industrial Relations" (Knox, 2003, p. 6) was successfully implemented at NJIT. In this position, the individual is responsible for maintaining industry contact, which includes: (a) establishing a network with local employers that are likely to hire NJIT students, (b) interacting with students on-site during their co-ops, and (c) partnering with the university career services office (Knox, 2003). The establishment of this position was successful, as the companies felt more comfortable when they could interact with a faculty member who had knowledge of their field, and the career services center reported higher numbers of successful job placements (Knox, 2003).

At the same time, the advisors can begin talking to students and compiling names and résumés of those who may be interested in completing an internship (Seevers et al., 2006; Woolston, 2002). Advisors can then begin submitting the résumés (or working in cooperation with the Co-op program or career services) to identified companies. While it is less likely that a freshman or sophomore would be invited to the organization to complete an internship, Seevers et al. (2006) stress the importance of identifying a faculty or staff member within the College of Engineering (or an engineer at the corporation) who would be willing to mentor students. In summary, to increase the students' satisfaction with information provided about internships, both instructors and advisors have to work in partnership to guarantee that the students are made aware of internship

opportunities. This process begins with the instructors and advisors identifying and building multiple relationships with companies that hire engineers.

Limitations

There are several limitations that should be noted about this study. First, this was an exploratory study. Next, we had a small sample size of students at $n = 15$. Further, the students included in the sample were freshman and sophomore engineering students. Therefore, the small sample size and the exploratory nature of the survey both reduce the generalizability of the findings in the study, especially the quantitative findings. In addition, we were unable to replicate all of the academic advising procedures that were identified in the Knox (2003) study. Also, we did not collect any data related to student retention (Knox, 2003). Next, the students who participated in this study may have experienced exhaustion, as the survey was administered and the focus group interviews were conducted on the same day during final exams week. Finally, the items included in the questionnaire need to be further validated to ensure construct validity.

Future Research

Future research on this topic might begin by replicating this study with a larger sample of engineering students. Also, it would also be useful to administer a survey to engineering students who are in the later years of their programs—that is, junior and senior-level engineering students. In addition, information needs to be gathered from both advisors and faculty members. Specifically, we are interested in assessing the perceptions that the advisors hold about the type of information and suggestions that they give students relevant to the critical attrition factors identified previously (e.g., complaints of poor teaching, lack of mentors). Further research should investigate the characteristics of the faculty members and advisors who are most willing to actively participate in programs for the purpose of increasing retention. That is, are there certain characteristics that universities should seek out in both faculty members and advisors of those individuals that would desire to collaborate with others for the benefit of increasing student retention?

All the recommendations made in the previous section would require the advisors and faculty members to assume additional job responsibilities. Therefore, another stream of research

might include identifying ways to provide advisors and faculty incentives to participate in programs that are implemented to address these student concerns.

Finally, an important and significant trend has occurred within the academic advising field. Specifically, it is now important not only to consider student satisfaction with advising services, but also to assess **student learning outcomes** (e.g. Hurt, 2007; Smith, Szelest, & Downey, 2004; Banta, Hansen, Black, & Jackson, 2002), where learning outcome assessment is the “process of gathering evidence for judging the effectiveness of the program” (Banta et al., 2002, p. 5). It is important to assess student learning outcomes, as academic advising should be directly linked to learning outcomes in order to evaluate the effectiveness of the advisors (e.g. Hurt, 2007). Learning outcomes, once established, can then be used to improve the services provided by the academic advising office (Banta et al., 2002). Finally, the assessment of student learning outcomes allows each college to determine whether the students have obtained a given set of skills and knowledge during the advising process (Smith et al., 2004). For example, it might be important to advisors within engineering colleges for students to have a basic knowledge of the career opportunities that exist within each of the engineering disciplines. Alternatively, another learning outcome that might be useful in engineering colleges is for students to be familiar with resources that will help them perform successfully in their engineering classes (e.g., tutorial sessions that may be available). Thus, the research in engineering education should reflect the most current developments in the academic advising field, most importantly conducting studies where the data related to student outcomes is collected relative to their experiences with academic advisors.

Conclusions

This article identified the extent to which students enrolled in an engineering program were satisfied with the information provided by the advisors and provided a set of recommendations based on the results of the survey and focus group results. We identified that the students were most satisfied with information provided on core concepts such as required pre-college prerequisites, required pre-engineering courses, and required major courses. However, the students were least satisfied with immediate factors such as how they should seek out a mentor in their field, insight into specific instructors,

recommendations of alternative majors, and details about internship opportunities. Based on the results, a set of findings were reported and four major recommendations were made. This article demonstrates the importance of faculty members and advisors working together to increase the perceived satisfaction of students on advising services. Such collaboration might lead to increased retention of students in STEM programs.

Acknowledgments

The authors would like to thank Howard Clayton and Barbara Kawulich for providing access to the respondents who participated in this study. In addition, both Laura Kincaid and Monica Cox should be acknowledged, as they provided invaluable project-related information and/or suggestions. The work in this paper was partially sponsored by NSF EEC # 0934800. The opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of the National Science Foundation.

References

- Banta, T. W., Hansen, M., Black, K.E., & Jackson, J. E. (2002). Assessing Advising Outcomes. *NACADA Journal*, 22 (1), 5–14.
- Baxter, K. & Yates, L. (2008). Addressing freshman retention through focused advisement and seminar programs. *Proceedings of the American Society for Engineering Education*, Pittsburgh, PA, 1–7.
- Bernold, L.E., Spurlin, J.E., & Anson, C.M. (2007). Understanding our students: A longitudinal study of success and failure in engineering with implications for increased retention. *Journal of Engineering Education*, 96, (3), 263–274.
- Cogdell, J. (1995). The role of faculty advising in science and engineering. *New Directions for Teaching and Learning*. 62, 65–70.
- Chowdhury, S. & Mohamed, S. (2010). Enhancement of learning outcome and retention of minority students in engineering. *Proceedings of the American Society for Engineering Education*, Louisville, KY, AC2010-2029.
- Doolen, T. L. & Long, M. (2007). Identification of retention levers using a survey of engineering freshman attitudes at Oregon State University. *European Journal of Engineering Education*, 32, (6), 721–734.
- Felderman, R.M. & L.K. Silverman, L.K. (1988). Learning and teaching styles in engineering Education, *Engineering Education*, 78, 674–681.
- Haag, S., Hubele, N., Garcia, A., & McBeath, K. (2007). Engineering undergraduate attrition and contributing factors. *International Journal of Engineering Education*, 23, (5), 929–940.
- H. Hartman, H. & Hartman, M. (2006). Leaving engineering: Lessons from Rowan University's College of Engineering. *Journal of Engineering Education*, 95 (1), 49–61.
- Hunter, M.S. & White, E. (2004). Could fixing academic advising fix higher education. *About Campus*, 9, (1), 20–25. 19
- Hurt, R.L. (2007). Advising as teaching: Establishing Outcomes, Developing Tools, & Assessing Student Learning. *NACADA Journal*, 27 (2), 36–40.
- Hyden, L.C. & Bulow, P.H. (2003). Who's talking: drawing conclusions from focus-groups- some methodological considerations. *International Journal of Social Research Method*, 6, 305–321.
- Jain, R., Shanahan, B., & Roe, C. (2009). Broadening the appeal of engineering- Addressing factors contributing to low appeal and high attrition. *International Journal of Engineering Education*, 25,(3), 405–418.
- Knox. D.E. (2003). Advisors and Mentors: Their role in the retention and success of chemical engineering students. *Proceedings of the American Society for Engineering Education*, Nashville, TN, 1–8.
- Levin, J. & Hussey, R.. (2007). Improving advising in the sciences. *Journal of College Science Teaching*, 36 (6), 28–35.

McCuen, R.H., Gulsah, A., Gifford, I.A., & Sri-kantiah, D. (2009). Recommendations for improving graduate adviser-advisee communication. *Journal of Professional Issues in Engineering Education and Practice*, 135, (4), 153–160.

McShannon, J., Hynes, P., Nirmalakhandan, N., Venkataramana, G., Ricketts, C., Ulery, A., & Steiner, R. (2006). Gaining retention and achievement for student programs: A faculty development program. *Journal of Professional Issues in Engineering Education and Practice*, 132 (3), 204–208.

Metzner, B.S. (1989). Perceived quality of academic advising: The effect on freshman attrition. *American Educational Research Journal*, 26, (3), 422–442.

Morgan, D. (1996). Focus Groups. *Annual Review of Sociology*, 22, 129–152.

Seevers, W., Knowlton, P., Pyke, C., Schrader and J. Gardner. (2006). Improving engineering undergraduate retention via research and internships. *Proceedings of the American Society for Engineering Education*, Chicago, IL, 1–10.

Smith, J.S., Szelest, B.P., & Downey, P. (2004). Implementing outcomes assessment in an academic affairs support unit. *Research in Higher Education*, 45 (4), 405–427.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45(1), 89–125.

Varma, R. & Hahn, H. (2007). Gender differences in students' experiences in computing education in the United States. *International Journal of Engineering Education*, 23,(2), 361–367.

Vogt, C. (2008). Faculty as a critical juncture in student retention and performance in engineering programs. *Journal of Engineering Education*, 97, (1), 27–36.

Woolston, D.C. (2002). Improving undergraduate academic advising in engineering: It's not rocket science. *Proceedings of the Frontiers in Education Conference*, (3) , S2C/2-S2C/4.

Kyra Leigh Sutton is an Assistant Professor of Human Resources Management in the Lowder College of Business, at Auburn University. She received her PhD in labor and human resources management from Ohio State University. Her research focuses on the talent acquisition and talent management of human capital, including: recruitment, organization socialization, career management, and employee compensation. Dr. Sutton's work has been published in the *Asia Pacific Journal of Management*, among other publications. In addition, her research has been presented at the Society for Industrial and Organizational Psychology (SIOP), and the Academy of Management (AMA).



Chetan S. Sankar is the College of Business Advisory Council Professor of Information Systems at Auburn University. He has received more than two million dollars from ten National Science Foundation grants to develop exceptional instructional materials that bring real-world issues into classrooms. He has won awards for research and teaching excellence from the Computerworld, Campus Technology, Society for Information Management, NEEDS, Decision Sciences Institute, American Society for Engineering Education, American Society for Mechanical Engineering, International Network for Engineering Education & Research, and the Project Management Institute. He is the editor-in-chief of the *Decision Sciences Journal of Innovative Education* and the managing editor of the *Journal of STEM Education: Innovations and Research*. He is also the director of Geospatial Research and Applications Center (www.auburn.edu/grac). He can be contacted at sankacs@auburn.edu.



Appendix A: Advisor Satisfaction Questionnaire

Auburn University Engineering Student Questionnaire

Below, please complete the brief survey. Your answers will remain confidential. Remember to complete pps. 1-2 of the survey.

	Very Dissatisfied	Dissatisfied	Neither Satisfied nor Dissatisfied	Satisfied	Very Satisfied
1. I am satisfied with the information that the advisor provides about the courses (e.g. math and science) I should have completed prior to entering college	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I am satisfied with the information the advisor provides about the required pre-engineering courses I have to complete	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I am satisfied with the information the advisor provides about instructors I should take	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I am satisfied with the information the advisor provides about alternative majors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I am satisfied with the information the advisor provides about internship opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I am satisfied with the information the advisor provides about career opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I am satisfied with the information the advisor provides about how to get paired with a mentor in my area of interest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I am satisfied with the information the advisor provides about the required courses I have to complete for my major	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I am satisfied with the information the advisor provides about where I can get tutoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Part 1: Rate the extent to which you are satisfied with the information provided by your academic advisor(s) .

Part 2: In order for us to better understand who has participated in our study, we ask that you please provide us with the following information regarding your personal background.

1) Age: _____years

2) Gender:

- Female
- Male

3) Major:

- PN (Pre-Engineering, General Studies)
- PAE (Pre-Aerospace)
- PBSE (Pre-Biosystems)
- PCE (Pre-Civil)
- PCHE (Pre-Chemical)
- PSWE (Pre-Software)
- PWRE/PWRS (Pre-Wireless Hardware/Software)
- PEE (Pre-Electrical)
- PIE (Pre-Industrial)
- PME (Pre-Mechanical)
- PMTL (Pre-Materials)
- PPF (Pre-Polymer and Fiber)

4) Classification:

- Freshman
- Sophomore
- Junior
- Senior

5) Number of Semesters enrolled in pre-engineering at time of the survey: _____semesters

6) Id Number _____