Implementing a Recursive Retention Assessment System For Engineering Programs


Office of Institutional Research
The University of Alabama

Introduction

*The Report of the Task Force on the Engineering Student Pipeline* (Engineering Deans’ Council, 1988) estimated that losses to other majors, and from school altogether, range between 30 percent and 70 percent in four-year engineering schools. This study also found that few engineering schools maintained longitudinal retention data for freshmen persistence in engineering programs. Astin (1993), in his colossal study of nearly 25,000 students at over 300 institutions, found that 43% of first-year engineering students went on to graduate in engineering. Moller-Wong and Eide (1997) found similar results with a probable graduation rate between 40% and 45%. They stated that retention in engineering programs is often argued to be so important that “it should be used as a college outcomes assessment parameter…” and be considered a measure of faculty and professional engineers ability to design programs of study that meet consumer and market expectations (p.7). Further highlighting the importance of the topic, retention rates have also been mentioned as a critical measure of institutional effectiveness (El-Khawas, 1992; Tinto, 1994).

Retention data are very important in planning curricula, facilities, academic intervention programs, and recruiting activities. Studies have shown that it is more expensive to recruit a new student than it is to keep a current one (Ferguson, et al., 1986). Thus, it is imperative to understand what factors contribute to attrition in engineering and other programs. This study’s aim is to discover and establish the relative importance of the factors with greatest bearing upon the decisions of undergraduates at the University of Alabama to leave engineering programs.
Research Questions

Question I: What majors did engineering transfers pursue?

Question II: What factors related to academic underpreparedness contributed to student attrition from the College of Engineering?

Question III: What factors related to psychosocial variables contributed to student attrition from the College of Engineering?

Question IV: What can be done to address these factors to reduce attrition from engineering programs?

Question V: How can retention assessment in engineering be made recursive?
Definition of Retention & Attrition

For a study of this nature, it is important to establish exact definitions for retention and attrition. For simplicity, it was decided that retention, i.e., retained students, were all undergraduate student declared majors who remained within the College of Engineering as of Spring 2001. This included students at all class levels (freshmen to senior). Attrition, on the other hand, was limited to those students who had left the College of Engineering and switched to another program at the University. This is often referred to as “leakage” from the engineering pipeline. Students who left the University were not included.
Historical, Theoretical, and/or Conceptual Framework

The problem of attrition, in engineering and all other programs, transcends the individual. Attrition generates social and financial losses for the student. Pascarella and Terenzini (1991) stated,

Students not only make statistically significant gains in factual knowledge and in a range of general cognitive and intellectual skills, they also change on a broad array of value, attitudinal, psychosocial, and moral dimensions. (p.557).

The institution of higher education is also a loser with attrition. It is a loss of revenue for the institution, especially tuition driven institutions (Tinto, 1993).

But what causes attrition? Attrition is largely the product of risk. Students with higher probabilities of failing to obtain their academic goals, for whatever reason(s), can be described as high-risk and/or at-risk students. Attrition, however, is an outcome. Numerous factors of risk are preliminary to attrition. Thus, rather than focusing only on retention and attrition, colleges and universities should direct programs and strategies toward risk in its multiple forms.

Academic Underpreparedness

While attrition occurs among students of sound academic standing, some argue that the major source of attrition is academic underpreparedness for college (Astin 1975). Academic background and preparation are determinants of academic preparedness. A number of studies have shown that poor academic preparation and academic performance affected retention (Arnold, Mares, and Calkins, 1986; Moline 1987; Nora 1987). Levin and Wyckoff (1988) looked into a predictive model of persistence for engineering students. They determined that
math ability was the single best predictor (better than S.A.T., college or high school G.P.A. scores), followed by the choice of their major on the basis of interest in the subject. Additionally, Warburton and Carroll, (2001, p. iii) noted, “The academic rigor of students’ high school curriculum was strongly associated with their postsecondary GPA, the amount of remedial coursework they took, and with their rates of persistence and attainment.”

Academic background and preparation, however, in part, are socially determined (Reyes and Stanic, 1985). Experiences at primary and secondary schools are key determinants of college preparation.

Academic and related factors are compounded by an assortment of nonacademic factors that enhance risk and attrition. Variables such as numbers of hours worked, nature and number of credits carried, involvement in extracurricular activities, etc., impact risk and ultimately attrition.

Psychosocial Variables

While inherent abilities and other factors beyond the limits of intervention can lead to academic underpreparedness, a number of other variables appear to be of equal or greater importance. Psychosocial variables cannot be viewed as separate from academic underpreparedness. There is a connection between the two, since psychosocial processes can contribute to academic underpreparedness. Pantages and Creedon (1978) documented the role of psychosocial variables, such as clear-cut goals and self-concept. Also, students’ educational aspirations are highly correlated with their eventual attainment (Hanson, 1994).

The goals and intentions of students are a considerable factor when addressing retention. “Among entering college students the range of educational or occupational intentions may be
quite varied, and not all intentions or goals are clearly held. Also, the goals may not be consistent with degree completion or compatible with the educational goals of the institution” (Folsom, 1996, p. 36).

Astin and Panos (1969), in studying 36,000 college students, found that 75% of their subjects changed career plans after entering college. Uncertainty by students in their career/academic path impacts their persistence, academic performance, and satisfaction with college in general. Also, within this psychosocial realm is the notion of “‘fit’ as perceived by students or mismatch of students’ interests with academic programs offered by the institution” (Li and Killian, 1999, p. 2). Echoing these notions of fit and satisfaction with college Yorke (1999) identified three primary causes of withdrawal among full-time students: a mismatch between students and their choice of field of study, financial difficulties, and poor quality of the student experience (i.e., the quality of teaching, level of support by staff, and organization of the program).

Related to the fit concept are personality characteristics. Brown and Cross (1993, p. 661) state, “It is logical to assume that personality plays a part in selecting and persisting in a major field of study, as interest inventories and career development rely heavily on personality characteristics in their theoretical foundations.” A number of studies have shown that personality variables often discriminate between students of differing fields of study. Knott (1978), using the California Psychological Inventory (CPI) and Work Values Inventory, found that personality variables that discriminated significantly between engineering students and non-engineering students included Socialization, Self-Control, Good Impression, Achievement via Conformance, Intellectual Efficiency, and Flexibility. Others, such as Izard (1960), Korn
(1962), and Scott and Sedlacek (1975) also established a difference in the personality traits of engineering students and non-engineering students.

The most established and tested theory of student attrition is Tinto’s Student Integration Model (Tinto, 1975, 1987, 1993). This model views student departure as a consequence of the interaction between the individual student and the college or university as an organization. Tinto (1993) claimed the primary roots of departure from higher education can be identified as a student’s “intention” and “commitment.” One might, similarly, think that a student’s departure from a major or program is a consequence of these phenomena as well.
Methods

This section describes the methods used to conduct this study. The subjects of the study are described first, followed by the methods used to answer each of the research questions.

In brief, this study intends to ascertain the factors associated with attrition in engineering programs on all fronts. Academic underpreparedness, psychosocial variables, and their interconnectivity will be examined.

Data Subjects

The subjects for this study included all enrolled University of Alabama students, as of the Spring 2001 term, who at one time or another were classified as engineering majors. This resulted in 1,395 current and 536 former majors being identified. Data were obtained from the UA SIS Database and web-based and paper surveys.

Data Analysis

Methods for Addressing Research Question I

Question I: What majors did engineering switchers pursue?

Former students were categorized by their present major and their new college or school.
Methods for Addressing Research Question II

Question II: What factors related to academic underpreparedness contributed to student attrition from the College of Engineering?

Numerous quantitative variables were examined, including the student’s high school, performance (i.e., GPA), ACT entrance examination scores (components and composite), math placement scores, and performance in gateway, engineering, and all college classes.

Independent t-tests were used to compare current and former students for a variety of quantitative variables. Logistic regression and discriminant analysis techniques were employed to ascertain a predictive quantitative model of factors that contribute significantly to attrition in engineering programs. Additionally, cluster analysis was also performed to further see if the two groups could be categorized by similar characteristics.

Methods for Addressing Research Question III

Question III: What factors related to psychosocial variables contributed to student attrition from the College of Engineering?

Seymour and Hewitt (1997, p. 33) identified 23 categories raised by participants as factors and concerns possibly leading to attrition in SME (Science, Math, Engineering) majors.

A survey was administered to former students who transferred to other departments or programs outside of the College of Engineering. This survey consisted of a structured component that dealt with 22 of the 23 categories found by Seymour and Hewitt (1997), and
other structured sections dealing with their experiences at UA in general. The survey also gave
the student the opportunity to express any and all concerns in an open-ended format.

Qualitative analytical techniques were utilized to identify broad themes mentioned by the
students. Specific comments were also listed.

Roughly half of the respondents filled out a web-based survey and the other half a paper
questionnaire. The forms were identical with regards to the structured responses, but differed
slightly with the open-ended questions.
Results

Results for Research Question I

Question I: What majors did engineering switchers pursue?

Former engineering majors were classified in 71 different programs as of Spring 2001. Table 1 shows the distribution by major. Pre-business (PREB) was, by far, the largest choice of major for these students. Following distantly were management information systems (MIS) and finance (FIN). More generally, the College of Commerce and Business Administration received over half of these students (see Table 2). The College of Arts and Sciences received almost a third.
<table>
<thead>
<tr>
<th>Major</th>
<th>N</th>
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<th>N</th>
<th>Major</th>
<th>N</th>
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</thead>
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<td>181</td>
<td>General Health Studies</td>
<td>4</td>
<td>Music</td>
<td>1</td>
</tr>
<tr>
<td>Mgmt. Info. Systems</td>
<td>29</td>
<td>Environmental Science</td>
<td>4</td>
<td>Music Therapy</td>
<td>1</td>
</tr>
<tr>
<td>Finance</td>
<td>28</td>
<td>Consumer Science</td>
<td>4</td>
<td>Performance</td>
<td>1</td>
</tr>
<tr>
<td>Marketing</td>
<td>16</td>
<td>Sec. Educ. Mathematics</td>
<td>4</td>
<td>Philosophy</td>
<td>1</td>
</tr>
<tr>
<td>Undesignated AS</td>
<td>15</td>
<td>Physics</td>
<td>4</td>
<td>Pre-Law Studies</td>
<td>1</td>
</tr>
<tr>
<td>Accounting</td>
<td>15</td>
<td>Nursing</td>
<td>4</td>
<td>Pre-Medical</td>
<td>1</td>
</tr>
<tr>
<td>Pre-Major Studies</td>
<td>15</td>
<td>Interior Design</td>
<td>4</td>
<td>Pre-Occup. Therapy</td>
<td>1</td>
</tr>
<tr>
<td>Management</td>
<td>14</td>
<td>Journalism</td>
<td>3</td>
<td>Pre-Physical Therapy</td>
<td>1</td>
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<tr>
<td>Criminal Justice</td>
<td>13</td>
<td>Public Relations</td>
<td>3</td>
<td>Pre-Psychology</td>
<td>1</td>
</tr>
<tr>
<td>Art</td>
<td>12</td>
<td>Undesignated CM</td>
<td>3</td>
<td>Religious Studies</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics</td>
<td>12</td>
<td>Anthropology</td>
<td>3</td>
<td>Sec. Educ. Early Child Handicap</td>
<td>1</td>
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<tr>
<td>Biology</td>
<td>9</td>
<td>CB Upper Division</td>
<td>3</td>
<td>Sec. Educ. Social Studies</td>
<td>1</td>
</tr>
<tr>
<td>History</td>
<td>8</td>
<td>Chemistry</td>
<td>3</td>
<td>Spanish</td>
<td>1</td>
</tr>
<tr>
<td>Health Care Mgmt. AS</td>
<td>8</td>
<td>Food &amp; Nutrition</td>
<td>3</td>
<td>Urban Planning Geography</td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>8</td>
<td>Marine Science Biology</td>
<td>2</td>
<td>American Studies</td>
<td>1</td>
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<tr>
<td>Pre-Teacher Education</td>
<td>8</td>
<td>Pre-Major Studies Education</td>
<td>2</td>
<td>Art History</td>
<td>1</td>
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<tr>
<td>Psychology</td>
<td>7</td>
<td>Pre-Pharmacy</td>
<td>2</td>
<td>Asian Studies</td>
<td>1</td>
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<tr>
<td>Computer Science AS</td>
<td>7</td>
<td>Rest, &amp; Hospitality Mgmt.</td>
<td>2</td>
<td>Communication Studies</td>
<td>1</td>
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<tr>
<td>Geology</td>
<td>6</td>
<td>Social Work</td>
<td>2</td>
<td>Economics AS</td>
<td>1</td>
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<tr>
<td>Geography</td>
<td>6</td>
<td>Undesignated CB</td>
<td>2</td>
<td>Human Dev. &amp; Family Studies</td>
<td>1</td>
</tr>
<tr>
<td>Advertising</td>
<td>6</td>
<td>Economics</td>
<td>2</td>
<td>Human Performance</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Non-Cert.)</td>
<td></td>
</tr>
<tr>
<td>Political Science</td>
<td>6</td>
<td>Health Care Mgmt. CB</td>
<td>2</td>
<td>HP: Physical Education</td>
<td>1</td>
</tr>
<tr>
<td>External Degree</td>
<td>5</td>
<td>HP: Sports/ Fitness Mgmt.</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Management</td>
<td>5</td>
<td>Interdisciplinary</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telecomm. &amp; Film</td>
<td>5</td>
<td>Microbiology</td>
<td>1</td>
<td></td>
<td></td>
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</table>
Table 2. Present College or School of Former Engineering Students

<table>
<thead>
<tr>
<th>College</th>
<th>N</th>
<th>Percent</th>
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<tbody>
<tr>
<td>College of Arts &amp; Sciences</td>
<td>168</td>
<td>31.3</td>
</tr>
<tr>
<td>College of Commerce and Business Administration</td>
<td>305</td>
<td>56.9</td>
</tr>
<tr>
<td>College of Communication and Information Sciences</td>
<td>21</td>
<td>3.9</td>
</tr>
<tr>
<td>College of Education</td>
<td>18</td>
<td>3.4</td>
</tr>
<tr>
<td>College of Human Environmental Sciences</td>
<td>18</td>
<td>3.4</td>
</tr>
<tr>
<td>College of Nursing</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td>School of Social Work</td>
<td>2</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Results for Research Question II

Question II: What factors related to academic underpreparedness contributed to student attrition from the College of Engineering?

Academic underpreparedness, naturally, has a lot to do with the student’s high school education. This section sets out to determine what, if any, quantitative differences exist based on entrance exam scores and high school GPA between retained and former engineering students.

Pre-College Comparisons

Quantitative differences between the former students and the current students were analyzed for all of the ACT scores (components and composite), the math placement score, and their high school GPA. Table 3 outlines the averages between the two groups and specifies whether the differences were statistically significant.

The data indicated that the former students scored significantly lower on all ACT components and the composite, as well as the math placement examination. It showed that their
performance in high school was significantly poorer as well. Table 4 breaks down the data by race and sex.

Table 3. Comparisons between Current and Former Students

<table>
<thead>
<tr>
<th></th>
<th>Former Mean</th>
<th>Former St.Dev.</th>
<th>Current Mean</th>
<th>Current St.Dev.</th>
<th>t</th>
<th>df</th>
<th>Sig. 2-Tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT English</td>
<td>23.66</td>
<td>4.54</td>
<td>24.62</td>
<td>4.90</td>
<td>3.612</td>
<td>1586</td>
<td>.000</td>
</tr>
<tr>
<td>ACT Math</td>
<td>24.04</td>
<td>4.56</td>
<td>25.56</td>
<td>4.57</td>
<td>5.993</td>
<td>1586</td>
<td>.000</td>
</tr>
<tr>
<td>ACT SS</td>
<td>24.45</td>
<td>5.46</td>
<td>25.37</td>
<td>5.67</td>
<td>2.973</td>
<td>1586</td>
<td>.003</td>
</tr>
<tr>
<td>ACT NS</td>
<td>23.78</td>
<td>4.37</td>
<td>24.96</td>
<td>4.50</td>
<td>4.755</td>
<td>1586</td>
<td>.000</td>
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<tr>
<td>ACT Composite</td>
<td>24.13</td>
<td>4.12</td>
<td>25.30</td>
<td>4.30</td>
<td>4.948</td>
<td>1586</td>
<td>.000</td>
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<tr>
<td>Math Placement</td>
<td>35.85</td>
<td>10.00</td>
<td>39.59</td>
<td>9.92</td>
<td>6.829</td>
<td>1580</td>
<td>.000</td>
</tr>
<tr>
<td>HS GPA*</td>
<td>3.216</td>
<td>.569</td>
<td>3.482</td>
<td>.503</td>
<td>8.486</td>
<td>733.7</td>
<td>.000</td>
</tr>
</tbody>
</table>

Note: *Unequal variances

Table 4. Comparisons between Current and Former Students by Sex and Race

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Former</th>
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<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>AA</td>
</tr>
<tr>
<td>ACT English</td>
<td>25.20</td>
<td>21.46</td>
</tr>
<tr>
<td>ACT Math</td>
<td>26.65</td>
<td>22.11</td>
</tr>
<tr>
<td>ACT SS</td>
<td>26.20</td>
<td>21.64</td>
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<tr>
<td>ACT NS</td>
<td>26.12</td>
<td>21.74</td>
</tr>
<tr>
<td>ACT Composite</td>
<td>26.20</td>
<td>21.90</td>
</tr>
<tr>
<td>Math Placement</td>
<td>40.49</td>
<td>34.75</td>
</tr>
<tr>
<td>HS GPA</td>
<td>3.491</td>
<td>3.236</td>
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</table>

Figures 1-7 display these comparisons graphically by individual score or GPA. These graphs are useful in identifying possible cut-off scores in order to determine baselines or minimum standard requirements. In every case, with the exception of high school GPA, the graphs reveal a point of consistency at which and below the likelihood of transferring from engineering exceeds the likelihood of remaining. For example, these cut-off scores appear to be
Figure 1. Percent of Students by ACT English Score and Status

Figure 2. Percent of Students by ACT Math Score and Status
Figure 3. Percent of Students by ACT Social Studies Score and Status

Figure 4. Percent of Students by ACT Natural Sciences Score and Status
Figure 5. Percent of Students by ACT Composite Score and Status

Figure 6. Percent of Students by Math Placement Score and Status
Figure 7. Percent of Students by High School GPA and Status

![Graph showing percent of students by high school GPA and status.]

Note: Current 4.0 = 20.78%

24 for ACT English, 25 for ACT Math, 24 for ACT SS, 22 for ACT NS, 21 for ACT Composite, and 36 for Math Placement. The pattern for high school GPA is less defined. Below a GPA of 2.1 students are much more likely to leave engineering, however, few students with such low GPAs are admitted. There is a marginal area between GPAs of 2.1 to 2.7 where students face an equal chance of continuance or attrition.

Figures 8-10, essentially, combine the data from figures 1-7. These graphs relate the probability of attrition at or below a specific score or GPA. The probability of attrition for the ACT components merges around scores of 26, meaning at and above this score these components do not discriminate. The attrition probabilities gradually and increasingly diverge below 26 indicating discrimination among the tests. The ACT composite and natural sciences component are the best discriminators, with notable increases in attrition with lower scores (see
Figure 8b). The social studies component is the least useful predictor. High school GPA and math placement scores are more consistent with negative linear trends.

Figure 8a. Probability of Attrition at or below each ACT Score

Figure 8b. Probability of Attrition at or below each ACT Score
Figure 9. Probability of Attrition at or Below each High School GPA

Figure 10. Probability of Attrition at or Below each Math Placement Score
College Performance

This section looks at how the current and former student’s performed in college at various levels: individual courses, within the college of engineering, and overall.

Performance in Gateway Courses

All engineering programs have a number of “gateway” courses. These are courses that successful completion is required of the student in order to continue in the program. Gatekeeper courses frequently block students from progressing into degree programs, thus eliminating students who are judged as lacking the analytical ability to become competent scientists and engineers. “‘Weed-out’ is a long established tradition in a number of academic disciplines, but is dominant in all SME (Science, Math, Engineering) majors. It has a semi-legitimate, legendary status and is part of what gives SME majors their image of hardness (Seymour & Hewitt, 1997, p. 122).”

The question then arises, are these courses a barrier or a filter? At the University of Alabama these required prerequisite courses include general chemistry (CH 101, 102, 131, 132), calculus (MATH 125, 126, 131, 132), and general physics (PH 105, 106, 131, 132).

Table 5 lists the performance breakdown by status for each of these classes. In every case the current students outperformed the former students. Also, note the substantial attrition from each course to its successor. For example, former students took 33.2% of the CH 101 classes, but only 22.8% of the CH 102 classes.
Table 5. Gateway Course GPA Comparison by Status

<table>
<thead>
<tr>
<th></th>
<th>Status</th>
<th>N (Classes)</th>
<th>Credits Attempted</th>
<th>Credits Earned</th>
<th>Quality Points</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 101: General Chemistry I</td>
<td>Current</td>
<td>512</td>
<td>2048</td>
<td>1604</td>
<td>3950.8</td>
<td>1.929</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>255</td>
<td>1020</td>
<td>688</td>
<td>1512.1</td>
<td>1.482</td>
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<tr>
<td>CH 102: General Chemistry II</td>
<td>Current</td>
<td>292</td>
<td>1168</td>
<td>1048</td>
<td>2721.1</td>
<td>2.330</td>
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<tr>
<td></td>
<td>Former</td>
<td>86</td>
<td>344</td>
<td>240</td>
<td>546.6</td>
<td>1.589</td>
</tr>
<tr>
<td>CH 131: General Chemistry for Engineering I</td>
<td>Current</td>
<td>450</td>
<td>1797</td>
<td>1337</td>
<td>3560.5</td>
<td>1.981</td>
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<tr>
<td></td>
<td>Former</td>
<td>98</td>
<td>390</td>
<td>262</td>
<td>603.4</td>
<td>1.547</td>
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<tr>
<td>CH 132: General Chemistry for Engineering II</td>
<td>Current</td>
<td>150</td>
<td>597</td>
<td>581</td>
<td>1499.1</td>
<td>2.511</td>
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<tr>
<td></td>
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<td>17</td>
<td>67</td>
<td>59</td>
<td>147.0</td>
<td>2.194</td>
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<td>MATH 125: Calculus I</td>
<td>Current</td>
<td>444</td>
<td>1776</td>
<td>1292</td>
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<td>288</td>
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<tr>
<td>MATH 126: Calculus II</td>
<td>Current</td>
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<td>2112</td>
<td>1680</td>
<td>4411.6</td>
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<td></td>
<td>Former</td>
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<td>272</td>
<td>144</td>
<td>409.4</td>
<td>1.505</td>
</tr>
<tr>
<td>MATH 131: Calculus I, Integrated Curriculum</td>
<td>Current</td>
<td>252</td>
<td>1008</td>
<td>948</td>
<td>2982.7</td>
<td>2.959</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>20</td>
<td>80</td>
<td>68</td>
<td>192.0</td>
<td>2.400</td>
</tr>
<tr>
<td>MATH 132: Calculus II, Integrated Curriculum</td>
<td>Current</td>
<td>177</td>
<td>708</td>
<td>684</td>
<td>2140.3</td>
<td>3.023</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>8</td>
<td>32</td>
<td>32</td>
<td>96</td>
<td>3.000</td>
</tr>
<tr>
<td>PH 105: General Physics with Calculus I</td>
<td>Current</td>
<td>609</td>
<td>2286</td>
<td>1984</td>
<td>5460.2</td>
<td>2.389</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>125</td>
<td>421</td>
<td>267</td>
<td>648.6</td>
<td>1.541</td>
</tr>
<tr>
<td>PH 106: General Physics with Calculus II</td>
<td>Current</td>
<td>532</td>
<td>2061</td>
<td>1869</td>
<td>4993.6</td>
<td>2.423</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>44</td>
<td>155</td>
<td>115</td>
<td>282.4</td>
<td>1.822</td>
</tr>
<tr>
<td>PH 131: Physics I, Integrated Curriculum</td>
<td>Current</td>
<td>235</td>
<td>940</td>
<td>884</td>
<td>2389.6</td>
<td>2.542</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>19</td>
<td>76</td>
<td>56</td>
<td>160.0</td>
<td>2.105</td>
</tr>
<tr>
<td>PH 132: Physics II, Integrated Curriculum</td>
<td>Current</td>
<td>66</td>
<td>263</td>
<td>251</td>
<td>701.4</td>
<td>2.667</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>7</td>
<td>28</td>
<td>24</td>
<td>61.3</td>
<td>2.189</td>
</tr>
</tbody>
</table>

Note: Grades of I, W, WP, and N were not included.
Performance in Engineering

Some former students made it through the gateway classes and began their engineering coursework. However, the pattern remained the same in that former students performed more poorly than current students (see Table 6).

Table 6. Overall Engineering Course GPA Comparison by Status

<table>
<thead>
<tr>
<th>Status</th>
<th>N (Classes)</th>
<th>Credits Attempted</th>
<th>Credits Earned</th>
<th>Quality Points</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>12607</td>
<td>35369</td>
<td>32429</td>
<td>100404.5</td>
<td>2.839</td>
</tr>
<tr>
<td>Former</td>
<td>2369</td>
<td>6429</td>
<td>5211</td>
<td>15187.7</td>
<td>2.362</td>
</tr>
</tbody>
</table>

Looking at specific courses and programs it is apparent that almost all of the former students who started their engineering program did not make it past the 200 level courses. Introductory courses with a sizable number of former students were selected for comparison. Of the classes shown in Table 7, the former students performed much more poorly than the current students in all cases. The former students’ GPA was from 0.3 to 1.1 points lower than the current students’. No statistical comparison was made due to some students repeating courses.
Table 7. Engineering Course GPA Comparison by Status

<table>
<thead>
<tr>
<th>Course</th>
<th>Status</th>
<th>N (Classes)</th>
<th>Credits Attempted</th>
<th>Credits Earned</th>
<th>Quality Points</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE 125: Intro Aerospace Engineering</td>
<td>Current</td>
<td>69</td>
<td>138</td>
<td>120</td>
<td>385.3</td>
<td>2.792</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>18</td>
<td>35</td>
<td>25</td>
<td>68.7</td>
<td>1.963</td>
</tr>
<tr>
<td>CE 260: Elementary Surveying</td>
<td>Current</td>
<td>145</td>
<td>435</td>
<td>426</td>
<td>1470.1</td>
<td>3.380</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>24</td>
<td>72</td>
<td>72</td>
<td>223.0</td>
<td>3.097</td>
</tr>
<tr>
<td>DR 125: Engineering Graphics</td>
<td>Current</td>
<td>449</td>
<td>1347</td>
<td>1185</td>
<td>3497.5</td>
<td>2.597</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>151</td>
<td>453</td>
<td>348</td>
<td>864.2</td>
<td>1.908</td>
</tr>
<tr>
<td>ESM 201: Statics</td>
<td>Current</td>
<td>459</td>
<td>1377</td>
<td>1080</td>
<td>2914.6</td>
<td>2.117</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>35</td>
<td>105</td>
<td>66</td>
<td>139.1</td>
<td>1.325</td>
</tr>
<tr>
<td>GES 126: Intro Engineer Computing</td>
<td>Current</td>
<td>506</td>
<td>1518</td>
<td>1326</td>
<td>3949.4</td>
<td>2.602</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>132</td>
<td>396</td>
<td>270</td>
<td>639.0</td>
<td>1.614</td>
</tr>
<tr>
<td>IE 203: Engineering Economics</td>
<td>Current</td>
<td>424</td>
<td>1272</td>
<td>1092</td>
<td>3263.6</td>
<td>2.566</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>83</td>
<td>249</td>
<td>141</td>
<td>364.0</td>
<td>1.462</td>
</tr>
<tr>
<td>ME 110:</td>
<td>Current</td>
<td>129</td>
<td>228</td>
<td>224</td>
<td>723.5</td>
<td>3.173</td>
</tr>
<tr>
<td></td>
<td>Former</td>
<td>45</td>
<td>76</td>
<td>68</td>
<td>198.7</td>
<td>2.614</td>
</tr>
</tbody>
</table>

Performance Overall

Overall grade point averages were calculated for all classes taken at the University of Alabama for both current and former students. The former students performed substantially more poorly than the current students (see Table 8). No statistical comparison was made due to the disparate nature of credit hours completed/taken and curriculum difficulty, and also the repeating of classes among the students.
Table 8. Overall College GPA Comparison by Status

<table>
<thead>
<tr>
<th>Status</th>
<th>N (Classes)</th>
<th>Credits Attempted</th>
<th>Credits Earned</th>
<th>Quality Points</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>30654</td>
<td>93183.5</td>
<td>83519.5</td>
<td>250901.8</td>
<td>2.693</td>
</tr>
<tr>
<td>Former</td>
<td>16398</td>
<td>48990.0</td>
<td>41755.0</td>
<td>120170.6</td>
<td>2.453</td>
</tr>
</tbody>
</table>

Figure 11. Percent of College Grades by Status

Looking at the distribution of grades (Figure 11) shows how retained students are more likely to earn from an A+ to a B. Former students are more likely to earn a B- and below.

Perhaps the most striking characteristic of this data is that former students are nearly 60% more likely to obtain an F or WF than current students (9.99% vs. 6.33%).
Logistic Regression Model

A logistic regression model was calculated for the following nine independent variables (SEX, RACE, ACTENG, ACTMAT, ACTSS, ACTNS, ACTCOM, MATHPL, GPAHS), with STATUS as the dependent variable. STATUS was coded as 1 = Current, 0 = Former. SEX was coded as 1 = Males and 2 = Females. RACE was coded similarly with 1 = Whites and 2 = African-Americans. Other racial groups were excluded due to their small size. The remaining independent variables (ACTENG, ACTMAT, ACTSS, ACTNS, ACTCOM, MATHPL, GPAHS) used their actual scores. (see Tables 9 and 10) Logistic regression is useful for situations where you want to predict the presence or absence of a characteristic, event, or outcome based on a set of predictor variables. Logistic regression is similar to linear regression but is suited to models with a dichotomous dependent variable.

The forward stepwise (likelihood ratio) procedure indicated GPAHS, MATHPL, and RACE, was the best model. The ideal cut value was changed from .50 to .55. This increased the overall error slightly, but reduced greatly the error in predicting former students. However, while the overall percent correctly predicted at 69.6 seems good, consider that blindly estimating retention based on the most frequent category would yield a correct percentage of 72.2. Thus, the model actually does worse than our blind estimation.
Table 9. Attrition Logistic Regression Models

<table>
<thead>
<tr>
<th>Model/Step</th>
<th>Coefficients</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>-2.280</td>
<td>.392</td>
</tr>
<tr>
<td>GPAHS</td>
<td>.915</td>
<td>.116</td>
</tr>
<tr>
<td>2 (Constant)</td>
<td>-2.535</td>
<td>.403</td>
</tr>
<tr>
<td>GPAHS</td>
<td>.748</td>
<td>.128</td>
</tr>
<tr>
<td>MATHPL</td>
<td>.021</td>
<td>.007</td>
</tr>
<tr>
<td>3 (Constant)</td>
<td>-2.527</td>
<td>.405</td>
</tr>
<tr>
<td>GPAHS</td>
<td>.788</td>
<td>.129</td>
</tr>
<tr>
<td>MATHPL</td>
<td>.025</td>
<td>.007</td>
</tr>
<tr>
<td>RACE</td>
<td>-.382</td>
<td>.153</td>
</tr>
</tbody>
</table>

Table 10. Logistic Regression Models’ Predicted Classification

<table>
<thead>
<tr>
<th>Model</th>
<th>Status</th>
<th>Pct. Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Former</td>
<td>Current</td>
</tr>
<tr>
<td>1</td>
<td>90</td>
<td>308</td>
</tr>
<tr>
<td></td>
<td>87</td>
<td>804</td>
</tr>
<tr>
<td></td>
<td>69.4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>79</td>
<td>319</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>815</td>
</tr>
<tr>
<td></td>
<td>69.4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>89 (52)</td>
<td>309 (346)</td>
</tr>
<tr>
<td></td>
<td>83 (41)</td>
<td>808 (850)</td>
</tr>
<tr>
<td></td>
<td>69.6 (70.0)</td>
<td></td>
</tr>
</tbody>
</table>

The cut value is .550
Note: Values in parentheses are for a cut value of .500
Discriminant Analysis Model

Discriminant analysis was performed on the same nine independent variables (SEX, RACE, ACTENG, ACTMAT, ACTSS, ACTNS, ACTCOM, MATHPL, GPAHS), with STATUS as the dependent variable. Like logistic regression, discriminant analysis is a technique used to build a predictive model of group membership based on observed characteristics of each case.

The stepwise procedure indicated GPAHS, MATHPL, and RACE was the best model, the same as the logistic regression. (see Table 11) Table 12 shows the predictive utility of the model. Unfortunately, it, like the logistic regression prognosis, does not match the blind estimate (62.1% vs. 72.2%). Interestingly, the discriminate analysis did a much better job in predicting the former students than the logistic regression, but worse at predicting the current students.

Table 11. Discriminant Analysis Models

<table>
<thead>
<tr>
<th>Model/Step</th>
<th>Tolerance</th>
<th>F to Remove</th>
<th>Wilks’ Lambda</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GPAHS</td>
<td>1.000</td>
<td>68.945</td>
</tr>
<tr>
<td></td>
<td>GPAHS</td>
<td>.817</td>
<td>36.821</td>
</tr>
<tr>
<td></td>
<td>MATHPL</td>
<td>.817</td>
<td>.969</td>
</tr>
<tr>
<td>2</td>
<td>GPAHS</td>
<td>.803</td>
<td>40.279</td>
</tr>
<tr>
<td></td>
<td>MATHPL</td>
<td>.778</td>
<td>.947</td>
</tr>
<tr>
<td></td>
<td>RACE</td>
<td>.899</td>
<td>.942</td>
</tr>
</tbody>
</table>

Table 12. Discriminant Analysis Model’s Predicted Classification

<table>
<thead>
<tr>
<th>Status</th>
<th>Predicted Group Membership</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Former</td>
<td>Current</td>
</tr>
<tr>
<td>Count</td>
<td>245</td>
<td>173</td>
</tr>
<tr>
<td>%</td>
<td>58.6</td>
<td>41.4</td>
</tr>
<tr>
<td>%</td>
<td>36.4</td>
<td>63.6</td>
</tr>
</tbody>
</table>

62.1% of original grouped cases correctly classified.
K-Means Cluster Analysis

This technique attempts to identify relatively homogeneous groups of cases based on predetermined characteristics. The procedure, however, requires the number of clusters to be specified.

Clusters of two and three groups were specified using all nine independent variables and for only high school GPA, since it was determined earlier to be the single best predictor. Table 13 outlines the results of these combinations.

Table 13. Cluster Membership

<table>
<thead>
<tr>
<th>Predicted Group</th>
<th>Cluster Centers</th>
<th>Current</th>
<th>Former</th>
<th>Total</th>
<th>Percent Current</th>
<th>Percent Former</th>
<th>Percent Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (Former)</td>
<td>*</td>
<td>376</td>
<td>228</td>
<td>604</td>
<td>42.2</td>
<td>57.3</td>
<td>46.9</td>
</tr>
<tr>
<td>High (Current)</td>
<td>*</td>
<td>515</td>
<td>170</td>
<td>685</td>
<td>57.8</td>
<td>42.7</td>
<td>53.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>891</td>
<td>398</td>
<td>1289</td>
<td>Correct = 57.6%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two Clusters: High School GPA

<table>
<thead>
<tr>
<th>Predicted Group</th>
<th>Cluster Centers</th>
<th>Current</th>
<th>Former</th>
<th>Total</th>
<th>Percent Current</th>
<th>Percent Former</th>
<th>Percent Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (Former)</td>
<td>2.857</td>
<td>356</td>
<td>253</td>
<td>609</td>
<td>34.5</td>
<td>58.2</td>
<td>41.5</td>
</tr>
<tr>
<td>High (Current)</td>
<td>3.791</td>
<td>677</td>
<td>182</td>
<td>859</td>
<td>65.5</td>
<td>41.8</td>
<td>58.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1033</td>
<td>435</td>
<td>1468</td>
<td>Correct = 63.4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Three Clusters: All Independent Variables

<table>
<thead>
<tr>
<th>Predicted Group</th>
<th>Cluster Centers</th>
<th>Current</th>
<th>Former</th>
<th>Total</th>
<th>Percent Current</th>
<th>Percent Former</th>
<th>Percent Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (Former)</td>
<td>**</td>
<td>214</td>
<td>148</td>
<td>362</td>
<td>24.0</td>
<td>37.2</td>
<td>28.1</td>
</tr>
<tr>
<td>Middle (Current)</td>
<td>**</td>
<td>322</td>
<td>152</td>
<td>474</td>
<td>36.1</td>
<td>38.2</td>
<td>36.8</td>
</tr>
<tr>
<td>High (Current)</td>
<td>**</td>
<td>355</td>
<td>98</td>
<td>453</td>
<td>39.8</td>
<td>24.6</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>891</td>
<td>398</td>
<td>1289</td>
<td>Correct = 64.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Three Clusters: High School GPA

<table>
<thead>
<tr>
<th>Predicted Group</th>
<th>Cluster Centers</th>
<th>Current</th>
<th>Former</th>
<th>Total</th>
<th>Percent Current</th>
<th>Percent Former</th>
<th>Percent Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (Former)</td>
<td>2.513</td>
<td>133</td>
<td>120</td>
<td>253</td>
<td>12.9</td>
<td>27.6</td>
<td>17.2</td>
</tr>
<tr>
<td>Middle (Current)</td>
<td>3.243</td>
<td>379</td>
<td>187</td>
<td>566</td>
<td>36.7</td>
<td>43.0</td>
<td>38.6</td>
</tr>
<tr>
<td>High (Current)</td>
<td>3.890</td>
<td>532</td>
<td>128</td>
<td>649</td>
<td>51.5</td>
<td>29.4</td>
<td>44.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1033</td>
<td>435</td>
<td>1468</td>
<td>Correct = 70.2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Cluster Centers Low:
ACTENG 21, ACTMAT 22, ACTSS 22, ACTNS 22, ACTCOM 22, MATHPL 31, GPAHS 3.154, SEX 1, RACE 1
*Cluster Centers High:
ACTENG 28, ACTMAT 29, ACTSS 29, ACTNS 28, ACTCOM 28, MATHPL 46, GPAHS 3.646, SEX 1, RACE 1
**Cluster Centers Low:
ACTENG 20, ACTMAT 20, ACTSS 21, ACTNS 21, ACTCOM 21, MATHPL 27, GPAHS 3.069, SEX 1, RACE 1
**Cluster Centers Middle:
ACTENG 24, ACTMAT 25, ACTSS 24, ACTNS 24, ACTCOM 24, MATHPL 39, GPAHS 3.387 SEX 1, RACE 1
**Cluster Centers High:
ACTENG 29, ACTMAT 30, ACTSS 30, ACTNS 29, ACTCOM 30, MATHPL 48, GPAHS 3.723, SEX 1, RACE 1
Equating the lowest performance group to the former students and the other group(s) (i.e., High or High and Middle) to the current students we can compare how well the model distinguishes the actual breakdown. The analyses using all nine independent variables, in both two and three-cluster cases, did not classify group membership as accurately as the sole variable of high school GPA (Two: 57.6% vs. 63.4%, Three: 64.0% vs. 70.2%).

The three-cluster high school GPA model nearly equaled the predictive utility of our blind estimate. More importantly, students classified in the lowest cluster had nearly a 50% departure rate, which would indicate they are highly at-risk students.

Results for Research Question III

Question III: What factors related to psychosocial variables contributed to student attrition from the College of Engineering?

A synopsis of the responses to the survey of the former students is provided below. Survey items are reproduced in the write-up. Percentages of structured responses are reported in tables. Open-ended questions have a brief summary of the comments in italics that categorizes the themes of the specific remarks. This summary is followed by a list of all of the students’ remarks. An ID number is provided each student to allow comparisons and context among their open-ended responses. The number in parentheses in the summary of opinions refers to how many references were made to a specific concern. If no number is given that remark was mentioned once. The number of respondents (N) for each structured item and those providing open-ended comments is given as well.
College of Engineering Survey for Former Majors

02. Why did you first choose an engineering program when entering UA?  N = 85

Summary of opinions

Having an interest in engineering or wanting to be an engineer was mentioned most often with 30 references. Interest in computer science/technology also was a large factor being mentioned 18 times. Having a family member be an engineer, or pressure from one’s family, was referenced 15 times. Academic interests in math (10), science (7), chemistry (2), or physics (1) were all mentioned. Seven students noted money, while career considerations were stated by five students. The reputation of the program was mentioned five times. Participation in the SITE program or an internship was mentioned by four students. Scholarships were referenced twice, as was working previously with an engineering firm. Resources offered, the co-op program, relatedness to architecture, advisor recommended, and prestige were all mentioned once.

List of all student comments

1. My father is an engineer and I had previously worked at his office and thought that was my professional choice. I also had taken an engineering drawing class in high school which I enjoyed.
2. Parental influence
3. I had an interest in engineering and I was told this University's program was good.
4. Engineering majors tend to get higher paying jobs.
5. Wanted to do computer science.
6. I chose chemical engineering for a couple reasons: strong mixture of math and science (chemistry in particular), prestige, and money!
7. My brother is a graduate of ECE and thought it is what I wanted to do.
8. My father was an engineer and he chose. He received his degree through the military and he wanted me to follow in his footsteps.
9. I like math and science. I'm good at math and science. I especially liked physics and calculus, but I was fascinated by chemistry. The plan was to get a BA or MA in chemical engineering then go to med school and become some kind of doctor like everyone else in my family. I will be #8.
10. I was very interested in computers and how they were made and worked. UA's engineering program was always talked about very well.
11. I chose engineering because I had always been interested in civil engineering. The University was close to my hometown and I liked the programs they presented at the open house.
12. My strong points and interests were in math and sciences.
13. I thought I was going to be a chemical engineer.
14. I wanted to be a civil engineer.
15. My dad made me.
16. I do very well in math and sciences, but most important that's what my father wanted me to be.
17. I always wanted to be an engineer. This started when I was in high school.
18. I believed I would like a career in engineering based on my performances in the fields of mathematics and science. I also was attracted by scholarship money available as well as the co-op program.
19. Because both my uncles are engineers and it seemed to be a very interesting and profitable field.
20. I have always been interested in building things and designing things. I love to see how things work by taking them apart and putting them back together.
21. I came to the summer engineering program at the University and I thought it would be a good field for me.
22. I chose the engineering program because I thought they had a good program.
23. I was planning on majoring in civil engineering and working in that field.
24. I chose engineering because all my life I was fascinated with taking things apart and putting them back together again. Also I was fascinated with the salaries engineers made.
I heard good things about the program.

Interesting field

Because I wanted to do chemical engineering and specialize in environmental engineering and then go onto law school to pursue environmental law. I thought environmental engineering would be an interesting career path.

Because of the CS program.

It's what I wanted to do in high school.

Scholarships

My father was an engineer.

The program was more established than the one that I left. After talking to Mr. Singleton. I thought I had a good opportunity to do well. The resources available were the biggest factor: Computers, Labs, Tutors, etc.

I have an avid interest in computer technology, thus I thought computer engineering would be the best field.

I heard that it ranked among the top in the U.S.

Because the computer science program is good at UA.

I thought I wanted to get a degree in electrical engineering. My father is an electrician by trade and I did work with him growing up.

took CS in junior college.

I was very interested in Computer engineering

I had wanted to study engineering because it interested me.

Strong interest in the field of civil engineering. Family expectations.

I was in the site program and had an internship

I liked computers and thought computer science was a good major to have that matched my interests

I believed a degree in computer science would be helpful in finding a good job since the future of business in the world relies on computers.

I went to the summer engineering camp and loved it. That's what made up my mind to chose engineering over anything else.

It sounded interesting and I wanted to do something with computers.

Wanted to learn about technology.

Thought that was what I wanted to do

Because that is what I believed that I wanted to do with my life.

I attended the SITE program in 1997 and enjoyed it. Also, I was told that I should be an engineer because I was good in math and science.

it seemed like a good idea at the time

I chose engineering because all of the really well off people I knew were engineers furthermore I have an interest in the way things work and their dynamic systems. This is the reason I chose a double major in Geo/Gy after my engineering interests didn't pan out.

I thought it would be a good major that would provide a life career.

I wanted to try to do engineering in order to be able to make prosthesis for the body

Really interested and outlook was really good.

Most of my family constitutes Engineers.

I was inspired by the student introduction to engineering program (SITE)

Felt I was above average in my mathematics skills post-graduation salary averages were awesome and enjoyed working with computers.

I had a genuine interest in working with computers. I had a background from my high school Pre-Engineering program that helped me to determine my major.

The major was very appealing to me when I was a senior in high school. I knew that I wanted to do computer science and the engineering program sounded good.

I wanted to do something with computers and the engineering college seemed promising.

I was exceptional in math and I liked working with my hands

I thought engineering would be a fascinating field of study from my high school experience.

I thought it was a good field of work that allowed me to put my technical background to work. Also, the amount of money made in these fields also helped, and the challenge of trying something complicated and enjoyable.

Because I worked for an engineering company the summer prior to coming to UA liked it and thought that I would enjoy being an engineer.

It sounded like a good idea at the time.
68 Because I had interned at an chemical engineering plant the previous summer therefore chemical engineering seemed like a good idea. Also, there are a lot of engineering plants in my hometown and I thought I'd be better able to find a job at/near home.
69 It seemed promising as a career. I enjoyed chemistry and physics classes in high school.
70 Pressure from parents
71 I was unsure of a major and engineering seemed to be wide open and my father pushed me to lean towards engineering. It seemed like a great choice at the time.
72 I was interested in that field and had visited the engineering department and thought that was what I wanted to pursue a career in.
73 Because it was the closest thing that was offered to Architecture.
74 I really liked computers and I though computer science would be the way to go. I was under the impression I would learn hands-on with companies
75 I was convinced that I would enjoy the theories of Aerospace.
76 I thought I wanted to be an engineer ever since I was young.
77 My advisor told me I should try engineering because it lent to my talents.
78 because I knew I wanted to do something with computers and i thought that computer science would be the right thing for me
79 I liked the chemistry in high school.
80 I was considering engineering and didn't want to waste time being undecided since engineering requires higher level classes.
81 The major sounded interesting and challenging
82 I was good at math and loved taking challenges and problem solving. My parents sort of pointed me to engineering and I decided to join the Foundation Coalition (now T.I.D.E.).
83 I thought that I wanted to be a civil engineer and my dad is a mechanical engineer and he pushed me to go into engineering.
84 The pay looked better than chemistry majors' salaries.
85 I thought that if you liked math and science in high school then engineering was the one of the only areas to study.
86 I thought it was the best school for a CS major.
87 Liked to work with computers.

03. Was your engineering program what you expected? If not, how did it differ from your expectations? N = 84

Summary of opinions
Twenty-six students indicated yes, while 40 students indicated no. Three students did not know. Of those that answered no, many stated that the curriculum or workload was too hard (12). Other concerns mentioned were too much math (4), uncaring or bad faculty/advising (4), boring (3), more hands-on activity (2), and unkind people (2). A host of other issues were mentioned once.

List of all student comments
1 The curriculum was hard, as expected. I enjoyed many of my core classes and they were pretty much what I expected. I was only in the program one year.
2 It met expectations
3 I really did not take or get to any engineering classes.
4 No, it was a little more tough than expected.
5 Yes
6 No, it did not meet my expectations. The workload was very heavy and certain skills (computer programming skills, familiarity with particular software) were expected without being listed as prerequisites for classes.
7 Yes
It was very much what I expected, which is why I didn't have any interest in it.
Yes, it's what I expected.
Yes, a whole lot harder than what I expected, but I found it was not my field.
Yes, I believe it was what I expected.
I didn't go very far into it, so I cannot answer this question.
Well, when I was a freshman, I decided to take calculus, chemistry, Fortran 90, and engineering graphics.

This combination, plus my new found freedom in college was a bad combination. I should have taken easier classes, and been more responsible with my life.

I had a bad advisor.
No, it was horrible.
Yes.
Yes.
Yes- it was math and science intensive and the courses were challenging.
Not really, but I got to DR 125.
Yes and No. I expected the classes to be hard, but I did not expect for the classes to be like high school, where I went to class with the same people everyday.
I expected the classes to be very hard and some of them met my expectations.
No, I expected the classes to be more hands-on. The computer classes were the only one's that gave or gives that experience. I think that needs more work. The majority of students I talked to said that they weren't learning anything from the teaching methods.
Yes
Yes the engineering program was what I expected. It seemed to involve lots of math and natural science like I had heard about in high school. To me the curriculum seemed too intense so I started to look for other options.
No, engineering takes a lot of time and that was too much pressure.
No.
No, with engineering being such a different way of thinking. I felt the professors did a very poor job of guiding or teaching us-they wanted us to teach ourselves.
No. I did not expect all the math.
More difficult than expected. However I feel I didn't put enough time into the work necessary to properly understand all of the aspects of the courses I took.
Yes
Yes
My program was not what I expected. Personally, I had a lot of outside distractions that I could not control. So I was not able to stay focused, and be productive.
Well, it was tough, and I also wasn't prepared mentally for the curriculum.
Yes, I only had DR 125, but I enjoyed it.
I expected it to be tough, but it was tougher than I thought.
No it was not what I expected. It was boring to me.
No, it was hard as hell with German, Japanese and Arabs professors not talking clear English
I changed majors after first semester did not take any real engineering classes
Not really. I expected smaller classes and engineering rather than chemistry and calculus.
No, the staff WAS NOT nurturing the advisors DID NOT care for the students.
No, it was a majority of math and EE classes very few of the classes in the curriculum related to the field of CS that I was looking for like programming and software training.
No, my experience showed me you must be 100% devoted to your major in order to succeed in the engineering college.
I knew that engineering would be a tough major but when you do all you can and study as hard as you can and still fail tests it's time to give it up.
I didn't expect it to be as team-oriented.
Yes.
It was what I expected but I got behind in Calculus and there was no turning back
I'm not sure what my expectations were but I knew that I was not happy in the COE.
No- I wasn't really interested in the kind of work done by engineers. Plus, the people I worked with were really formal and not very nice.
I did not really know what to expect originally. The program seemed very well orchestrated. My interests were just not as strong in CS once I got involved in geography.
Look to your left look to your right only one of the three of you will graduate as an engineer. "I'm sure it'll be these other two dudes" I thought. After slugging through three years of tough core classes I hit the brick wall no more. I hear the classes in designated fields aren't as bad. My Cal. III teacher thought she had to hurry up and finish and teach 6 weeks of Linear equations. No engineers I know use all of this math, greens theorem, etc. Furthermore I see no examples of this in application (towards engineering) and lose my determination (I expected to be trained to do engineering work, not raw math. I could get a math degree If I wanted that). I knew it would be tough. I hung in there till I lost my determination.

It was not what I expected. First of all, the faculty could careless if you passed and/or learn anything. The faculty was very uncaring about the program and the students.

No. I wanted more hands on activity at an earlier stage.

Pretty much what I expected, but harder than expected.

The core curriculum classes (i.e., chemistry, math, etc.) were more difficult than expected; the few engineering courses taken were not as bad and were interesting. I just did not feel up to finishing the so-called "weed-out" courses.

it seemed as if the light at the end of the tunnel would never shine through.

The people (Dean and advisors) were very helpful, however, the mathematics level was more difficult than I had first expected and I didn't feel like I was very prepared to take these classes.

No. I did not expect to sit in the lab for hours on end searching for one mistake. I did not expect to have to teach myself introduction class material. My teacher prepared slides for us and read them. That's all. When I did go to him as I was having problems he just would do my program for me and not teach me how to do it myself.

No. I did not expect to be placed in classes with the same 30 people for my entire freshman year. The classes were fine, but there was a definite lack of diversity in the people who I had class with.

I expected it to be hard, but I didn't expect to still feel like I was in High School. The TIDE program gave the feel of High School dealing with the same people everyday. Sometimes that was a good thing, but not always.

No, I guess I expected it to be a more socially oriented program which incorporated a lot of complex information whereas it turned out to be just a lot of complex information with little social interaction even in a classroom setting.

It was not what I expected. It just seemed too dull and unimportant. I want to do something that I think will have a more personal impact on society.

Yes, to a point. I liked the program but it had to much electrical and not enough computer and computer was vice versa. Also when I got in the thought of relocating was something I did not want to do to find a good job.

I didn't really know what to expect, but it was a lot more confusing than I thought it would be.

The program was fine; I did not want to put forth the effort.

Yes and No. I only took DR 125 and that alone showed me that I wasn't comfortable in this major. I knew there would be a lot of math, chemistry, etc., and I was ready for that, but that one engineering class discouraged me.

Somewhat. There was much more math involved than I anticipated.

I'm not sure if I wasn't cut out for engineering or if i was just too immature my freshman year of school with everything being new and I was unadjusted.

Yes, the program was what I expected.

No, it just was not architecture.

No. The computer science department is a good program but they don't offer a practical learning experience. I wanted to learn something I could apply the real world.

I never really got my feet on the ground...I was initially part of the "Foundation Coalition". There I quickly found out that engineering was not for me.

No, because I did not enjoy anything we did in class. I was bored while everyone else was intrigued.

Yes

I didn't get to take anything relative to my major in the beginning; I had to take all the basics first. I really wanted to take some intro class to give me an idea of what engineering was all about.

No, that major turned out to deal more with things not interesting to me and the job market in that field is little to non-excitant

The program was much more intensive than I expected. But that wasn't a big deal at first. It did become a problem later on once I had to start supporting myself through school.
Yes, it was what I expected because it was hard and very demanding.

I thought I would find it interesting.

Engineering did not cause me to change. I just realized that engineering was not the path I wanted to choose.

No. The people in the college of eng. were not particularly kind to me.

No. Engineering strived to teach me how to send 1's and 0's across a wire. I wanted to learn how to APPLY technology to solve problems.

04. What did you like best about your engineering program, i.e., what were its strengths? N = 34

Summary of opinions

The respondents mentioned faculty (7), small class size (5), and good classes (4) most often. Five respondents said the program was challenging or strong, while three said they didn’t like anything. Hands-on, easy getting help, one-on-one advising, TIDE program, physical applications, scholarship, labs, tutors, engineering center, available advisors, co-op program, technical aspect, and familiarity with faculty were all mentioned once.

List of all student comments

1. See above. The program seemed to have a good cooperative education program.
2. The hands-on approach. Ex., working with the students at the Stallings Center.
3. Getting help was easy, but I was in my core when I was enrolled in the engineering department.
4. Nothing that I know of. Most instructors were from Pakistan, China, or Japan. I would have more trouble understanding the instructor than the material.
5. Classes were typically a little smaller. Advising seemed to be more one-on-one than other colleges.
6. One thing- Dr. April was genuinely concerned about his students and did all he could to assist them.
7. Small classes, some good professors
8. To be honest- nothing!
9. The TIDE program is outstanding; everything about it is good: labs, professors, TA's, schedules, facilities, and the way the classes are composed of similar faces in each, and the cultural credit is a great idea. Just what we engineering anti-socials need.
10. Undecided
11. The faculty.
12. I am an analytical and physical thinker, so doing calculations that resulted in physical application appealed to me.
13. I liked the scholarship I had until the spring rolled around.
14. I enjoyed my fellow students and classes, but took the wrong classes at the wrong time.
15. Nothing. But it definitely was challenging.
16. Numbers and formulas, labs, tutors, engineering center.
17. I like the fact that it was challenging.
18. The classes in the curriculum were challenging and I felt a sense of accomplishment when I completed them.
19. I only took DR 125, and it was fun at first, but got way too difficult and the teacher was very biased towards males and routinely helped the females in class, but not the males.
20. Teachers are very serious about preparing students for upper level classes.
21. Your advisors and people in the engineering offices were always available for you to talk to.
22. The only strength the engineering program has is the co-op program. I really didn't like anything about engineering.
23. Technical aspect of it.
24. At that time I hadn't made it to upper level classes, but just peeking in on them they looked very interesting and sort of motivated me to want to stay in that field of study.
25. I never really got the chance to see the strengths of the program.
The professors.
The small class size and the familiarity with the professors.
You dove right into the material. There was no having to wait to your junior year to start learning the important things.
I had a chance to talk to some of the faculty and staff. I like the involvement of students after they leave school. The program is strong and competitive, that’s what I like.
The faculty, Dr. Jordon, seemed very nice and helpful.
The University of Alabama has a strong engineering program. I know several people that have graduated with a degree from their school.

05. What did you like least about your engineering program, i.e., what were its weaknesses?
N = 35

Summary of opinions
Advising and the math requirements led all concerns here with five references each. Numerous issues were mentioned once.

List of all student comments
1. I didn’t understand the requirements of CH 131 and CH 132 for civil engineering majors and not for all other majors. Also, my advising experience was not at all pleasant. The advisors I spoke with seemed to have too much else to do and were not very concerned about me and my academic progress.
2. TA’s seemed more helpful in other colleges.
3. I liked it. No weaknesses that I could tell.
4. See #4.
5. Many professors seemed to be unconcerned with how well students grasped the class material they were exposed to. Also, they need to be more detailed about prerequisites for classes (See 03).
6. Too much “group work”
7. The main thing was how many math classes you had to take.
8. Not necessarily your weakness, more like my lack of motivation to sit down every night for a couple hours to learn MatLab. A sort of wish I had some programming skills taught to me in high school.
9. Undecided

I think they try to throw you in too fast. It should be a more gradual assimilation.
Did not see any weaknesses.
Fortran 90
My classes were set up wrong.
It just was not for me.
Nothing, except that it moves to slowly, too boring.
I put a lot of hours studying in, but never got the grades I wanted.
The advising process was horrible. The professors that advised me were incompetent about administrative matters and were difficult, at times, to understand. Also, I personally felt a lack of common interests between the other students, although this is not a weakness per se.
The personal advisors were horrible and he spoke to me as if I were a four year old and reprimanded me for my grades.
I hated the fact that in three of my four classes I was placed with all engineering students. I had class with the same people all semester. College is a lot about meeting people and being stuck in class with the same people everyday is not going to broaden my horizons.
I was majoring in Metallurgical engineering and I really didn't know what I would be doing in this field. There wasn’t a class to really tell you about the different engineering fields.
Better teaching methods in classes. They need to go into more detail rather than just reading from slides. The computer facilities.
Too much science.
24 Too much math. I think that the advisors could take a little more time with the students also.
25 I wasn't in it long enough to find weaknesses.
26 Math.
27 The teachers and the lack of help and guidance.
28 The math.
29 Seemed a bit disorganized.
30 Language difficulties in engineering calculus. It took me a few weeks to be able to understand clearly by
then I was too far behind.
31 At the time I was in engineering it was hard to get help when you need it.
32 I was a transfer. I would have to say advising for me. I could not keep in contact with the advisor I had (Dr.
Pandey). I always had different people doing my schedules. I think all advisors should be in the same building. To
this day I don't know where his office is. I was in the engineering building, but he moved three or four semesters
ago.
33 There was no TIDE program when I started.
34 Was not in it long enough.
35 Mathematics.
36 It did not intrigue me like I thought it would.

Among the following list of issues please identify factors that led to your leaving engineering.

06a. Table 14.

| Percent of Responses | Non-engineering major more interesting | Non-engineering career option more appealing | Switched as a means to career goal | Lack of/Loss of interest in engineering | Curriculum overload, fast pace | Discouraged by poor grades | Discovered an aptitude for a non-engineering subject | Inadequate advising or help with academic problems | Language difficulties with foreign faculty or TA's | Prefer teaching approach in non-engineering courses | Conceptual difficulties with subject matter | Inadequate high school preparation | Non-engineering major offers better education | Poor teaching by faculty | Lack of peer group support | Unexpected length of engineering degree | Career options not worth effort to get degree | Rejection of engineering career and lifestyle | Morale undermined by competition | Problems related to class size | Poor lab/computer facilities | Financial problems |
|----------------------|---------------------------------------|----------------------------------------|----------------------------------|----------------------------------------|------------------------------|-----------------------------|-----------------------------------------------|----------------------------------|---------------------------------|-----------------------------------------------|---------------------------------|---------------------------------|-----------------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                      | N          | Strong Factor | Weak Factor | Not a Factor | N          | Strong Factor | Weak Factor | Not a Factor | N          | Strong Factor | Weak Factor | Not a Factor | N          | Strong Factor | Weak Factor | Not a Factor | N          | Strong Factor | Weak Factor | Not a Factor | N          | Strong Factor | Weak Factor | Not a Factor | N          | Strong Factor | Weak Factor | Not a Factor | N          |
| Non-engineering major more interesting | 87 | 66.7 | 19.5 | 13.8 |
| Non-engineering career option more appealing | 88 | 61.4 | 21.6 | 17.0 |
| Switched as a means to career goal | 87 | 52.9 | 16.1 | 31.0 |
| Lack of/Loss of interest in engineering | 88 | 50.0 | 27.3 | 22.7 |
| Curriculum overload, fast pace | 88 | 42.0 | 31.8 | 26.1 |
| Discouraged by poor grades | 88 | 42.0 | 26.1 | 31.8 |
| Discovered an aptitude for a non-engineering subject | 88 | 39.8 | 29.5 | 30.7 |
| Inadequate advising or help with academic problems | 87 | 34.5 | 24.1 | 41.4 |
| Language difficulties with foreign faculty or TA's | 88 | 34.1 | 27.3 | 38.6 |
| Prefer teaching approach in non-engineering courses | 88 | 34.1 | 26.1 | 39.8 |
| Conceptual difficulties with subject matter | 88 | 30.7 | 28.4 | 40.9 |
| Inadequate high school preparation | 88 | 26.1 | 22.7 | 51.1 |
| Non-engineering major offers better education | 88 | 20.5 | 25.0 | 54.5 |
| Poor teaching by faculty | 87 | 19.5 | 39.1 | 41.4 |
| Lack of peer group support | 88 | 17.0 | 22.7 | 60.2 |
| Unexpected length of engineering degree | 88 | 14.8 | 25.0 | 60.2 |
| Career options not worth effort to get degree | 88 | 13.6 | 23.9 | 62.5 |
| Rejection of engineering career and lifestyle | 88 | 12.5 | 31.8 | 55.7 |
| Morale undermined by competition | 88 | 11.4 | 13.6 | 75.0 |
| Problems related to class size | 87 | 6.9 | 13.8 | 79.3 |
| Poor lab/computer facilities | 87 | 5.7 | 18.4 | 75.9 |
| Financial problems | 88 | 3.4 | 11.4 | 85.2 |
06b. Please identify any other factors you feel led to you leaving engineering. N = 37

Summary of opinions
No interest in, or not liking, engineering was mentioned by seven respondents. The reputation of CBA, and better facilities in CBA were noted. Also, a racial accusation, improper treatment, unattainable TA’s, and same people in classes were all mentioned once. Note: any of the issues mentioned below that were addressed in the structured question above were not included in this synopsis.

List of all student comments
1. Other than the advising and required chemistry classes- I had an overall satisfactory experience. I simply decided that this profession was not the one for me.
2. I would not say language difficulties as much as unattainable TA’s.
3. Sick of math and physics; think MIS is geared more towards what I would like to do than computer science.
4. Too time consuming.
5. Not interested.
6. Guess you could say that I shot myself in the foot. I took AP Chemistry in high school and planned for Chem. E. However, when I got here, I took CH 101 and 102 to make sure I knew the basics. This led to the "Lack of/Loss of interest".
7. I can make more money with a business degree.
8. It just was not for me.
9. No other reasons.
10. Too much difficulty with the advisors.
11. Class load, teachers, and advisor.
12. The new program in which everyone is put into the same classes. I had three classes with the same people. College is a lot about meeting people. Not just engineering majors.
13. The program is strong. I was just one of those weak ones that could not survive.
14. Language difficulties.
15. CBA has a better reputation than the UA engineering department has. If the engineering department had a higher rank and reputation I might have stayed.
16. CS seemed like it was an afterthought that was cut and pasted together from other Engineering classes.
17. My high school did not prepare me adequately for the math required.
18. Wanted to learn more about business.
19. I just wanted to reiterate the difficulty I had with foreign teachers.
20. I just didn't like it.
21. The advising at the University is atrocious. It is horrible. I go in for my first advising session, he asks, so what are you going to take? I will advise myself then!!!! So then I go and try to pick out some classes. I come back he signs my form and PRESTO. I am advised. If you want to change something give a seminar to advisors on how to advise. You have people who don’t even know which courses count for what. Fix It.
22. The faculty just does not seem interested in teaching. They really do not care about the performance of their students. When asking for help outside of class certain professors would not help you and instead they just told me to “Just go read the book” (i.e. Dr. Leland).
23. I thought it would be better for my career choice (orthopedics) and thought that the engineering major would not prepare me for the MCAT as well as another degree would. Also, I felt the students and some faculty did not regard me as a serious student simply because of the way "I handled" my engineering plans.
24. A racially motivated accusation of cheating on a test that the majority of the class failed besides a friend and I by an instructor that I had to take numerous times. Dr. Baker chemistry 101 to be perfectly blunt about the subject.
25. I felt more comfortable with my major.
26. The major one was I said before, the placement into groups which you had no choice in.
27. The whole engineering lifestyle at UA is a very dark and dreary one. The buildings are antiquated and dark and most of the people in engineering are very dark and non-interactive.
28. The biggest was chemistry with Nickles. It was a real demoralizer. Over half of the students in the tide program had him and he sucks whether it be with the tide program or not. He cannot teach. He was the one that got
me looking to other degrees. The other thing was the lack of action in the engineering department to act on the matter in a timely and just way.
69 I discovered it was not an appropriate career for me.
71 Social work is something that I have always wanted to do.
73 I just knew it wasn't what I wanted to do for the rest of my life.
75 The look of the engineering department looked old and behind on the times. Too many horrible professors with tenure.
76 I did not like the subject matter that makes up the engineering curriculum.
83 The biggest problem I had was the fact that the Electrical Engineering dept had a shortage of teachers and of those teachers available only about three were worth having. I believe the faculty's lack of skill (and personality) helped lead me to a loss of interest in the subject. Once I had lost interest my grades suffered tremendously. I also had problems balancing the work-load while trying to support myself through school. It is tremendously difficult to balance a 15 hour engineering workload while working 20-30 hours per week off campus. Another factor leading me to C&BA was that school's superior facilities and equipment. Engineering classrooms are drab and devoid of the technology that should be present. The teachers are also drab. I am still dumbfounded that the C&BA has superior computer lab facilities. This is even more astounding since the Bashinsky and Alston networks are run almost solely by students while the Engineering labs are run by full-time employees! The bottom line: I feel the education I am receiving from C&BA is about 10 times the value of the education I was receiving from the College of Engineering.
84 I lost an interest for engineering and there were classes that I felt were very hard and I did not find the material that was being taught in those classes interesting.
86 The Physics lab instructors could not speak any English. This is intimidating and students fear the future engineering classes will be the same. I'm a top student and was struggling. I can imagine that many students left because of this one class.
87 I was treated as a cheater because I couldn't prove that I didn't give out a program for a CS class. How do you prove a negative?
88 Foundation Coalition was horrible. Kent Martin should have never been hired.

The following items pertain to your overall evaluation of your experiences at UA.

In general, how satisfied are you with each of the following? (VS=Very Satisfied, S=Satisfied, D=Dissatisfied, VD=Very Dissatisfied, N/A=Not Applicable).

07a. Table 15

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<thead>
<tr>
<th>Percent of Responses</th>
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<tr>
<td>N</td>
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<tr>
<td>Academic experiences (courses, professors).</td>
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<td>Academic performance (GPA, honors).</td>
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<td>Social experiences.</td>
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<td>Recreational experiences (SRC, Intramurals).</td>
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<tr>
<td>Cultural experience.</td>
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<td>Overall undergraduate experience.</td>
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<td>Professional development.</td>
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07b. Please identify the nature of any of your concerns regarding your overall experiences at UA. If you have any suggestions for improvement, please include them. N = 13
Summary of opinions

Newer facilities, more human interaction in engineering, more social opportunities for older students, stop lights in city, too warm in EE building, disjoined culturally, better advisors, more adept teaching, racism on campus, improve teachers, lack of teacher understanding, and developing a stress program were all mentioned once.

List of all student comments

4 Newer facilities, better faculty.
6 Many engineering professors would do much better if they relied less on electronic teaching (powerpoint, web page notes, etc.), and more on actual human instruction.
8 When I was in the engineering program I was a teenager and there were things on the campus for us to do. Now that I am a 32 year old single mother this campus has very little to offer for me socially.
9 Make the city change the timing of all the stoplights so when I sit at a red then go to the next light it won't be red. If this is about people speeding then put cops out with some radar guns. I have been in this city for a year and I have yet to see a cop catching speeders. Then people wouldn't run redlights, and I could drive to Wal-Mart in less than fifteen minutes.
10 Please turn AC on in EE building. The whole building stinks as well. But the lab is awesome.
14 Having a wonderful time.
15 I'm very happy now.
18 Culturally, the UA is very disjoi nted. Some students, me included, very much enjoy cultural events and the fine arts (regardless of major), while others only seem interested in a career. i.e., they see college only as a segway to money.
19 Better advisors and more adept teaching.
21 I have run into racism at the University of Alabama.
25 Some improvement could come from teachers. I feel their time is the student’s time, without the students the University would have no purpose.
31 The lack of understanding among the faculty that some students have to work to attend the university. I always used to hear "school has to come first", but in reality a lot of kids wouldn't be in class without their job."
32 Develop a program that would help students to deal with stress whether financial, academic, or relating to school. If there is such a program let students know how to get some help. I sure needed it.

Please select the response that corresponds to your opinion about each item.

08. With how many faculty members in engineering did you develop a close professional relationship, such that you could ask them for a letter of recommendation? N = 87

Percent of Responses

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>None</td>
<td>[ 65.5 ]</td>
</tr>
<tr>
<td>One</td>
<td>[ 25.3 ]</td>
</tr>
<tr>
<td>Two</td>
<td>[ 5.7 ]</td>
</tr>
<tr>
<td>Three or more</td>
<td>[ 3.4 ]</td>
</tr>
</tbody>
</table>
09. All things considered, how would you characterize the intellectual environment at UA?  
N = 87

Percent of Responses
[ 12.6 ] Very Strong
[ 43.7 ] Strong
[ 36.8 ] Average
[  5.7 ] Weak
[  1.1 ] Very Weak

10. If you had to do it again, would you choose to attend UA?  N = 87

Percent of Responses
[ 52.9 ] Definitely
[ 35.6 ] Probably
[ 11.5 ] Probably not
[  0.0 ] Definitely not

11. What advice would you give for improving enrollment and persistence in UA engineering programs?  N = 28

Summary of opinions
Overwhelmingly, issues pertaining to the faculty were mentioned. Ten students recommended having better teachers or better teaching, with four additional references pertaining to the English competency of some faculty. Obtaining better facilities was mentioned by three students, while having smaller classes was stated by two. A plethora of issues were mentioned once.

List of all student comments
37 Get some people who speak English
41 Make things more interesting and give examples on why all the things that the students are learning relate to engineering.
42 Better teaching. More help available outside class.
43 Better teachers, more good teachers (CS), more concern for the program. Maybe then you can get more Alumni to give back to the department.
44 Get more feedback from the students. Find out why they are having to take certain classes 2-3 times in order to pass them.
45 Let the teachers interact more with the students instead of teaching behind a computer.
49 Keep up with Calculus.
51 Make sure that the students are truly interested in what they are signed on to do. Also, have students keep same advisor throughout their college career so the advisor can know the student and his/her interests well.
53 Use Engineering examples in core classes when possible.
54 Revamp the program. Get back to the basics and actually teach. Hire professors that actually care about the performance of their students.
55 Make the students feel like that even though this is a difficult major it is certainly possible to succeed and do well in this field.
57 A better networking of peer groups and rework the core curriculum such as the science and math.
58 I don't have any advice.
Put more emphasis on the early Calculus classes and understanding of the concept. Some teachers within the Calculus and Chemistry (Labs) didn't seem very fluent in English and didn't seem like they really cared whether or not you understood them or not.

Better quality of education. Teach and discuss, not inform. Give concrete examples. Have more group effort activities.

I was required to be in class for an estimated 25 hours a week and only received credit for 16. This was a major discouragement. The recitations were horrible and I received no credit at all for them.

I know that it is hard because of finances, but try to get more money for nicer facilities. Also, try to get faculty who can make learning an unforgettable experience as opposed to professors who make learning so boring and reduce it to a bunch of numbers and equations.

Show high school students what engineering is really about.

Do not push the tide program. I believe my time and energy could have been better spent. Also the tide program makes courses much harder than they need to be.

Smaller classes and larger computer facilities.

Smaller classes, more effective teaching, and better availability of help to students in need.

Structure the program so students work on real world problems. The department needs to give students sense of competitive advantage over other students in other school.

Have more introductory classes that better define what will be expected of each major. Also, do not force new students to take some pre-determined curriculum.

Professors that speak good English and professors that actually stimulate learning.

The first thing I would improve is the quality of the faculty. The short-staffed Electrical Engineering department had people teaching classes in subjects that they weren't very good at teaching. Also, a foreign professor may be the world's foremost expert in his field, but if he cannot effectively communicate what he understands to his class he is useless as a teacher. The next area I would concentrate on is the facilities available to students. Advanced computer labs and laboratory facilities would greatly improve recruitment, retention, and overall quality of education. The bottom line: If the value of an engineering education is far lower than the value of an equally priced education in another college you will have a very difficult time recruiting and retaining students.

I must include a positive note. I have bashed the faculty but there were some bright spots. Drs. Morley, Stern, and Pimmel are valuable assets. Their enthusiasm and interest was contagious and they are very good at teaching and motivating their students.

Improve the math department. More quality teachers need to be in the math department. Math is the basis for so much engineering material, but students feel mathematically weak because of poor preparation. The engineering degree requires many hours in math. If the math department had better faculty in its 100-300 level classes almost all engineers would take one or two more classes for their math minor.

No more Kent Martins. Get LOTS of Jeff Jacksons.
Scholarships

Commitment and intent, when it comes to accepting scholarships from the college, needs to be examined. The college is making a financial investment in the student, which is lost should they transfer. The concern centers on students accepting the funding with the premeditation of leaving their engineering program at a later date.

Scholarship information was gathered from the college for the 1999-2000 and 2000-2001 academic years. For those two years 519 students were offered at least one scholarship for at least one academic year. Of those students 41, or 7.9%, transferred to other programs. This is a small percentage, but is misleading because it represents students who have been at the University a short amount of time (i.e., less than one or two years). Most of those 41 students received their scholarship during the 1999-2000 year. Thus, it is likely that number will rise substantially in the upcoming year as more scholarship-receiving students from the 2000-2001 year transfer.

Most of the scholarships are based on academic performance. Hence, it is not surprising that the 41 transfers, overall, did much better when it came to academic preparedness. Table 16

<table>
<thead>
<tr>
<th></th>
<th>Former Mean: All</th>
<th>Former Mean: Scholarship</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT English</td>
<td>23.66</td>
<td>28.73</td>
</tr>
<tr>
<td>ACT Math</td>
<td>24.04</td>
<td>28.40</td>
</tr>
<tr>
<td>ACT SS</td>
<td>24.45</td>
<td>29.15</td>
</tr>
<tr>
<td>ACT NS</td>
<td>23.78</td>
<td>28.28</td>
</tr>
<tr>
<td>ACT Composite</td>
<td>24.13</td>
<td>28.78</td>
</tr>
<tr>
<td>Math Placement</td>
<td>35.85</td>
<td>44.24</td>
</tr>
<tr>
<td>HS GPA</td>
<td>3.216</td>
<td>3.708</td>
</tr>
</tbody>
</table>
compares these scholarship students to all former students. Several references were made in the survey with regards to scholarships as a factor in entering an engineering program.
Discussion

Discussion for Research Question IV

Question IV: What can be done to address these factors to reduce attrition from engineering programs?

Pre-College Psychosocial

One needs to begin with the preconceptions a potential college student has with regards to engineering as a field of study and a career option. Many potential students do not understand the demands of engineering in higher education or comprehend the breadth and depth of the field as a career. A student, even one who is considered academically prepared, who falls into this trap is at-risk. Substantial evidence of this is found within the survey responses of the former students for this study. The top four structured responses cited as strong factors leading to the student leaving engineering dealt with realizations of a more interesting major or a more desirable career path outside of the discipline. Also, numerous respondents indicated they chose engineering initially because of a family member, mainly a parent. Brown and Cross (1993, p. 669) say it best in stating, “If the personality of students entering engineering differs significantly from that of prior students and engineers in the field, then the expectations and activities that were effective with prior students will not be effective with current students.”

A retention analysis completed for the COE by ACT using the ACT Interest Inventory (Hovland, 2001) similarly found occupational/academic major interests to be a significant predictor of attrition. They determined this by using the Hexagon Congruence Index (HCI),
which compares an individual’s pattern of interests across six UNIACT-R Basic Interest Scales with the interest pattern of the Engineering Cluster.

One means of addressing this is by offering a “pre-college primer course” to introduce students to the subject matter, and possibly foster interest in the field. Ayorinde & Gibson (1995) claimed success in offering a pre-college primer course in composites engineering for six weekends. This course could be offered at the high school level or during college orientation. Another option would be having the college of engineering require an engineering orientation, complete with class lectures about the various programs and their particular demands, with mentoring and counseling by engineering faculty and upperclassmen providing a more interpersonal experience.

Pre-College Academic Underpreparedness

Next, academic underpreparedness needs to be addressed. All of the quantitative data provided for research questions II and III indicate that the former students were less prepared academically, in all aspects, than the current students. Performance in high school, prerequisite gateway courses, engineering courses, and all courses were poorer for the transfer students than the continuing students. The survey revealed that between one-quarter and one-half of former student survey respondents indicated that curriculum overload, poor grades, or inadequate high school preparation were strong factors leading to their departure (see Table 14). Plus, nearly one-half of the survey respondents said they were either dissatisfied or strongly dissatisfied with their academic performance at the University (see Table 15).

The logistic regression and discriminant analysis models outlined previously indicated that high school GPA, followed by math placement score and race were significant contributors
to attrition from the College of Engineering at UA. While race was determined to be a significant factor there were multicollinearity concerns with sizable correlations between it and high school GPA ($r = -.213$, Sig. .000), and math placement score ($r = -.271$, Sig. .000). African-American students, for a variety of economic and social reasons, suffer academically, which is evidenced by the low scores in Table 4 as compared to White students. Thus, eliminating race, a student’s overall high school performance with an emphasis in their math competency should be our focus dealing with academic underpreparedness. The cluster analysis provided further evidence that academic underpreparedness was a substantial determinant of attrition.

The ACT study (Hovland, 2001), likewise, found that math proficiency and high school performance were significant factors. While this study determined a students’ math placement score and overall high school GPA to be significant predictors, the ACT study concluded that the ACT Math component and high school GPA were relevant predictors of attrition in engineering.

Tackling these variables at the high school level is no easy task. Raising GPA’s and math competency levels have been goals of the education community in perpetuity, but many students still fall short. One possible solution could be bridging higher education with secondary education and creating a communication pipeline that fosters better high school preparation for college. Problem high schools could be identified and targeted for help.

Another solution dealing with academic underpreparedness would be to raise admission standards. Figures 8, 9, and 10 show the proclivity of students to transfer from engineering based on their high school GPA, ACT scores, and math placement score. While no minimum score can assure the college a student will be successful the data in those charts do provide insight as to relationship between academic underpreparedness and engineering continuance.
It should be emphasized that even though high school GPA, and math competency were found to be significant indicators of attrition, based on the predictive models, they should not be viewed exclusively as a solution. It was noted that both the logistic regression and discriminant analysis models could not predict attrition with sufficient accuracy to warrant their exclusive use. This is because other variables that contribute to attrition, namely psychosocial aspects, were missing from the equation.

**College Gateway Courses**

Once a student is in higher education further steps can be taken to deal with risk factors. One area that needs to be looked at are the specific gateway courses. The crucial point here is what is a reasonable amount of time for a gateway course to prepare a student for further study within engineering. The ICE² model (Indicies of Course Efficiency and Effectiveness), which was constructed by the University of Texas at El Paso, deals with this matter. This model recommends 24 months, i.e., four semesters. “Any longer period suggests that the gateway course is serving as a barrier rather than a springboard into the major or degree program” (Andrade, 2001, p. 5).

**College Psychosocial Variables**

Another area of concern is the sense of identity or community the student has with the institution. This is often mentioned as a factor associated with retention. Students are most vulnerable in their freshmen year. Thus, intervention needs to take place immediately. One avenue to build a relationship between the student and the institution is through Freshmen Interest Groups (FIG). FIG’s are clusters of first-year students who elect to live near one another
in the residence halls, co-enroll in courses, and take a seminar together. Each FIG is organized around a fairly broad theme, such as Science or Arts or Politics. (AIR, Indiana University Report)

The University of Alabama has a similar forum for first-year students in engineering called the TIDE (Teamwork, Curriculum, Integration and Design in Engineering) Freshmen Program. The TIDE Program was initiated in the Fall of 1999, and has met with considerable success thus far. Consideration should be given to expanding this program.

The notion of students deceptively taking engineering scholarships needs to be addressed as well. The easiest solution is to make multi-year scholarships contingent upon continuation in engineering programs. It’s a bit more problematic when dealing with single, or one-year scholarships. The option of restitution exists, either partial or in-full. Student notification about the expectations and consequences associated with their funding should reduce attrition through this outlet.

A sizeable number of students in the survey indicated some problem with regards to pedagogical methods. Roughly a third of the respondents indicated that the teaching approach in non-engineering courses was a strong factor leading to their departure, while another quarter said it was a weak factor. Similarly, a third of the respondents noted language difficulty with foreign faculty or TA’s as a strong factor. This is not unusual. There is evidence that pedagogy in engineering has an affect on retention. Felder, et al. (1998) looked at instruction techniques with regards to student performance and retention in chemical engineering. They concluded that course instruction using more active and cooperative learning in conjunction with other techniques designed for a broad spectrum of learning styles led to a higher retention and graduation rate.
Also related to this, there is some evidence that there is a negative correlation between first- to second-semester retention and courses taught by part-time faculty (Study: Part-Time Instruction Hampers First-Year Retention, 2002). However, it was found that students taking more courses from part-time faculty were more likely to be male, have lower entrance examination scores, and earn lower GPAs than other students. Thus, one needs to be cautious of the actual causes of lower retention- the part-time faculty or the increased at-risk factors these students bring to the classroom.

Discussion for Research Question V

*Question V: How can retention assessment in engineering be made recursive?*

1) The college has to make a commitment to assessment.

2) The college needs to track students and attrition-related factors. Tracking such factors for a large number of students requires enormous planning and effort, because the targets being tracked are constantly changing. A longitudinal database needs to be implemented and maintained on all prospective, incoming, current, and former students. This database needs to be comprehensive and incorporate scores of quantitative and qualitative variables.

3) The college should do a more thorough job of understanding its prospective students. Recruiters should counsel and/or query the recruits to ascertain or assess if the prospective student is psychologically and academically prepared for study in the college.

4) The college needs to advance more one-on-one interaction between prospective and admitted students and faculty, advisors, and upperclassmen.
5) The college needs to work with other related disciplines (i.e., Math, Chemistry, Physics) to ensure effective, high-quality teaching is offered in prerequisite freshmen courses. A greater percentage of at-risk students gravitate towards classes taught by part-time faculty. Make sure that all faculty members, in particular adjuncts, have the skills necessary to identify these students.

6) The college should implement annual or semester assessments of all engineering students. These could be administered during advising or with course evaluations. Students deemed “at-risk” should be counseled periodically until they are no longer considered susceptible to loss. Counseling could be carried out twice or three times a semester. Data from these assessments would be input into the longitudinal database.

7) Monitor retention efforts. “Students’ goals, preparedness, and a variety of other factors will deviate from year to year, therefore, efforts to monitor the effectiveness of retention activities must be rigorous and continuous” (Moller-Wong & Eide, 1997, p. 8).
Conclusions

The implications of this research are clear: attrition cannot be viewed as a predictable consequence of differential levels of ability. Academic underpreparedness was found to be a substantial determinant in engineering persistence. However, other non-preparedness variables were found to contribute to attrition as well. Predicting success in the College of Engineering, or any college, is difficult due to the infinite antecedent variables each student brings to higher education. No model can be perfect, so the results presented here must be taken for what they are, our best estimate.

The data in this research seem to indicate that most of the factors associated with attrition from the College of Engineering are pre-college attributes, i.e., academic underpreparedness, ignorance about engineering, or calculation to leave after a certain timeframe. However, other factors specific to higher education need to be considered as well. These include assessing pedagogical methods in gateway and engineering courses, and increasing the student’s sense of belonging within the college and the University through greater interaction with faculty, advisors, and other students.

One can never totally eliminate attrition. It, however, can be limited with a comprehensive effort to address its many aspects.
References


