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Factors Influencing Attrition and Retention of Female Students in the College of Engineering

Sheryl A. Brockett

FACTORS INFLUENCING ATTRITION AND RETENTION OF FEMALE STUDENTS IN THE COLLEGE OF ENGINEERING

By

Sheryl A. Brockett

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Advisory Committee:

Sandra L. Caron, Professor of Family Relations, Advisor

Sharon Barker, Director of Women's Resource Center

Michael L. Peterson, Assistant Professor of Mechanical Engineering

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An Abstract of the Thesis Presented
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The purpose of the study was to explore experiences of female undergraduates in the College of Engineering at the University of Maine with an eye toward attrition and retention issues. A total of 152 engineering students were included in this study (n=93 women; n=59 men). Specifically, this study investigated what differences and similarities exist between male and female engineering majors in terms of: family background, choosing to major in engineering, high school academic performance, college academic performance, use of college academic services, perception of support, participation in outside activities, perception of their academic ability/experience, and perception of impact of their gender. These findings offer some insight into what might be helpful in the recruitment of female students to major in engineering and provides a basis for understanding retention issues for females in the engineering program.

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OVERVIEW OF COLLEGE ATTRITION AND RETENTION ISSUES

Attrition and retention are major concerns for colleges and universities. The decision to go on to college after high school should not be done without thoughtful consideration. Yet, many students do not put much effort into this decision and continue on to college for many of the wrong reasons: friends, family tradition or lack of an alternative plan are just a few examples. Fifty percent of all first year students leave college after the first year, and of those students, 50% leave during the first six weeks (Edwards and Cangemi, 1990). They also found that 25% of college students who withdrew from school reported they had no intention of completing the degree and they had considered withdrawing before classes started.

Factors Contributing to Student Attrition

There are many reasons why students fail to complete college: they include personal, financial, emotional and environmental factors. It is likely that at least one of these factors play a major role in a student's decision to drop out. One of the best predictors of student attrition is a student's uncertainty of long-term goals. Students find it quite difficult staying interested and motivated in something they do not see as valuable.

Lack of financial support along with tuition increases each year force many students, who lack adequate resources, to find work to help finance their education (Gardner and Broadus, 1990). This can be quite frustrating for a

student. Study time, professors' office hours, and peer study groups often conflict with students' work schedules.

Making the transition from family to college is a big step for many first year students. For many, this is the first time away from their families and experiencing life on their own. Along with meeting new people, they are learning and using new values and behaviors. If the student is unable to make the adjustments in values and behaviors, it is unlikely the student will remain in college (Eimers and Pike, 1997). It is important to note that not all college attrition is bad; for some it is a "healthy coping device" (Edwards and Cangemi, 1990). External support from family and friends also makes a difference in the student's desire to remain in college.

Students come to college with expectations of academic achievement, the financial support they will receive and the college environment. Once there, some find it very different from their preconceived expectations. Students do not expect to have scheduling conflicts and for many first year students this is the case. First year and transfer students encounter a greater degree of scheduling conflicts than upper level undergraduates or students on track. Scheduling conflicts can also extend the time it takes to complete a program. They also find heavier course loads and more difficult courses than expected. The majority of students find faculty intimidating and unapproachable, and for some students, difficulty getting help from their professors or advisors contributes to the decision to switch majors or leave college (Seymour, 1995).

Terenzini, Springer, Yeager, Pascarella, and Nora (1996) found first-generation students present special problems for colleges. Many experience some of the same anxieties and difficulties of other students, but many also have to deal with cultural transitions as well as social and academic transitions. First generation students were less likely to receive encouragement from family and friends in the pursuit of their education. Many first generation students are older than traditional students, come from lower income families, are more likely to have more dependent children and work more hours off-campus than their college peers. Knowing this, one would expect that first generation students would spend less time on their studies, take fewer courses each semester and take longer to complete the degree.

Many of the variables relating to first generation students have been shown in other studies to be factors of college attrition, and these students are thus considered to be students at academic risk. First generation students who withdraw from college are much more likely to have an easier time going home and taking their place in the workforce along with their families and friends. For traditional students whose parents are college graduates, this is not the case. Failure to complete college is an embarrassment to the student as well as to the family (Edwards and Cangemi, 1990).

Factors Contributing to Student Retention

One of the most powerful predictors of retention is the student's commitment to the institution (Eimers and Pike, 1997). The more committed the better the chances are the student will remain in college. Students who share

the same attitudes and values of their peers and faculty within the institution, the better integrated the student becomes. Student involvement within the college community is just one of the ways for a student to become more connected with the college. Johnson, Goldberg and Sedlacek (1995) found this to be especially important for women in engineering. If a woman experienced significant levels of psychological and physical involvement she would stay in the program. The decision to remain in college is a function of positive academic and social encounters within the university or college (Edwards and Cangemi, 1990).

Many of the factors that increase the probability of a student remaining in college are the opposite of what makes them withdraw. Students who choose to attend college for themselves have a higher rate of academic persistence than students who attend for other reasons. For students who are self-motivated and have higher intellectual and academic abilities, retention rates increase. External support and encouragement from parents and friends have a positive effect on persistence (Eimers and Pike, 1997). Financially secure students have more time to study than those who have to work to help pay for college. Persistence or withdrawal from college depends on students' social and intellectual experiences within the college community (Eimers and Pike, 1997).

The decision to continue with one's education is a personal one. That decision should be made carefully and with as much information as possible. Basic knowledge of the field the student wishes to study, having the academic ability to be successful in that area, and the willingness to do whatever it takes to complete the degree, makes the college experience more enjoyable for the

student. Colleges need to develop mentoring programs for students at risk so they can benefit from social and academic successes. Then, they too, will be more likely to remain in college.

Chapter 2

LITERATURE REVIEW ON WOMEN IN ENGINEERING

Very few women go into the field of engineering. However, it is encouraging to know that the number of women receiving bachelor's degrees and doctorates in science and engineering did increase over the last three decades (Barber, 1995). Looking over the figures it is important to note that from 1960 to 1990 significant demographic and social changes occurred in the United States. Seventeen years after World War II, many of the baby-boomers were graduating from high school. College enrollment increased during this period and over the next thirty years, colleges and universities granted a significant number of bachelor's degrees. Outlawing sex discrimination in areas of education and employment with the passage of the Civil Rights Act and Title IX, as well as the resurgence of the women's movement, has certainly not done any harm.

Although these legislative efforts did not produce the equal opportunity classroom it had hoped for, they have helped to increase the efforts in mentorship, curriculum revision, and enrichment programs to address the "chilly climate" for women (Johnson et al., 1995).

With the increase in numbers of women attaining bachelor's degrees in science and engineering one would expect there to be an increase in women pursuing doctoral degrees in these areas. Unfortunately this has not been the case. Over the last three decades women earning doctoral degrees in science and engineering has increased very little. Of doctoral degrees awarded during

this time, men earned 10 PhD degrees for every 7 PhD's earned by women (Barber, 1995).

Women who go on to graduate school perceive their experiences to be much different than their male peers (Baum, 1989). Male graduate students are offered research positions working along side mentors and peers, while female graduate students are assigned teaching assistantships dealing with undergraduate students. Baum believes this often delays women in completing the degree. Some female graduate students experience inappropriate treatment by male faculty and colleagues; this affects their concentration on their graduate studies. Survey results from Stanford University showed women graduate students experienced diminished self-esteem as a result of their graduate school experiences. Women have difficulties in the advisor/student relationship, stating that male faculty have difficulty viewing women as professionals first and women second.

Morgan (1992), in an attempt to replicate a study done in 1961 by the National opinion Research Center (NoRC), surveyed both male and female students to see if identified barriers for women in science and engineering still existed or if they had changed over time. The major concern perceived for a woman entering science fields was that she would have difficulty combining professional work with home and family responsibilities. This was the number one response given in 1961 and again in 1992. In 1961, the response given most often was that women would be viewed as unfeminine if they entered engineering programs, but this ranked fourth in 1992. Another big concern for

women entering engineering was the resentment directed at them by male colleagues. Many of the barriers identified in 1961 still exist for women entering science and engineering today.

Rodman and Fisher (1999) also looked at external and internal barriers experienced by women who choose to enter into nontraditional programs. As stated earlier, many women who enter these programs are better qualified than many of their male peers; the problem is that many women who are qualified choose not to enter these programs because they lack confidence in themselves. Opinions expressed by well meaning parents and friends and peers can discourage women from going into these fields.

Under-representation of women and minorities in science and engineering is not new to research (Leslie et al., 1998). Each year articles are written, papers are presented at conferences, and single educational institutions grapple with their statistics in this area. For many females preparing for admission to colleges and universities, majoring in one of these areas may already be out of reach. Studies have shown that during grade school years boys and girls are very much equals in mathematics and science; it is not until after elementary school the differences begin to appear (Leslie et al., 1998). Studies have shown that by the time girls reach high school they are not as interested or see the usefulness of math and science (Leslie et al., 1998). Males on the other hand do. Male students take more classes in math during their high school years than do females and the math courses they choose to take are more advanced than the courses chosen by their female peers, thus giving them an advantage.

Making the Decision to Enter an Engineering Program

Engineering programs are known for their rigorous curriculums. Students who enter the program should have strong background knowledge in both mathematics and science. Good mathematical skills are important to the success of engineering students (Durio, Kildow, and Slover, 1979). Students entering engineering take on average between nine and ten math and science courses while they are in high school. The breakdown between genders looks like this: males take between six and thirteen courses in these areas, while females take between six and eleven (Gardner and Broadus, 1990).

Factors Influencing Decision to Major in Engineering

A student choosing to enter an engineering program should have a clear understanding of how his/her interests, abilities and academic performance fit the area he/she chooses to study. Students who fail to complete the program often do not have the academic ability and also have unrealistic expectations of their performance while in school, while others have little or no idea what engineers do as professional workers (Hayden and Holloway, 1985; Levin and Wyckoff, 1990).

Their decisions to enter the engineering program were based purely on extrinsic reasons such as job opportunities, high salaries and job status. Unfortunately, external reasons do not aid in the retention of students. Students who choose engineering based on internal reasons are better prepared for the program. Internal reasons include a basic knowledge of the engineering field, strong math and science abilities along with a genuine interest in this type of work (Gardner and Broadus, 1990). Engineering students like the structured

curriculum and intense competition of the classes and schedules (Hayden and Holloway, 1985).

High School Background

The decision to pursue an engineering degree often begins sometime during high school. For males the decision is made by the eleventh or twelfth grade (Gardner and Broadus, 1990). Being in the top 25% of their high school graduating class is one of the strongest predictors in a major selection in science or engineering for white males (Leslie, McClure and Oaxaca, 1998). For many males, choosing to study engineering is seen as the next step in a progression of tinkering first with childhood toys and later with cars and appliances (Yauch, 1999). Females, on average make the decision sometime in the latter part of the eleventh grade (Gardner and Broadus 1990). These students rate themselves as above average compared to their high school peers in academic abilities and in problem solving, and female students rated themselves higher than male students. Once these students enter college they do not rate themselves as high among their peers.

Persistence in College Engineering Programs

Students enter college with certain expectations of how well they will perform, external support and encouragement they will receive and the college environment itself. Many times reality does not live up to their expectations. Many students who enter engineering programs are in the top 10% of their high school graduating class with an average GPA of 3.50. For the most part, first-year engineering students enter as equals but this changes quickly (Gardner and

Broadus, 1990). First-year students are weighted down with heavy course loads and many of the introductory courses are more difficult than they expected. Heavier course loads, coupled with many long nights spent doing homework, leaves very little time for sleeping or socializing. The weeding-out process has begun.

Students who persist differ from those students who leave the program on two dimensions: academic performance during the first year and career goals. GPA at the end of their freshman year and achievement in basic engineering courses are the best predictors for retention of engineering students (Jackson, Gardner and Sullivan, 1993). Many studies have shown that admission test scores and high school achievement are also significant predictors of student retention in college (House, 2000).

Students who use academic and support services offered on many college campuses show improvement on grade performance. Unfortunately, many students choose not to use them until it is too late (House, 2000). Another helpful resource for students is the professor. In spite of misperceptions by some students that professors are unapproachable, many still seek them out to discuss their academic progress, future career paths or personal problems. Faculty-student interaction has been shown to be a consistently good predictor of student persistence in college (Eimers and Pike, 1997).

The perception of one's ability to perform well in these areas is one of the keys to success in engineering. Male students often perceive their ability to perform well in math and science above their actual ability while females discount

their abilities in these areas. Studies have shown that for all age ranges females are just as capable of performing well in mathematics as their male peers.

Women in Engineering Programs

Many women who are recruited into engineering programs from high school show high levels of aptitude in math and science and are usually at the top of their high school graduating class (Yauch, 1999). Only the very best female students are encouraged by their teachers or guidance counselors to pursue a career in engineering, yet males with mediocre math skills are also pointed in this direction (Baum, 1989). In their study, Gardner and Broadus (1990) found that women who enter engineering programs often have a basic knowledge of the profession. Many come from families with a father or other family member in the engineering field (Yauch, 1999). Unfortunately, unlike their male peers, this knowledge does not protect them from negative experiences. For women to be successful in male dominated fields they must assimilate—this means leaving important parts of their identities behind (Barber, 1995).

Women perceive themselves to be lower in their overall academic ability even though many women who continue on with the program and graduate have higher GPA's than their male classmates. They spent more time studying throughout the week than the men in their classes. Women reported more faculty discrimination in the classrooms than men and they correctly felt they had fewer female role models (faculty and graduate students) in the program. Women were more aware of student support services on the campus than the men were and were more likely to use them (Jackson et al., 1993). The two best

predictors for engineering persistence in women are GPA at the end of the first year and expected salary at the time of graduation. For men, freshmen GPA and fewer personal problems while in the engineering program were the two best predictors of persistence. Both expect to earn nearly the same salaries when they start their careers, although women receive slightly higher starting salaries than men.

Jackson et al. (1993) examined background characteristics of professional engineers for gender differences. They found women in engineering were more likely to have a father or other family member in the engineering field, and also were from a well-educated family. They also found that 75% of male engineers working in the field were married compared to less than half of the female engineers, and of those women who do marry, many marry engineers or other professionals. Women who were married were less likely to have children or they had fewer children than male engineers.

Other findings on women who entered male dominated fields show that many of them come from intact families, with well-educated parents who worked outside the home. These women also considered career success more important than women who entered female dominated fields. Women in these fields also experience more feelings of isolation, lack of support from male colleagues and sex discrimination in the workplace. Women working as engineers feel they are not taken as seriously as their male coworkers and that they experience more peer pressure in a male dominated work environment (Gardner and Broadus, 1990).

Backgrounds of Women in Engineering

During the 1970's much of the research done on women's choices in careers focused on the differences between those women who chose traditional and those who chose to enter nontraditional fields (Fitzpatrick and Silverman, 1989). Most research defines nontraditional occupations as those with less than 30 – 34% women working in those areas. Earlier research found that many women who chose nontraditional fields came from what some called "enriched environments;" women whose parents were highly educated and who were very supportive of their daughters' education (Fitzpatrick and Silverman, 1989). Much of the earlier research focused on family characteristics such as birth order, sex of siblings, education of parents, and their employment status.

Other areas of research on women who chose nontraditional careers were on the childhood socialization and the perception of support by external sources in their choice of nontraditional fields. The study done by Fitzpatrick and Silverman (1989) did not find significant differences in family composition between women who chose traditional and nontraditional careers as found in earlier research.

What they did find and what has been found to be characteristic of women who choose engineering is that many have a father who is employed in a science or engineering field. The parents were more supportive and had higher expectations of their daughter's achievements, (especially the fathers) than those of women who chose traditional fields. They also found that college professors and friends were more supportive of women in humanities and social science

fields. Two other important factors for women choosing careers in science and engineering have to do with salaries and job availability once they have completed their education, these two factors were not as important to women who chose traditional majors.

Under-representation of women in engineering programs is not just a problem here in the United States. In the past thirty years the United Kingdom has noticed a decline in women entering science and engineering programs (Siann and Callaghan, 2001). Under-representation of women in these occupations may be caused by the lack of female role models as well as female networks in these areas. As was also found in an earlier study by Baum (1989), women who enter male dominated fields give up a part of themselves in order to gain access into these fields. Many women are socially oriented; they enjoy working with the public and for the good of society. It is safe to say many would not be happy working in technical positions which focus on objects rather than people. Prestige, financial and job security are important factors to those women who enter technical fields (Siann and Callaghan, 2001).

O'Hara (1995), surveyed first-year women from four different institutions majoring in engineering, science and humanities to find if there were similarities and differences in the women's family backgrounds, academic abilities, career choices, goals and values.

She found, as did Fitzpatrick and Silverman (1989), that women who work in engineering are more likely to have a father working in the field of engineering and that these women felt strong maternal support in their career choice.

Female engineering students in this study had goals and values that were consistent with those women surveyed in the study done by Gardner and Broadus (1990). They ranked in order of importance the need to "become an authority in their own field", "to be successful in their own business", "be well off financially", "obtain recognition from colleagues" and "help others in difficulty" (O'Hara, 1995).

O'Hara found that women who choose to go into engineering programs were more confident in their mathematical abilities than humanities majors. SAT math scores for these women confirmed this.

Many of the female engineering students surveyed came from families with lower parental income and educational levels. This finding was inconsistent with earlier studies; O'Hara (1995) felt that women who enter engineering programs today come from very different family backgrounds than those pioneering women of thirty years ago, i.e., job availability and financial security are important factors to women entering these programs.

Attrition of Women in Engineering Programs

Females who enter engineering programs have a higher rate of attrition than males, with the majority of them leaving in the first two years of college (Henes, Gland, Darby, and McDonald, 1995). Women who leave engineering programs may feel less confident in their abilities to be an engineer. Many of the women in this survey were uncomfortable asking questions in class, and discouraged about the likelihood of obtaining an engineering degree. Women underestimate their academic abilities whereas male students are over confident

in their abilities (Henes et al., 1995). Women who leave the program do not leave it because of their lack of academic ability.

Unfortunately many children, both male and female, have little knowledge of what an engineer does for work, unless of course there is a family member or friend of the family in this field. If they do know an engineer, the possibility of that person being female is relatively small (Henes et al. 1995).

Female engineering students, faculty and professional engineers surveyed gave reason why women left engineering programs. From those surveys five major reasons were indicated as to why women become discouraged with or leave engineering programs. The major reasons are: isolation, not seeing relevance in highly theoretical basic courses, negative experiences in lab classes, classroom climate, and the lack of role models.

Isolation is not only a problem for females but for many first year students. Core classes in math and science have students spread all over the campus. First year students may not attend a major course until their second semester in college. Because of this, many students find it difficult to join in engineering organizations or build academic or social networks. Forming friendships within the college and study groups are key issues of survival in an engineering program (Henes et al., 1995). Female students may experience isolation to a greater degree because of the low numbers of women in these types of programs.

Course work in math, physics and chemistry set the foundation for many engineering courses. Although female students usually do well in these courses,

many lose interest in the program before they are able to put the principles learned from basic classes into practice (Henes et al., 1995). Another problem concerning course work is the lab classes. Male students may have an advantage when it comes to mechanical and electrical devices. If they have not had some hands on experience with them, they have at least seen them and know how they are used. For many women this is not the case, many enter lab classes with little knowledge of how this equipment works. This type of lab experience continues throughout most of their undergraduate program (Henes et al., 1995).

The "chilly climate" of classrooms was mentioned by women in this study. These women found it difficult to ask questions in their engineering classes. Much of the difficulty may stem from prior classroom experiences in asking questions. Many experienced negative reactions from other students or professors, either by ignoring or trivializing their questions or comments. Women were also discouraged by the competitive environment and strict grading procedures (Henes et al., 1995). The competitive environment and strict grading procedures are also discouraging to some male students.

As found in other research, female students have a difficult time finding role models in this field. There are very few female faculty or graduate students that female engineering students can go to with problems or concerns.

Pope (1995) found that women who choose to enter nontraditional fields of study, such as science and engineering, must possess high levels of persistence, motivation and good coping skills to help them to be successful in

these programs. Research has shown that many women pursuing degrees in these programs perceive gender discrimination and in fact as many as 41% of women in this study reported experiencing some form of gender discrimination (Pope, 1995)

The role of the academic advisor is an important one for all students, but especially for female students. Advisors are there to help put students on the academic path, to answer any questions they might have concerning career opportunities, and to be there if the student needs to have someone to talk to about problems and concerns they might have (Pope, 1995).

Women who "cross the line" and major in science and engineering programs not only need to possess persistence, motivation and coping skills, Eden (1992) believes these women need to make changes in their behavior and attitudes. Men value competitiveness, assertiveness, political skill and commitment to their careers. If a woman wants to be successful in the engineering field she must adopt these same behaviors and attitudes.

Many of the women stated that engineering is an all-boys network. They felt that there was little chance for promotion once they reached a certain level—supervisory and managerial positions were out of reach.

Eden (1992), found that the perception of women who worked in engineering fields felt some amount of intimidation by male coworkers. Also, they did not feel they were able to compete with male coworkers as equals. The female engineers needed to work harder and be better than their male peers considered for advancement.

Studies have shown that college students who come from rural areas may be at a disadvantage from those students who come from urban/suburban areas (Felder, Mohr, Dietz, and Baker-Ward (1994). These rural students are also at greater risk of dropping out of college. Students coming from rural areas have low levels of pressure to attend college. Parents of rural students had lower levels of education than did those parents of urban students, many of whom had advanced degrees. Parental expectation of college attendance was high for all students surveyed. For students who come from families where college attendance is not the norm, dropping out is not viewed necessarily in a bad light (Edwards and Cangemi, 1990). For students who come from families were college graduation is a family tradition, dropping out can bring embarrassment to the student as well as the family (Edwards and Cangemi, 1990). In the Felder et al. (1994) study urban parents would have been quite disturbed had their children chosen not to attend college. Limited funding to schools in rural areas put students at a disadvantage because of the limited high school course offerings. Many students from rural areas do not have access to advanced science or mathematics courses, (AP). Felder et al. (1994) cited that students from rural areas might not receive the intellectual stimulation, role modeling or good career counseling needed to judge their aptitude for engineering programs.

Retention of Women in Engineering Programs

Retention of females in engineering programs has been a concern for many universities and colleges. UC Davis developed two workshops for faculty members. The workshops had three objectives. The first objective was to make

faculty aware of the many difficulties women face daily in engineering programs; the second objective was to aid faculty in creating ideas that would improve the classroom environment. The final objective was to develop a workshop model that could be distributed to other engineering programs (in hopes of helping) in the retention of women engineering students. It is important for faculty members to become more sensitive to issues female students struggle with on a daily basis (Henes et al., 1995).

Evaluations of the two workshops by participants showed that they were successful in making faculty more sensitive to issues female students in engineering programs face. Many were able to take to the classroom information gained from these workshops. Helping faculty become aware of and understand some of the difficulties faced by women help faculty to be more supportive of women who continue on in these programs. Workshops such as these are a step in the right direction in encouraging faculty to help all students navigate sometimes-difficult academic environments (Henes et al., 1995).

Purpose of the Study and Research Questions

The purpose of the study was to explore experiences of female undergraduates in the College of Engineering at the University of Maine. It was hoped that this information might be helpful in the recruitment of female students to the college and would provide a basis for understanding retention issues for females in the college. A sample of male engineering students was also obtained to compare the background and experiences of women versus men in the program.

Specifically, this study sought to investigate what differences and similarities exist between male and female engineering majors in terms of:

- **Family background**. Items #4-10, and 12.

Research has found women who successfully complete an engineering program come from homes where parents are highly educated (Jackson, et al. 1993), come from intact families (Jackson, et al., 1993; Gardner and Broadus, 1990) and are very supportive of their daughters nontraditional career choice (Fitzpatrick and Silverman, 1989).

- **Choosing to major in engineering.** Items # 28-35, 62, 64, 82, 83.

Research has found that the decision to major in engineering is usually made by the end of high school (Gardner and Broadus, 1990). For females, influential figures in their lives were family members, especially fathers (Eden, 1992), and desire for job stability, prestige, and higher salaries (Siann and Callaghan, 2001; O'Hara, 1995).

- **High school academic performance.** Items #15-27.

Research indicates that both males and females who enroll in engineering typically excel in math and science (Yauch, 1999; Baum, 1989), and are the top 25% of high school class (Gardner and Broadus, 1990).

- **College academic performance.** Items #43, 44, 48, 50, 53-56, 58, and 60.

Research findings indicate students who succeed in engineering have good grades in math and science (Yauch, 1999; Baum, 1989), and study more than the average student, (Jackson et al., 1993).

- **Use of college academic services.** Items # 36-41, and 47.

Research has shown that female engineering students are more likely than their male peers to use academic services, meet with their advisors, use tutoring services and study groups while in college (House, 2000; Jackson et al., 1993).

- **Perceptions of support/non-support**. Items # 42, 45, 51, 52, 61, 65, 66, 68, 84.

Research findings suggest that students who feel supported by faculty and peers are more likely to stay in the program (Edwards and Cangemi, 1990; Johnson et al. 1995). Research has found that non-support leads to attrition (Edwards and Cangemi, 1990; Eimers and Pike, 1997; Johnson et al., 1995).

- **Participation in outside activities**. Items #46, 49, 59, 63.

Students who work more than 20 hours a week are more likely to drop out (Gardner and Broadus, 1990).

- **Perception of their academic ability/experience**. Items #57, 67, 73-76, 78, 80, 81, 85-88.

Research has found that women tend to underestimate their abilities, whereas men tend to over estimate their ability and show a greater degree of self-confidence (Rodman and Fisher, 1999; Jackson et al.,1993)

- **Perception of impact of their gender.** Items # 69-72, 77

Research suggests that females, more so than males, perceive their gender to be a barrier to their academic success in engineering (Rodman and Fisher, 1999; Jackson et al., 1993; Baum, 1989).

Chapter 3

METHODOLOGY

Sample

The study is comprised of a sample of undergraduate women and men, 18 years or older in the College of Engineering. The ratio of females to males in the engineering program is 1:7. Therefore, an attempt was made to reach as many female engineering majors as possible using the convenience sampling method. For male engineering majors, a random sampling method was used. Data collected from 62 female engineering majors during the Spring 2001 is also included in the analysis.

As outlined in Table 1, a total of 152 engineering students are included in this study (n=93 women; n=59 men). One-third of the students in the sample (33%) are first-year students, 24% are juniors, 23% are seniors, and 20% are sophomores. The majority identified themselves as "White" (92%), single (85%), and with no children (97%). Most (67%) indicated they are traditional students (continuing directly to college from high school). Nearly one-third (29%) of the respondents said they are majoring in Mechanical Engineering, while 21% are in Civil Engineering, 15% are Chemical Engineering, and 15% are Electrical Engineering. Only a very small percentage said they are majoring in Engineering Physics (6%), Biological Engineering (5%), Computer Engineering (4%), and Spatial Engineering (2%). Three percent are either Undeclared or in General Engineering.

Table 1
Description of the Sample (N = 152)

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
What is your year in college?				5.48
First-Year	44%	26%	33%	
Sophomore	17%	21%	20%	
Junior	20%	27%	24%	
Senior	19%	26%	23%	
What is your ethnic background?				2.77
White	96%	91%	92%	
Asian	2%	2%	2%	
Black	---	2%	2%	
Hispanic	---	---	---	
Native American	---	1%	1%	
Other	2%	4%	3%	
Are you currently:				2.71
Single	88%	84%	85%	
Living with partner	5%	6%	6%	
Married	5%	10%	8%	
Divorced	2%	---	1%	
Do you have children?				0.98
Yes	5%	2%	3%	
No	95%	98%	97%	
Select choice that best describes you:				7.23
1st generation	20%	25%	23%	
1st generation/non-traditional	2%	2%	2%	
Non-traditional	15%	3%	8%	
Traditional	63%	70%	67%	
What is your major?				**38.83****
Biological Engineering	2%	8%	5%	
Civil Engineering	15%	25%	21%	
Chemical Engineering	3%	23%	15%	
Computer Engineering	9%	1%	4%	
Electrical Engineering	14%	15%	14%	
Engineering Physics	3%	9%	7%	
Mechanical Engineering	48%	17%	29%	
Spatial Engineering	---	3%	2%	
Undeclared/General	7%	---	3%	

* $p < .05$
** $p < .001$

Chi-Square analysis of the demographics revealed only one significant difference between the males and females who responded to the survey. Significantly more women indicated their major as Civil or Chemical Engineering versus more males indicated they are majoring in Mechanical Engineering (X^2=38.83; p<.001).

Procedure

The sample was acquired though e-mail announcements sent to all female students in engineering, and to 136 male engineering students (see Appendix A). The e-mail had contact information for anyone interested in volunteering to participate in the study. Potential subjects were asked to reply if they were interested, and told that the questionnaire would mailed to them with a return envelope.

Survey Instrument

The survey was designed by the researcher after a review of the literature determined factors that may influence attrition and retention of students in engineering programs (see Appendix B). The survey consisted of 88 questions. These questions fell under the broad categories of description of the sample (such as sex, year in college, ethnicity, marital status; items #1, 2, 3, 11, 13, 14), family background (Items #4-10, and 12), choosing to major in engineering (Items # 28-35, 62, 64, 82, 83), high school academic performance (Items #15-27), college academic performance (Items #43, 44, 48, 50, 53-56, 58, and 60), use of college academic services (Items # 36-41, and 47), perception of support (Items # 42, 45, 51, 52, 61, 65, 66, 68, 84), participation in outside activities

(Items #46, 49, 59, 63), perception of their academic ability/experience (Items # 57, 67, 73-76, 78, 80, 81, 85-88), and perception of impact of their gender (Items # 69-72, 77).

Data Analysis

Frequency and percentages are reported. In addition, Chi-square analysis was performed to determine if significant differences exist between males and females on the various items of interest.

Chapter 4

RESULTS

The purpose of the study was to explore experiences of female undergraduates in the College of Engineering at the University of Maine. A comparison group of male engineering students was also surveyed. The survey focused on nine areas of interest, including: family background, choosing to major in engineering, high school academic performance, college academic performance, use of college academic services, perception of support/non-support, perception of impact of their gender, perception of their academic ability and experiences, and other outside activities. Results are presented below.

Family Background

Eight questions focused on the respondents' family background. As the results are reported in Table 2, there were no significant differences between the males and females on any of the family background questions.

The majority of the students (78%) said that their parents were married and that they were raised by both parents (82%). In terms of parents' education, over half of the students said that both their father and their mother had either some college or a bachelor's degree. It is interesting to note that they were just as likely to report that a parent had a Ph.D. as they were to report that a parent had dropped out of high school. Most students said that both their father (91%) and their mother (81%) worked outside the home. Just over half (52%) had a family member who worked in the field of engineering. Only 35% have a sibling currently attending college.

Table 2
Family Background

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
Are your parents married?				0.47
Yes	75%	79%	78%	
No	25%	21%	22%	
Who were you raised by?				3.63
Both Parents	85%	80%	82%	
Mother/Step-Father	3%	6%	5%	
Mother Only	9%	9%	9%	
Father/Step-Mother	---	3%	2%	
Father Only	---	---	---	
Grandparents	---	---	---	
Other	3%	1%	2%	
What is your father's education?				5.46
Ph.D.	2%	8%	5%	
Master's	17%	12%	14%	
Bachelor's	36%	34%	35%	
Some College	24%	19%	21%	
High School Diploma	19%	22%	21%	
GED	---	3%	2%	
Did Not Finish High School	2%	2%	2%	
What is your mother's education?				3.75
Ph.D.	---	3%	2%	
Master's	8%	13%	11%	
Bachelor's	37%	38%	38%	
Some College	31%	21%	25%	
High School Diploma	22%	23%	22%	
GED	---	---	---	
Did Not Finish High School	2%	2%	2%	
Does your mother work?				0.54
Yes	78%	83%	81%	
No	22%	17%	19%	
Does your father work?				0.09
Yes	90%	91%	91%	
No	10%	9%	9%	
Family member who's an engineer?				0.92
Yes	48%	55%	52%	
No	52%	45%	48%	
Do you have siblings in college?				2.55
Yes	27%	40%	35%	
No	73%	60%	65%	

* $p < .05$
** $p < .001$

Choosing a Major in Engineering

Twelve questions were asked to access their decision to major in engineering. Results are reported in Table 3. Students were asked at what point they chose engineering as a career. While the majority of students said they made this decision in high school, significantly more males than females (16% versus 3%) reported making this decision in elementary/middle school (X^2=7.65; p=.02). In terms of what influenced them to go to college, most cited their family, teachers, and friends. Males were significantly more likely than females (25% versus 13%) to select "lack of alternative plans" as an influence on going to college (X^2=3.87; p=.05). Thirty-eight percent cited other influences, with the most common being "self" (5 males; 18 females).

When asked about external reasons for choosing engineering, the most common responses were salary and job prospects. Females were significantly more likely than males to choose job prospects (83% versus 58%) and job security (52% versus 34%) as reasons for choosing engineering (X^2=11.61; p=.001; X^2=4.58; p=.03). Other reasons were cited by 34% of the students, with "interest in field" as the most common write-in reason.

The most common personal reasons for choosing engineering included problem-solving (78%), interest in the work (76%), and enjoy a challenge (74%). Several significant differences were found between males and females on this question. Females were significantly more likely than males to say that they enjoy a challenge (84% versus 54%), and because it involves service to people (40% versus 24%) as reasons for their career choice (X^2=20.43; p<.001;

Table 3
Choosing a Major in Engineering

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
When did you choose engineering?				**7.65***
Elementary/Middle School	16%	3%	8%	
During High School	72%	80%	77%	
In College	12%	17%	15%	
What influenced you to go to college? (check all that apply)^				
Parents	80%	86%	83%	1.06
Extended Family	37%	38%	38%	0.01
Friends	46%	52%	49%	0.49
Teachers	59%	68%	64%	0.84
Lack of Alternative Plan	25%	13%	18%	**3.87***
Other	36%	39%	38%	0.15
External Reasons for Choosing Engineering (check all that apply)^				
Salary	70%	77%	74%	1.19
Job Prospects	58%	83%	73%	**11.61****
Job Security	34%	52%	45%	**4.58***
Promotion within Field	29%	28%	28%	0.01
Prestige	42%	46%	45%	0.22
Other	41%	30%	34%	1.79
Personal reasons for choosing engineering (check all that apply)^				
Enjoy a Challenge	54%	84%	74%	**20.43****
Service to People	24%	40%	34%	**4.17***
Problem Solving	80%	77%	78%	0.11
Interest in the Work	85%	71%	76%	**3.80***
Job Flexibility	36%	42%	40%	0.61
Independence	42%	51%	47%	0.97
Other	5%	7%	6%	0.12
Who prompted you to choose a major in engineering? (check all that apply)^				
HS Guidance Counselor/Teacher	14%	35%	27%	**7.42***
Parent	36%	45%	41%	1.13
Extended Family	7%	7%	7%	0.02
Friend	21%	8%	13%	**5.94***
Other	41%	33%	36%	1.09

Table 3 (continued)
Choosing a Major in Engineering

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
Have you switched colleges?				0.04
Yes	15%	14%	17%	
No	85%	86%	85%	
Did you transfer to UMaine?				1.20
Yes	22%	15%	18%	
No	78%	85%	82%	
Have you switched majors within engineering?				0.11
Yes	17%	19%	19%	
No	83%	81%	81%	
Did you know what engineers do before choosing your major?				**6.76***
Agree	64%	43%	51%	
Neutral	26%	35%	32%	
Disagree	10%	22%	17%	
Are you aware of the types of engineering jobs once you graduate?				0.65
Agree	71%	69%	70%	
Neutral	22%	26%	25%	
Disagree	7%	4%	5%	
Are you comfortable with your choice to be in the College of Engineering?				1.45
Agree	81%	77%	79%	
Neutral	12%	19%	16%	
Disagree	7%	4%	5%	
Are you comfortable with your major choice within engineering?				0.34
Agree	79%	78%	79%	
Neutral	10%	13%	12%	
Disagree	9%	9%	9%	

* $p < .05$
** $p < .001$

(X^2=4.17; p=.04). On the other hand, males were more likely than females to say they are interested in the work (85% versus 71%) as a reason for their career choice (X^2=3.79; p=.05). A small number of students cited other personal reasons for entering engineering, including "to save the environment" and "desire to work in automotive field."

When asked who prompted them to choose a major in engineering, their parent was the most common response. Significantly more females than males (35% versus 14%) indicated that a high school guidance counselor or teacher prompted them (X^2=7.42; p=.006). Males were significantly more likely than females (21% versus 8%) to say a friend prompted their decision (X^2=5.94; p=.02). Thirty-six percent cited other influences, with the most common response being "self."

The majority of both male and female students have not switched colleges (85%), transferred in from another university (82%), or switched majors within the college of engineering (82%). For the most part, these students are comfortable with the College (79%) and their major (79%). In addition, 70% of them are aware of the job opportunities once they graduate. When asked if they knew what engineers do before choosing their major, significantly more males agreed with this statement (64%), while more females were neutral or disagreed (35% and 22%) on knowing what engineers do beforehand (X^2=6.76; p=.03).

High School Academic Performance

Twelve questions assessed high school academic performance issues. These results are reported in Table 4. Students were asked about math and

Table 4
High School Academic Performance

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
Which math courses did you take in high school? (check all that apply)^				
Algebra I	75%	76%	76%	0.06
Algebra II	93%	94%	93%	0.01
Calculus	46%	46%	46%	0.01
Geometry	88%	94%	91%	1.35
Advanced Math	81%	88%	86%	1.36
AP Calculus	43%	56%	51%	2.65
Which science courses did you take in high school? (check all that apply)^				
Biology	95%	97%	96%	0.33
Physics	97%	97%	97%	0.01
Chemistry	97%	97%	97%	0.01
AP Sciences	36%	33%	34%	0.08
Did you take AP courses?				0.32
Yes	64%	69%	67%	
No	36%	31%	33%	
Did you bring AP credits to college?				0.01
Yes	45%	44%	44%	
No	55%	56%	56%	
What was your high school rank?				**17.66****
Top 10 percent	53%	66%	61%	
11-20 percent	18%	28%	24%	
21-25 percent	8%	1%	4%	
Below 25 percent	21%	5%	11%	
Verbal SAT Scores				1.22
400-490	11%	9%	10%	
500-590	48%	41%	44%	
600-690	33%	43%	39%	
700-800	8%	7%	7%	
Math SAT Scores				1.87
400-490	---	---	---	
500-590	25%	18%	21%	
600-690	58%	56%	57%	
700-800	17%	26%	22%	

Table 4 (continued)
High School Academic Performance

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
Perception of your math ability in hs				4.57
Above average	76%	88%	83%	
Average	22%	12%	16%	
Below average	2%	---	1%	
Perception of your science ability in hs				0.66
Above average	78%	72%	74%	
Average	22%	28%	26%	
Below average	---	---	---	
Vocational testing while in high school?				
Yes	27%	29%	28%	0.05
No	73%	71%	72%	
Did you receive career information?				0.54
Yes	76%	70%	73%	
No	24%	30%	27%	
Were you adequately prepared for college?				0.33
Yes	79%	75%	77%	
No	21%	25%	23%	

* $p < .05$
** $p < .001$

^ Percentages reported for those who selected this option

science courses they had taken in high school. The overwhelming majority of both males and females had taken Algebra I and II, Calculus, Geometry, Advanced Math, Biology, Physics, and Chemistry. While 67% said they had taken AP courses while in high school, only 51% took AP Calculus, and 34% took an AP Science course. Less than half (44%) brought AP credits with them to college. There were no significant differences between males and females in terms of coursework in high school.

Students were asked to indicate their class rank in high school. This ranged from being number one in their class (17 females; 2 males), and number two in their class (8 females; 4 males), to being near the bottom of their class (90^{th} percentile; 1 male). In fact, from the 50^{th} percentile down to 90^{th} percentile were all males (n=7). The majority (61%) of these engineering majors were in the top 10% of their high school class. Females were significantly more likely than males to be in the 11-20^{th} high school rank (28% versus 18%), while males were more likely than females (21% versus 5%) to be below the 25^{th} percentile (X^2=17.66; p=.001).

In terms of their SAT scores, verbal scores ranged from a low of 440 to a perfect score of 800 by two students (1 male; 1 female). In terms of Math, the range was from 510 to a perfect 800 (again, 1 male, 1 female). There was no significant difference between males and females when the scores were groups by 400's, 500's 600s and 700s. The mean for SAT scores on Verbal for males was 583, while the mean for females was 592. On the SAT scores for Math, the

mean for males was 646, and the mean for females was 652. In both cases, the mean for females was higher than for males.

Students were asked about their perceptions. In terms of both math and science ability, the majority of students (83% and 74%) felt their ability was above average. Few students (28%) said they received vocational testing while in high school although most did receive career information (73%). Overall, the majority (77%) felt they were adequately prepared for college by their high school.

College Academic Performance

Ten questions focused on college academics. The results are presented in Table 5. Students reported that they typically take more than 15 credits per semester (60%), and spend an average of 4 hours a day studying (range was from 1 to 17 hours per day). When asked their first-year GPA, approximately one-third reported a GPA of 3.75 or higher. Over half were above a 3.00. In terms of their current GPA, only one-quarter reported a GPA of 3.75 or higher, although half have a GPA over 3.00.

In terms of their course average in the major, most report either an A or B average. Significantly more females report having an A average (52% versus 31%), while significantly more males report a B average (51% versus 34%) in the major (X^2=11.05; p=.03). Looking at specific grades in courses, the majority received either an A or B in Physics I, Physics II, Calculus I, and Calculus II. Very few students (37%) report having to repeat a course.

Table 5
College Academic Performance

	Males (n=59)	Females (n=93)	Total (N=152)	X^2
What is your normal course load?				2.27
12 or fewer credits	9%	11%	10%	
13-15 credit hours	37%	26%	30%	
More than 15 credits	54%	63%	60%	
How many hours a day do you spend on studying/homework?				1.45
1-5 hours	80%	78%	79%	
6-10 hours	17%	21%	19%	
more than 10 hours	3%	1%	2%	
What was your first-year GPA?				4.74
3.75-4.00	34%	26%	29%	
3.50-3.74	3%	---	1%	
3.00-3.49	19%	32%	28%	
2.00-2.99	25%	18%	20%	
less than 2.00	19%	24%	22%	
What is your current GPA?				7.31
3.75-4.00	11%	27%	24%	
3.50-3.74	14%	13%	14%	
3.00-3.49	33%	31%	32%	
2.00-2.99	35%	27%	30%	
less than 2.00	7%	2%	4%	
What is your course average in major?				**7.64***
A	31%	52%	44%	
B	51%	34%	40%	
C	16%	14%	15%	
D	---	---	---	
Fail	2%	---	1%	
What is your grade in Physics I?				2.73
A	38%	48%	44%	
B	34%	34%	34%	
C	26%	16%	20%	
D	---	---	---	
Fail	2%	2%	2%	
What is your grade in Physics II?				2.61
A	37%	45%	43%	
B	30%	28%	29%	
C	23%	20%	21%	
D	7%	6%	6%	
Fail	3%	---	1%	
What is your grade in Calculus I?				**11.05***
A	37%	46%	43%	
B	23%	35%	31%	
C	29%	17%	22%	
D	8%	1%	4%	
Fail	4%	---	2%	

Table 5 (continued)
College Academic Performance

	Males (n=59)	Females (n=93)	Total (N=152)	X^2
What is your grade in Calculus II?				0.50
A	42%	40%	40%	
B	31%	26%	28%	
C	28%	34%	32%	
D	---	---	---	
Fail	---	---	---	
Have you ever had to repeat a course?				0.09
Yes	36%	38%	37%	
No	64%	62%	63%	

* $p < .05$
** $p < .001$

Use of College Academic Services

Seven question assessed students' use of academic services. Results are presented in Table 6. Slightly less than half (46%) reported using the university Help Centers (Math Center, Writing Centers). And even fewer reported using the university's Tutoring Program (only 30%). However, there was a significant difference, with more females than males (37% versus 19%) reporting that they used the Tutoring Program (X^2=5.48; p=.02). Few (20% or less) had participated in any tutoring sessions within the major or in the engineering wing in the residence hall. However, if they had used any tutoring program, most (85%) felt it was helpful. Significantly more females than males (96% versus 70%) felt is was helpful (X^2=6.54; p=.01).

In terms of seeing their academic advisor during the semester, significantly more females than males (60% versus 39%) said they visited their advisor with academic concerns or other problems (X^2=6.14; p=.01). When asked to rank their interaction with the faculty in general, most said it was "as expected" (51%). Significantly more females than males (42% versus 22%) rated their faculty interaction as high, while more males than females (24% versus 10%) rated their interaction with faculty as low (X^2=8.81; p=.01).

Perceptions of Support/Non-Support

Nine questions focused on the students' perceptions of support within engineering. These results are reported in Table 7. The majority (55%) of students felt that faculty were very approachable, that they had adequate advising, and that they were getting the most from their professors.

Table 6
Use of College Academic Services

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
Have you used the Help Center?				1.53
Yes	40%	50%	46%	
No	60%	50%	54%	
Have you used the Tutoring Program?				**5.48***
Yes	19%	37%	30%	
No	81%	63%	70%	
Have you used tutoring sessions within major?				0.34
Yes	22%	19%	20%	
No	78%	81%	80%	
Have you participated in tutoring sessions in the engineering wings in dorm?				0.02
Yes	20%	19%	19%	
No	80%	81%	81%	
If you have used tutoring sessions: were they helpful? (Note: n=48)				**6.54***
Yes	70%	96%	85%	
No	30%	4%	15%	
Do you see your academic advisor?				**6.14***
Yes	39%	60%	52%	
No	61%	40%	48%	
Rank you interaction with faculty:				**8.81***
High	22%	42%	34%	
As expected	54%	48%	51%	
Low	24%	10%	15%	

* $p < .05$
** $p < .001$

Table 7
Perceptions of Support/Non-Support

	Male (n=59)	Female (n=93)	Total (N=152)	X^2
How do you perceive faculty approachability?				0.23
Very approachable	56%	54%	55%	
Moderately approachable	29%	28%	28%	
Approachable	15%	18%	17%	
Not approachable	---	---	--	
Do you have adequate advising?				0.72
Agree	51%	57%	55%	
Neutral	25%	24%	25%	
Disagree	24%	19%	20%	
Do you feel you are getting the most from your professors?				5.00
Agree	55%	55%	55%	
Neutral	35%	43%	40%	
Disagree	10%	2%	5%	
How do you perceive peer support?				0.65
Very supportive	41%	47%	44%	
Somewhat supportive	32%	29%	30%	
Supportive	24%	20%	21%	
No support	5%	4%	5%	
How do you perceive your relationships to your peers?				2.97
Positive	85%	78%	80%	
Neutral	15%	18%	17%	
Negative	---	4%	3%	
Do you have many friends within the college?				5.14
Agree	72%	65%	68%	
Neutral	16%	30%	24%	
Disagree	12%	5%	8%	
Are your friends supportive of your choice of major?				1.96
Agree	85%	81%	83%	
Neutral	15%	16%	15%	
Disagree	----	3%	2%	
Do you work on class assignments:				5.53
Alone	41%	42%	41%	
Study Groups	7%	19%	15%	
Combination of both	52%	39%	44%	
If you work in study groups are they:				**8.11***
Male	73%	47%	57%	
Female	---	6%	3%	
Mixed Groups	27%	47%	40%	

* $p < .05$
** $p < .001$

When asked about peer support, 95% of students felt their peers were supportive, and 80% perceived their relationships with their peers as positive. In fact, many (68%) said they had friends within the college. Most (83%) said that their friends were supportive of their choice to major in engineering.

When it came to working on class assignments, almost as many said they worked alone (41%) as worked in a combinations of both study groups and alone (44%). If students worked in study groups, they said they were typically all male (57%). Males were significantly more likely to say this (73% versus 47%), while females were significantly more likely to say they worked in mixed groups (47% versus 27%) for studying together (X^2=8.11; p=.02).

Participation in Outside Activities

Four questions looked at students' involvement in outside activities. As reported in Table 8, most of the students rated their social life as active or very active. When asked specifically about involvement in groups on campus, just as many students said they were involved in clubs (44%) as those who said they did not participate in any campus groups (41%).

Students were also asked about work for money. The number of hours worked ranged from none to more than 20 hours a week. Of those who worked the most hours, 9 were females and only 2 were males. The option that got the most responses was "none" – with 43%. On the other hand, nearly one-quarter said they worked more than 10 hours a week. About half had no concerns about financing their education, while over one-fourth did have concerns about this.

Table 8
Participation in Outside Activities

	Male (n=59)	Females (n=93)	Total (N=152)	X^2
Which best describes your social life?				3.53
Very active	17%	26%	22%	
Active	48%	49%	49%	
Slightly active	22%	18%	20%	
Not very active	13%	7%	9%	
Do you participate in any groups on campus? (check all that apply)^				
Sports	19%	17%	18%	0.05
Band	3%	5%	5%	0.32
Clubs	39%	47%	44%	1.02
None	44%	39%	41%	0.43
How many hours a week do you work for money?				1.38
0	47%	41%	43%	
1-5 hours	14%	20%	18%	
6-10	15%	14%	15%	
more than 10	24%	25%	24%	
Do you have concerns that you will not be able to finance your education?				2.84
Agree	29%	25%	27%	
Neutral	14%	25%	21%	
Disagree	57%	50%	52%	

* $p < .05$
** $p < .001$

^ Percentages reported for those who selected this option

Perceptions of Academic Ability/Experience

Twelve questions focused on students' academic ability as well as their experience. These results are presented in Table 9. Most students enjoy the engineering courses (70%), and say they consider themselves to be competitive students (66%). Slightly more than half (55%) say they feel comfortable asking questions in class.

When asked if their college experience has been what they expected, 56% said yes. It is interesting to note that just half the males and females in this study perceive their academic performance as average (despite the fact that more than half of the students have GPAs of 3.0 or higher). Few students have found the coursework to be more difficult than expected (21%). When asked if math or physics was harder than expected, results for the total sample revealed that about one-third agreed, one-third was neutral, and one-third disagreed. However, when looking at the responses for math by gender, significantly more males identified this as more difficult than expected (41%), whereas more females were neutral (42%) on this question; more than half the students have been discouraged by low grades.

Over half were neutral (did not agree or disagree) when asked about the pace of the program. Nearly half said they had experienced scheduling conflicts (47%). In terms of the structure of the program, males were significantly more likely than females (61% versus 38%) to say that they would prefer more flexibility, whereas more females were neutral or disagreed (62%) with this (X^2=7.87; p=.02).

Table 9
Perceptions of Academic Ability/Experience

	Male (n=59)	Females (n=93)	Total (N=152)	X^2
Do you enjoy the courses in your major?				0.26
Agree	71%	70%	70%	
Neutral	19%	22%	21%	
Disagree	10%	9%	9%	
Do you consider yourself competitive?				2.55
Agree	72%	62%	66%	
Neutral	16%	27%	22%	
Disagree	12%	11%	12%	
Do you feel comfortable asking questions in class?				0.53
Agree	59%	53%	55%	
Neutral	24%	26%	25%	
Disagree	17%	21%	20%	
Has your college experience been what you expected?				1.29
Agree	50%	59%	56%	
Neutral	26%	22%	23%	
Disagree	24%	19%	21%	
What is your perception of your academic performance?				3.29
Above average	30%	41%	37%	
Average	51%	49%	50%	
Below average	19%	10%	13%	
Are your academic experiences close to what you expected?				0.70
Agree	51%	50%	51%	
Neutral	24%	30%	28%	
Disagree	25%	20%	21%	
I have found courses at UMaine more difficult than expected?				4.81
Agree	31%	15%	21%	
Neutral	37%	48%	44%	
Disagree	32%	37%	35%	
I found math courses harder than expected?				**11.07***
Agree	41%	21%	28%	
Neutral	18%	42%	33%	
Disagree	41%	37%	39%	
I found physics courses harder than expected?				2.81
Agree	33%	23%	27%	
Neutral	28%	40%	35%	
Disagree	39%	37%	38%	

Table 9 (continued)
Perceptions of Academic Ability/Experience

	Male (n=59)	Females (n=93)	Total (N=152)	X^2
Have you ever been discouraged by low grades?				2.54
Agree	64%	54%	58%	
Neutral	17%	28%	24%	
Disagree	19%	18%	18%	
Do you think the pace of the program is too fast?				0.12
Agree	15%	14%	15%	
Neutral	54%	57%	56%	
Disagree	31%	29%	29%	
Have you experienced scheduling conflicts?				2.07
Agree	54%	42%	47%	
Neutral	20%	26%	23%	
Disagree	26%	32%	30%	
Would you prefer more flexibility in the courses you take?				**7.87***
Agree	61%	38%	47%	
Neutral	32%	49%	42%	
Disagree	7%	13%	11%	

* $p < .05$
** $p < .001$

Perceptions of Impact of Gender

Five questions asked students about their experience in the engineering program as it related to their gender. As can be seen in the results presented in Table 10, four out of the five questions revealed significant differences in the responses by males and females. While slightly over half did not think gender impacted faculty interaction, the rest were either neutral or agreed that this has an impact. In fact, significantly more females were neutral (41%), whereas more males disagreed (76%) with this statement (X^2=15.26; p=.01). When asked if they felt they were not taken seriously by faculty because of their gender, significantly more females agreed or were neutral (32%) in their response to this question, whereas more males (86%) disagreed (X^2=6.68; p=.04). In fact, significantly more females than males agreed or were neutral (28% versus 8%) when asked about being signaled out in class due to their gender. Again, significantly more males than females (92% versus 72%) disagreed with this statement (X^2=9.32; p=.01). No significant difference was found between males and females when asked if they felt they received a grade they did not deserve because of their gender; most disagreed with this statement (83%).

When asked about how their gender impacts other students' perceptions of them, significantly more females felt that they were not taken seriously by other students due to their gender (22% versus 2%). On the other hand, significantly more males (95% versus 56%) did not feel their gender impacts their peers perceptions (X^2=26.04; p<.001).

Table 10
Perceptions of Impact of Gender

	Males (n=59)	Females (n=93)	Total (N=152)	X^2
Do you think gender impacts faculty interaction?				**15.26****
Agree	12%	12%	12%	
Neutral	12%	41%	29%	
Disagree	76%	47%	59%	
Have you ever felt you were not taken seriously by faculty because of gender?				**6.68***
Agree	5%	13%	10%	
Neutral	9%	19%	15%	
Disagree	86%	68%	75%	
Have you ever felt you were singled out in class because of your gender?				**9.32***
Agree	---	8%	5%	
Neutral	8%	20%	15%	
Disagree	92%	72%	80%	
Have you ever felt you received a grade you did not deserve because of your gender?				3.33
Agree	3%	10%	7%	
Neutral	7%	11%	9%	
Disagree	90%	79%	83%	
Have you ever felt you were not taken seriously by other students because of your gender?				**26.04****
Agree	2%	22%	14%	
Neutral	3%	22%	15%	
Disagree	95%	56%	71%	

* $p < .05$
** $p < .001$

Chapter 5

DISCUSSION

The findings, limitations, and implications of the present study are discussed in this chapter. This study examined experiences of male and female undergraduates in the College of Engineering at the University of Maine. The objective of this study was to compare the women in the engineering program with their male counterparts to determine if there were similarities and differences in nine areas. Findings from this study indicate that the male and female students in the College of Engineering are more alike than unalike in many of these areas. It was the belief of the researcher that the findings from this study would be useful to the College of Engineering for the purpose of recruitment and retention of female engineering students.

Family Background

In the area of family background, both male and female students reported coming from very similar backgrounds (see Table 2). Questions concerning family background addressed each of the components of what has been termed as "enriched environment".

Earlier studies (Jackson et al., 1993; Fitzpatrick & Silverman, 1989) found that many of the women who entered engineering programs came from what has been termed "enriched environments," these are intact families, parents who are well educated, and mothers who work outside of the family home. The majority of the students reported having parents with some college background, and over

half of these parents hold a bachelor's degree and many have gone on to receive graduate degrees.

One of the most surprising findings from this research was the huge percentage of students who come from intact families with both parents taking an active role in raising the students. This researcher found this particularly interesting since the rate of successful marriages has dropped in recent years.

Earlier studies have found that having an engineer as a family member, or having prior knowledge of what engineers do for work, has been helpful for women who enter these male dominated fields. Both have been found to be helpful in areas of recruitment and retention of students in engineering programs.

Choosing a Major in Engineering

In the area of choosing to major in engineering male and female students' responses to questions began to differ (see Table 3). Questions asked students what grade they were in when they chose engineering as a major, who were the most influential people in the choice, reasons for choosing a major (both internal as well as external), and having some prior knowledge of the field.

The majority of students reported they had decided to major in engineering sometime during their four years of high school, with many of them choosing in the last 2 years. If a student reported that the decision to major in engineering was made before high school, the respondent was most likely male. This response is consistent with earlier research in the area. Gardner and Broadus (1990) found that women tended to choose to major in engineering programs in the latter part of the eleventh grade and into the first year of college.

A small percentage of students (male and female) choose a major during the first year of college.

Success in math and science during the high school years seems to be a key factor for female students to be considered as possible recruits for an engineering program (Yauch, 1999). Reported SAT math scores for female students indicate they had been successful in math while they were in high school. Female students also reported they enjoyed a challenge as well as the problem solving. This fits well with their ability to do well in math. Male students reported choosing an engineering major because of an interest in the work, and this is consistent with the literature. Entering an engineering program, for males is a natural choice after years of tinkering with toys and cars.

High school teachers, or guidance counselors, were most often reported by female students as influencing them to consider an engineering program. This is not surprising based on the findings by Yauch (1999) with math and science successes of high school females. Male students reported that their friends were most likely to influence them in their decision to major in engineering.

Levin and Wyckoff (1990) found attrition rates higher for students who were not academically prepared for college, or had little idea what engineers do as a profession. Many of the students who participated in this survey had some prior knowledge of what engineers do, and were well prepared to enter college.

External reasons for choosing majors within a college have no influence on attrition or retention rates. But, it is interesting to note that there are

significant differences among male and female students. Salary was the predominant reason, for both male and female students in this study, for choosing to major in engineering. Job opportunities, as well as job security, were important issues for female students when choosing to major in engineering programs. This is consistent with previous research (Gardner & Broadus, 1990).

High School Academic Performance

Another area looked at in this study for differences or similarities in male and females students was high school academic performance. Respondents were asked questions concerning the number of math and science courses taken in high school, their high school class rank, and their verbal and math SAT scores (see Table 4). Studies have shown that successful achievement in math and science is not strictly based on the number of courses a student takes in these areas; a student's attitude toward these subjects also plays a role (Yauch, 1999).

The students who responded to this survey were equally prepared in the areas of math and science when they left high school. The majority (both male and female) had taken courses in algebra, geometry and advanced math as well as biology, chemistry and physics. This finding is not consistent with other research; in an earlier study by Gardner and Broadus (1990), males entering engineering programs had taken at least two extra courses in these areas.

Over half of the participants in this study took Advanced Placement (AP) courses while they were in high school although just under half of the students brought the AP credits with them to college. It is not clear whether the students

took the AP test to receive credits for the courses, since the question was not asked. Research shows that students who have had some exposure to these higher levels of courses are more likely to be better prepared for an engineering curriculum (Yauch, 1999).

The majority of students responding to this survey reported graduating in the top 25% of their high school; this is consistent with previous research (Gardner & Broadus, 1990). There was a significant difference between female and male students, with female students reporting they had graduated in the top 10% of their class. Leslie, McClure and Oaxaxa, (1998) found that being in the top 25% of a high school graduating class is the single best predictor for white males in choosing a major in science or engineering.

The mean SAT score for those students who responded to this survey was SAT Verbal = 588 and SAT Math = 650, with a mean total SAT score of 1233. Female students scored slightly higher than males on both sections of the SAT. SAT scores, high school rank and first year GPA's are often used by colleges to predict success in college programs.

College Academic Performance

Another area looked at to determine differences and similarities was college academic performance (see Table 5). Questions asked concerned semester course loads, hours spent studying, first year GPA and grades received in the first two calculus and physics courses. Significant differences only appeared between male and female students when asked about the grade they

received in Calculus I and their course average in their major. Female students reported higher grades than their male peers in both areas.

The normal course load for students who responded to the survey was more than 15 credits each semester, and only 10% of those surveyed took 12 credits or less. Male students reported slightly higher GPA's after their first year of college with 37% having a GPA of 3.5 or above; 26% of the female students reported GPA's of 3.5 or higher after their first year in college. In previous studies (Levin & Wyckoff, 1995; Gardner & Broadus 1990) found first year-college GPA was a useful predictor of persistence in an engineering program. At the time of this survey more female than male students reported having a GPA of 3.5 or above.

The majority of the respondents reported study or doing homework between 1-5 hours a day; this amount of time spent preparing for classes seems adequate based on 2 hours of studying time for each credit hour spent in class.

Course grades in calculus and physics courses were for the most part equally dispersed. Females did report better grades in Calculus I than did their male counterparts. More male students reported failing at least one of these subjects; a very small percentage of the female respondents reported failing Physics I. Some students reported having to repeat a course due to failure or they did not receive the required grade to go on to the next course in the sequence.

Use of College Academic Services

The use of college academic services was also investigated (see Table 6). Questions were asked about the student's use of Tutoring Programs and Help Centers on campus, interaction with faculty and if they saw their academic advisor for problems during the semester. Jackson et al., (1993) showed female engineering students were more likely to use academic services provided by the university or college than their male counterparts. The results from this survey were consistent with Jackson's findings. Significant differences exists between male and female students in their use of the services provided by the University and within the College, as well as their interactions with faculty and their academic advisors. In his research, House (2000), found that students who use the tutoring programs provided by universities and colleges showed improvement of grade performance, which leads to persistence by students in their major programs.

Perceptions of Support/Non-Support

Student's perception of support/non-support was another area looked at by the researcher (see Table 7). Questions focused on perception of support/non-support for students with faculty, friends and their peers within their major and the College. There were more similarities among male and female students within the College, and there were no significant differences among them.

Eimers and Pike (1997) reported that informal contact with faculty by students outside of the classroom has a positive effect on student's persistence.

The students who responded to this survey did not feel they were unsupported by faculty or their peers. Many of the students reported they felt the faculty at the University of Maine to be very approachable; there were no reports by the students who responded to this survey of a faculty member being unapproachable. The majority of the students reported their academic advising as adequate. It should be noted that there were a few reports by students of inadequate advising and this should be a concern to the College. The majority of the sample felt their peers were very supportive of them, but again a very small percentage of the respondents felt they received no peer support. Eimers and Pike (1997) reported that students are more likely to persist in college if they separate a degree from family and pre-college friends. Many of the students reported that they had many friends within the college. Still there were those few who reported no friends at all within the college. Much of the findings in this section are consistent with previous research.

Participation in Outside Activities

Earlier studies (Eimers & Pike, 1997; Johnson et al. 1995) found the more connected a student was to the institution the better their chances are of staying in the program and completing the degree. This study included participation in outside activities (see Table 8). Questions that appeared on the survey included work for pay, the student's social life, and group activities on campus including sports, band or clubs. Over half of the students reported that they were involved in some sort of group activity (sports, band or clubs) on campus, and many were

involved in more then one. They considered their social life to be active or very active.

In an earlier study Eimers and Pike (1997) found that students who were financially secure had more time to study than those who had to work to help pay for college. An unexpected finding from this study was the number of hours worked each week (for money) reported by student. Just under half of the respondents reported that they do not work at all and only very few worked between one and five hours a week. Of those students who reported working more than ten hours a week, many were working in the dorms as Resident Assistants (RA). Many of the respondents to this survey reported having no concerns about financing their education. There were more similarities than differences among male and female students in this area.

Perceptions of Academic Ability/Experience

Students were asked a series of questions concerning their perceptions of their academic ability and experiences at the University of Maine (see Table 9). Questions focused on perceptions of their academic ability and their experiences at the University of Maine in some of the required courses. Significant differences were found in two questions. Male students found the math courses more difficult than the female students in the College, and male students wished there was more flexibility in the courses they took within the College.

The students seemed to enjoy the course work within their major and those who did not were too far into the program to make a change. Gardner and Broadus (1990) reported that both males and females had expected to perform

better than they did. Male students stated more often than female students that they found the math courses much harder then they had expected. For the physics course both male and female reported equally, some expressing the courses were not harder than expected and others stating the opposite. Over half the students reported that they had been discouraged by low grades and this is consistent with research; students expected to perform better than they did.

The preferred structure of an engineering curriculum reported in a previous study (Hayden & Hollaway, 1985) did not hold true for the male students at this University. Over half of the sample reported they preferred more flexibility in the courses they take. Scheduling conflicts were reported by some of the students, conflicts are more likely to occur when a student is off track within their major.

Perceptions of Impact of Gender

One of the most important areas looked at in this study was the perception of gender (see Table 10). Questions focused on the effects of gender in the classroom, interactions with faculty and peers, and grades received while attending the University of Maine. Significant differences were found in all questions but one. Not one of the students who responded to this question believed they had received a grade they did not deserve because of their gender.

It is important to note that the majority of male students responded with "Disagree" to all of the questions. Female students generally did not respond this way, and many of the questions were responded to by "Agree" or "Neutral". This is where the significant differences appear in this section.

Many of the female students sense their gender plays some role in their interactions with faculty and peers, but they are not really aware of what it is or they are unable or unwilling to voice it.

Students were asked if they felt gender had an impact on faculty interaction. It was obvious from the responses of male students that they do not believe their gender has any impact on faculty interactions, and the majority of male students disagreed with this statement. While there were female students who responded with "Disagree", many of them responded to this statement with "Agree" or "Neutral".

When asked if they had ever felt they were not taken seriously by faculty because of their gender, male students unanimously disagreed with this statement. Female students were not so sure. Over half of the respondents disagreed with this statement, but there were more female students than males who responded to this statement with "Agree" or "Neutral". This question showed significant differences between male and female students in the College. This is consistent with earlier research where female students reported more faculty discrimination in the classrooms than did male students (Jackson, et al., 1993).

Students were asked if they felt they were singled out in class because of their gender, and again male students did not see their gender as an issue in the classroom. This question showed significant differences between male and female students. Female students were more likely than their male peers to respond to this statement with "Agree" or "Neutral". Because male students

outnumber female students 7:1 in the College it would be difficult not to experience some vulnerability in a class that is predominantly male.

Another important finding in this section resulted from the question that asked students if they felt they were not taken seriously by their peers because of their gender. Male students disagreed with this statement 95% of the time. Male students used the "Disagree" response more often than female students. Just over half of the female students responded with "Disagree" to this statement, but again, many female students were torn between "Agree" and "Neutral".

It appears that the male students do not have any real concerns of how gender may impact their education, but they may be very aware of how gender impacts the female students in their classes.

Limitations

The ratio of female to male students in the College of Engineering is 1:7. When choosing to invite all female students in the College (minus those who participated last year) to participate in this study, (combined with the surveys that were collected in the previous year), the ratio of female to male engineering students was nowhere near an accurate representation of the population within the College. Some of the majors were not represented at all while others were over represented. For example, both civil and mechanical engineering students had very high response rates. This may be based on the fact that the researcher works in the same building as these two departments, and the students felt some obligation to complete the survey. This limits generalization to the population.

Although this survey was anonymous I do not believe female students felt they could be totally honest in their responses to some of the questions. The results suggest that females may not feel as strongly as their male counterparts when asked if they are treated differently because of their gender, but they are aware of the differences their presence make in a College that is predominately male.

Some of the questions may not have been worded clearly, causing confusion when trying to answer the question. An example of this would be the question on high school GPA. This question was finally dropped because there was no clear way in which to record the responses based on the different ways high schools report GPA's. In addition, Likert type questions (ranging from agree to disagree) were used when simple "YES" or "NO" answers would have made the results much clearer.

Implications for Attrition and Retention

- The State of Maine currently has 22.9% of adults with a bachelor's degree or higher, the College of Engineering currently does not recruit a representative cross-section of residents. Expanding enrollment for either male or female students is likely to be most successful if targeted at first generation students.
- High school teachers and counselors have a significant impact on female students' decisions in choosing a field of major. Therefore they should be encouraging all female students, not just those who show promise of high achievement in math and science, to take math courses up to the calculus

level as well as science courses, especially physics. Exposure to these types of classes would give female students who show medium aptitude in math and science possible consideration for enrollment in engineering programs.

- Evaluation and outreach of professionals working in engineering fields is indicated as helpful in recruitment and retention. Basic knowledge of what engineering entails promotes recruitment and retention of students in these programs.
- In general, the transition to a challenging curriculum is facilitated most effectively by high quality secondary education. Students recruited from outside this group are likely to need significantly greater support services.
- In terms of perception of support, based on favorable results of women in the College it seems reasonable to expand outreach especially to male students to enhance retention.
- It appears that a good environment is fostered by the intimacy and coordinate course sequence in the program. It is key to the success of the program to retain this character regardless of growth in enrollment. Rather than expanding enrollment in existing programs, growth may be best approached through strategic introduction of new focused programs.
- More female role models are needed in the College of Engineering, be it faculty or graduate students. All female students in the College should master the skill of networking. This is an especially important skill when working in an isolating environment such as engineering.

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APPENDIX A

****Email invitation for Study****

My name is Sheryl Brockett and I am currently a graduate student in Human Development and Family Studies here at the University of Maine. I am also the Administrative Assistant in the Mechanical Engineering Department in the College of Engineering.

I would like to invite you to participate in a survey of undergraduate engineering students enrolled here at the University of Maine. The survey takes approximately 15 minutes to complete. The questions focus on your high school academic background, family background as it relates to engineering, current college academic experience, perceived barriers, and activities outside academics.

The benefits of participation include providing new knowledge and understanding to the College on the experiences of engineering students. The findings may help in the recruitment of students into the college as well as help with retention issues.

If you are over the age of 18, you qualify for participation. Completion of the survey is voluntary and you may choose to not answer any question and you are free to discontinue participation at anytime. This is an anonymous survey. Since you will not be asked to put your name on the survey, there is no way for me to know who completed it. Once you complete the survey, you will mail it to me in the self-addressed envelope provided.

If you are interested in participating in this survey please reply to me via email and I will send you a survey with a return envelope. If possible, I would like to have the survey back by March 8th. Thank you.

Please note: If you already completed my survey last year, there is no need for you to complete a new one.

Sheryl Brockett
5711 Boardman Hall, Rm. 219
University of Maine
Orono, ME 04469-5711
581-2120
sheryl.brockett@umit.maine.edu

APPENDIX B

Cover Sheet and Survey

Undergraduate Engineering Student Survey

My name is Sheryl Brockett and I am currently a graduate student in Human Development and Family Studies here at the University of Maine. I am also the Administrative Assistant in the Mechanical Engineering Department in the College of Engineering. I am interested in studying the experiences of engineering students and their experiences with the faculty as well as with their peers.

The attached survey takes approximately 15 minutes to complete. The questions focus on your high school academic background, family background as it relates to engineering, current college academic experience, perceived barriers, and activities outside academics.

Do not put your name on the survey. All respondents' will remain anonymous and all surveys will remain confidential. You may choose to not answer any question and you are free to discontinue participation at any time. All surveys may be returned via campus mail in the envelope provided. Completion of the survey is voluntary. If possible, I would like to have the surveys back by March 8th.

If you are an undergraduate in the College of Engineering and you are over the age of 18, you qualify for participation. Completing this survey serves to acknowledge your consent to participate in this study. There are no known or foreseeable risks to participation. The benefits of participation include providing new knowledge and understanding to the College on the experiences of engineering students. The findings may help in the recruitment of students into the college as well as help with retention issues.

I hope you will take a few moments to fill out and return this survey. Your participation is most appreciated. If you have any questions, feel free to contact me (581-2120) or my advisor, Dr. Sandra L. Caron (581-3138). Thank you for taking the time to consider this survey.

Sincerely,

Sheryl Brockett
5711 Boardman Hall, Room 219
University of Maine
Orono, ME 04469-5711
581-2120
sheryl.brockett@umit.maine.edu

Undergraduate Engineering Survey

(Check one): [ ] MALE [ ] FEMALE

1. What is your major?
   - [ ] Biological Engineering
   - [ ] Chemical Engineering
   - [ ] Civil Engineering
   - [ ] Computer Engineering
   - [ ] Electrical Engineering
   - [ ] Engineering Physics
   - [ ] Mechanical Engineering
   - [ ] Spatial Information
   - [ ] General Engineering
   - [ ] Undeclared

2. What is your current year in college?
   - [ ] 1st year
   - [ ] Junior
   - [ ] Sophomore
   - [ ] Senior

3. Select the choice that best describes you:
   - [ ] 1st generation student*
   - [ ] Nontraditional student***
   - [ ] 1st gen./nontraditional student
   - [ ] Traditional student**

   *1st generation student is defined as 1st person in your family to attend college
   ** Traditional student is defined as continuing directly to college from high school
   *** Nontraditional student is defined by a break in enrollment from high school to college

4. Are your parents married?
   - [ ] Yes
   - [ ] No

5. Who were you raised by?
   - [ ] Both parents
   - [ ] Father/step-mother
   - [ ] Mother/step-father
   - [ ] Father only
   - [ ] Mother only
   - [ ] Grandparents
   - [ ] Other _____

6. What is the highest level of education attained by your father?
   - [ ] Ph.D
   - [ ] Master's degree
   - [ ] Bachelor's degree
   - [ ] Some college
   - [ ] High School Diploma
   - [ ] Did not finish HS
   - [ ] GED

7. What is the highest level of education attained by your mother?
   - [ ] Ph.D
   - [ ] Master's degree
   - [ ] Bachelor's degree
   - [ ] Some college
   - [ ] High School Diploma
   - [ ] Did not finish HS
   - [ ] GED

8. Does your mother work outside of the home?
   - [ ] Yes Occupation?_____
   - [ ] No

9. Does your father work outside of the home?
   - [ ] Yes Occupation?_____
   - [ ] No

10. Do you have a family member working or has worked in the engineering field?
    [ ] Yes If yes, how many males?____ Females?_____
    [ ] No

11. What is your ethnic background?
    [ ] White
    [ ] Asian
    [ ] Black
    [ ] Hispanic
    [ ] Native American
    [ ] Other (Specify)_____

12. Do you have siblings in college?
    [ ] Yes [ ] No

13. Are you currently:
    [ ] Single [ ] Married
    [ ] Living with partner [ ] Divorced

14. Do you have children?
    [ ] Yes [ ] No

15. Which math courses did you take in high school? (Check all that apply)
    [ ] Algebra I [ ] Geometry
    [ ] Algebra II [ ] Advanced Math/PreCalc
    [ ] Calculus [ ] AP Calculus

16. How many years of science did you take in high school? (Check all that apply)
    [ ] Biology [ ] Chemistry
    [ ] Physics [ ] AP Sciences

17. What was your high school class rank? _____ Out of a class of? _____

18. What was your high school GPA? _____

19. Do you think you were adequately prepared for college by your high school?
    [ ] Yes [ ] No

20. What was your verbal SAT score? _____

21. What was your math SAT score? _____

22. Did you take any Advanced Placement courses in high school?
    [ ] Yes [ ] No

23. Did you bring any AP credits with you to college?
    [ ] Yes [ ] No

24. What is your perception of your math ability while in high school?
    [ ] Above average
    [ ] Average
    [ ] Below average

25. What is your perception of your science ability while in high school?
    [ ] Above average
    [ ] Average
    [ ] Below average

26. Did you have any vocational testing while you were in high school?
    [ ] Yes [ ] No

27. Did you receive any career information while you were in high school?
    [ ] Yes [ ] No

28. At what point in your life did you decide to choose engineering as a career choice?
    [ ] Elementary/Middle School
    [ ] High school:
        - Freshman
        - Sophomore
        - Junior
        - Senior
    [ ] College:
        - 1st year
        - Sophomore

29. What influenced you go on to college? (Check all that apply)
    [ ] Parents
    [ ] Extended Family
    [ ] Friends
    [ ] Teachers
    [ ] Lack of alternative plan
    [ ] Other _____

30. Which of the following external reasons apply to you in your choosing a major in an engineering field? (Check all that apply)
    [ ] Salary
    [ ] Job prospects
    [ ] Job security
    [ ] Promotion within the field
    [ ] Prestige
    [ ] Other_____

31. Which of the following personal reasons apply to you in your choosing a major in an engineering field? (Check all that apply)
    [ ] Enjoy a challenge
    [ ] Service to people
    [ ] Problem solving
    [ ] Interest in the work
    [ ] Job flexibility
    [ ] Independence
    [ ] Other _____

32. Who prompted you to choose a major in engineering?
    [ ] HS guidance counselor/Teacher
    [ ] Parent
    [ ] Extended family
    [ ] Friend
    [ ] Other_____

33. Have you switched Colleges since you have been at UMaine?
    [ ] Yes [ ] No

34. Did you transfer to UMaine from another educational institution?
    [ ] Yes [ ] No

35. Have you switched majors within the College of Engineering?
    [ ] Yes [ ] No

36. Have you used the Tutoring Program at the UMaine?
    [ ] Yes If Yes, what subjects?_____
    [ ] No

37 Have you ever used any of the Help Centers (Math Lab, Writing Center) on campus?
    [ ] Yes [ ] No

38. Have you ever used any of the tutoring sessions available within major departments?
    [ ] Yes [ ] No

39. If you live on campus have you ever participated in the tutoring available in the engineering wings in the dorms?
    [ ] Yes [ ] No

40. If you have used any of the tutoring sessions, do you think they were helpful?
    [ ] Yes
    [ ] No If No, why not?_____

41. Do you see your academic advisor during the semester with academic concerns or other problems?
    [ ] Yes [ ] No

42. How do you perceive the approachability of faculty during office hours or after class?
[ ] Very approachable [ ] Approachable
[ ] Moderately approachable [ ] Not approachable

43. On the average how many hours a day are spent on studying/homework? _____

44. If you have completed your first year of college, what was your GPA at the end of your first year?_____

45. How do you perceive peer support?
[ ] Very supportive [ ] Supportive
[ ] Somewhat supportive [ ] No support

46. Which best describes your social life?
[ ] Very Active [ ] Active
[ ] Slightly active [ ] Not very active

47. How would you rank your interaction with faculty?
[ ] High
[ ] Low
[ ] As expected

48. What is your GPA at this time? _____

49. Do you participate in any groups on campus?
[ ] Sports [ ] Band [ ] Clubs [ ] None

50. What is your course average in your major?
[ ] A [ ] A- [ ] B+ [ ] B [ ] B- [ ] C+
[ ] C [ ] C- [ ] D+ [ ] D [ ] D- [ ] Fail

51. Do you work on class assignments alone or in study groups?
[ ] Alone
[ ] Study Groups
[ ] Combination of both

52. If you work in study groups are they primarily:
[ ] Male
[ ] Female
[ ] Mixed

53. What was your grade in Physics I?
[ ] A [ ] A- [ ] B+ [ ] B [ ] B- [ ] C+
[ ] C [ ] C- [ ] D+ [ ] D [ ] D- [ ] Fail

54. What was your grade in Physics II?
[ ] A [ ] A- [ ] B+ [ ] B [ ] B- [ ] C+
[ ] C [ ] C- [ ] D+ [ ] D [ ] D- [ ] Fail

55. What was your grade in Calculus I?

[ ] A [ ] A- [ ] B+ [ ] B [ ] B- [ ] C+
[ ] C [ ] C- [ ] D+ [ ] D [ ] D- [ ] Fail

56. What was your grade in Calculus II?

[ ] A [ ] A- [ ] B+ [ ] B [ ] B- [ ] C+
[ ] C [ ] C- [ ] D+ [ ] D [ ] D- [ ] Fail

57. What is your overall perception of your academic performance?

[ ] Above Average [ ] Average
[ ] Below Average [ ] Poor

58. Have you ever had to repeat a course?

[ ] Yes [ ] No

59. How many hours a week do you work for money?

[ ] none [ ] 1-5 [ ] 6-10 [ ] 11-15 [ ] 16 – 20 [ ] 21 and above

60. What is your normal course load a semester?

[ ] below 12 credit hours [ ] 12 hours [ ] 13-15 hours
[ ] 16-18 hours [ ] 19 and above

61. How do you perceive your relationships to your peers, positive or negative?

[ ] Positive
[ ] Neutral
[ ] Negative

Please respond to the following statements by circling the response that best describes your experiences at the University of Maine.

62. Did you know what engineers in your field do for work before choosing your major?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

63. Do you have concerns that you will not be able to finance your engineering education?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

64. Are you aware of the types of jobs that are available to you once you graduate from college?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

65. Are your friends supportive of your choice of major?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

66. Do you have many friends within the college?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

67. Do you enjoy the courses in your major?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

68. Do you feel that you are getting the most from your professors?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

69. Have you ever felt that you are not taken seriously by faculty because of your gender?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

70. Have you ever felt that you are not taken seriously by other students because of your gender?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

71. Have you ever felt you received a grade you did not think you deserved because of your gender?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

72. Have you ever felt you were singled out in class because of your gender?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

73. Do you feel comfortable asking questions during class?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

74. I would prefer more flexibility in the courses I take?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

75. Do you consider yourself to be competitive by nature?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

76. Do you think the pace of the engineering program is too fast?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

77. Do you think gender impacts faculty interaction?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

78. Have you ever been discouraged by low grades you have received in an engineering course?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

79. Do you feel you are getting emotional support from your family?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

80. Has your college experience at UMaine been close to what you expected?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

81. Are your academic experiences close to what you expected?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

82. Are you comfortable with your college choice?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

83. Are you comfortable with your choice of a major?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

84. Do you feel you have adequate advising?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

85. I found my math courses harder than expected?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

86. I found my physics courses harder than expected?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

87. Overall I have found the courses at UMaine more difficult than expected?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

88. Have you experienced any scheduling conflicts since you have been at UMaine?

Strongly agree Agree Neutral Somewhat disagree Strongly disagree

If this survey has raised concerns that you would like to talk with someone about, contact the University Counseling Center at the Cutler Health Center 581-1392.

BIOGRAPHY OF THE AUTHOR

Sheryl A. Brockett was born March 8, 1958 in Bangor, Maine to Richard and Evelyn Ellingwood. She attended grade school in California, including: Royal Oaks Elementary School in Duarte, Rio Hondo Prep School in Arcadia, and Cabrillo High School in Lompoc. She graduated in 1976. Sheryl enrolled at The University of Maine in 1987 and received her Bachelor of University Studies degree in December 1999. In January, 2000 she enrolled in the graduate degree program in Human Development at The University of Maine. While working toward her degree, she has worked full-time as an Administrative Assistant in the Mechanical Engineering Department. Sheryl is a candidate for the Master of Science degree in Human Development from The University of Maine in August, 2002.