What's It Like for the Women? Acceptance, Inclusion, and Equity in Predominantly Male Technical Programs

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Abstract

Efforts continue at our nation's colleges to recruit and retain an increasingly diverse student population. While overall enrollment is now more than 50% female, enrollment of women in electronics and other technical programs is still very small. What is it like for the female students who find themselves enrolled in programs where both the student body and faculty are predominantly male? This paper will present recent quantitative and qualitative research on female student perceptions of acceptance, inclusion, and equity at their institutions. The findings that will be shared reveal both positive factors and areas of ongoing challenge for both the women and their institutions. The reported perceptions are clearly useful to both faculty and administration as they endeavor to meet the needs of this segment of the student body.

In an effort to understand what their female students experience, surveys and focus groups were conducted in 1999, 2000, and 2001 at the North Brunswick New Jersey and Long Beach California campuses of DeVry Institute of Technology. The overall female enrollment at the Institutes is now approaching 25%. This represents an increase of approximately 6% in the past few years. Within the electronics program, however, the number is less than 10%. Women frequently find themselves enrolled in classes where there are 3 or fewer other women in a group of approximately 40 students. Women enrolling in these programs enter with GPAs and entrance exam scores equivalent to their male peers. The impetus for the research was whether or not they perceived that they were treated as equals once they were enrolled. Did they find themselves accepted by their male counterparts? Did they perceive that faculty members had the same expectations of success for them? Socially, did they feel comfortable? Did they perceive that they were subject to gender discrimination or sexual harassment? Did they have educational needs that were at variance with those of the male students? Could information be obtained that could be used for the basis of improvement of services?

The initial surveying was done using the Student Satisfaction Inventory (SSI) with several campus items tailored to capture gender equity data. The sample included a carefully stratified representative sample of approximately 50% of enrolled students. Focus groups were conducted with female students from an array of technical majors and whose length of enrollment varied from first to final year. A follow-up gender survey sampled the perceptions and experiences of successful senior level students. The information gained through these processes revealed areas in which to fruitfully fine-tune delivery of services and design gender specific support programs.

Results obtained varied greatly depending upon the method of data collection. SSI surveying at the Long Beach campus revealed female perceptions of equity to generally be on a par with, or even exceed, those of males. However, female perceptions of quality of instruction, access to resources and helpfulness of support staff were less favorable than those of the males. In marked contrast, the focus groups conducted at Long Beach and North Brunswick campuses tended to attract participants whose perceptions of equity were less positive than those found in the significantly larger subject sample utilized with the SSI. Focus group sampling techniques may have resulted in a biased sample. However, the information obtained from the focus group sessions allows detailed insight into the experiences of this group of self-selected students. The focus groups and gender inclusion survey allowed the collection of rich qualitative data, which can be used as a conceptual basis for developing enhanced support services and clarifying areas where inclusion might be an issue. The gender inclusion survey yielded a mixture of perceptions highlighting both experiences of inclusion and marginalization.

The paper will provide insight in three areas. The first will be the clarification of the differences between male and female college students as evidenced by the Cooperative Institutional Research Program (CIRP) data, which in 2001 included more than 261,000 respondents. The second, as outlined above, will be knowledge of specific methods and findings regarding equity perceptions of currently enrolled females within DeVry Institutes' technical programs. The third will be application level insight where the authors will share their own program improvement options.

I. Introduction

Although access for women into our nation's colleges was once a prime issue, it no longer is today. At present, more women than men are attending college, and the statistics on college graduation indicate proportionately fewer women than men are attriting. However, if we examine the segment of the college population that are pursuing careers in computer science, engineering, and other technical fields, we find that women are but a small minority here, and that some institutions experience selectively high migration of these talented women into other less technical and less high paying professions.

Clearly although much progress has been made in decreasing the gender gap in technical fields, women are still vastly underrepresented in engineering, science, information technology, and related fields. In fact, some estimates suggest a male/female ratio in engineering undergraduate programs of almost 5 to 1¹³. The percentage of female computer scientists today is still only 28%¹⁵.

With 64% of the impoverished population of this country being female, often single heads-of-households, we need to be concerned with the fact that women, even educated women, are still migrating into occupations that will inevitably pay them less than that earned by the average educated male. Additionally, the underutilization of such a talented proportion of our work force is a matter of concern to our society. The demand for qualified workers in science and engineering is increasing at the same time the historical source of workers in these fields, white males, is decreasing². Therefore, without increased gender and ethnic participation, we might

face a shortage of workers qualified to meet the technological demands of our society. For all of these reasons, it is imperative that we find ways to promote and advance women in technical majors in colleges today.

II. DeVry University

DeVry University is a private proprietary system of 21 campuses in the U.S. and Canada that offer Bachelor and Associate degrees of Science in a limited number of professionally focused fields. The system is, for the most part, non-residential and attracts an ethnically diverse group of primarily first generation nontraditional college students with an average student age of about 25. Student population has been predominantly male. Our gender composition today is approximately 25% female. Within the Institute, the majority of female students are enrolled in the business and accounting programs where female enrollment is close to 50%. The Computer and Telecommunications programs have female enrollments of approximately 25% and 20% respectively, and the Electronic Engineering programs are generally around 10% female. The faculty outside of the General Education departments is predominantly male.

III. CIRP Report ¹²

There is a lot we currently know about both women and men who are just entering college. The Higher Education Research Institute at UCLA issues an annual report based on the responses of nearly 270,000 first year college students. This compilation of data is known as the CIRP report (Cooperative Institutional Research Program.) The CIRP data indicates that there are numerous significant differences between female and male students at the time of college entry. Several of these differences are important to us in examining the minority status of women in technical programs today.

1. If we look at preparedness for college in terms of grades, and constructive time usage patterns we find that the females are at least as prepared as the males

A. Grades of entering first year students:

89% of females have a GPA of "B" or higher

80% of males have a GPA of "B" or higher

Females as a group also did not receive lower grades in math or science classes

B. Time Usage

Time spent studying

29% of females confessed to studying less than 3 hours a week

43% of males reported studying less than 3 hours a week

Females as a group spent less time partying, watching TV, playing video games, and working at paid employment during high school, than did their male counterparts.

11% of females partied over 10 hours a week

18% of males partied over 10 hours a week

23% of females watched TV over 5 hours a week
35% of males watched TV over 5 hours a week

48% of females played video games.
4% of females played video games over 5 hours a week
79% of males played video games
17% of males played video games over 5 hours a week

These numbers let us see why women, in general, are succeeding at entering and graduating from college.

2. But there are two other factors that mitigate against female student' success: self-confidence and stress.

A. Self-confidence

When students were asked to rate their own abilities in comparison to other people their age, females -despite their higher grades- rated themselves lower than males.

Area	Above-average Confidence Level	
	Female	Male
Computer Skills	23%	46%
Competitiveness	45%	70%
Mathematical Ability	37%	54%
Intellectual Ability	53%	69%
Emotional Health	47%	60%
Social Self-confidence	48%	57%

B. Stress

One of the most striking findings of the fall 2001 CIRP report was the gender difference in stress. In answer to the question as to whether they “frequently felt overwhelmed by all they had to do” –

36% of females said yes, while only half as many,
18% of males indicated yes.

Female students are applying and being accepted to college with equivalent or better grades and equivalent or better time usage patterns, but they have significantly lower self-confidence and experience double the stress.

3. After analyzing the majors that students select at time of entry, we find that the vast majority of women are still self-selecting away from technically demanding careers in a pattern that parallels their sagging self-confidence. Few choose engineering, or physical science, or computers. More choose nursing than medical school, and those interested in careers in education stack up on the early elementary end of the scale and away from higher education.

IV. CIRP Reflections

After reviewing the CIRP findings, we became interested in how these facts impact the college experiences of women who do go against type and choose majors not traditionally pursued by women. When the inevitable college stumbling blocks arise, do these women look around and finding themselves with few female role models and few if any gender peers, entertain disproportionate self-doubts about the path they have chosen and their likelihood of success? These areas became the underlying questions in our research.

V. Student Satisfaction Inventory Data (SSI), Long Beach DeVry, Fall 2000 ⁸

For the past 5 years, for more general assessment and retention purposes, data has been annually collected with this instrument using a stratified sample of nearly 50% of the student body- approximately 1200 students. Beginning two years ago, the data was analyzed to see if it could be helpful in providing insight into gender-based differences in expectations and experiences of satisfaction with college life. At the Long Beach campus of DeVry University during autumn of 2000 female students indicated they were significantly less satisfied than male students on four items. All four addressed areas outside of the classroom. The most substantive ones were items 44 and 22.

Item 44: Academic Support Services meet needs of students

	Importance	Satisfaction	Gap
Female	6.38	4.58	1.80
Male	6.09	4.78	1.31

Item 22: Counseling staff cares about students as individuals

	Importance	Satisfaction	Gap
Female	6.19	3.99	2.20
Male	6.02	4.41	1.61

The scoring range on the SSI is from 1 to 7, with 7 being high. (7 = extremely important or extremely satisfied.) Four is the neutral point.

For items 44 and 22, both academic support and academic counseling are self-identified as more important services for the women than they are for the men. In light of the CIRP data, this makes sense. Students with less self-confidence and more stress might be expected to be more concerned about their interaction with academic support and counseling services. Furthermore, not only did the women expect more, but they were also less satisfied with their experiences. The average response edges into negative territory.

The next two items may appear less substantive, particularly given the commuter nature of the campuses, but they do indicate a difference in comfort level and inclusion.

Item 38: Adequate Selection of Food in Cafeteria

	Importance	Satisfaction	Gap
Female	5.76	4.08	1.68
Male	5.69	4.61	1.08

Item 42: # of Adequate Weekend Activities for Students

	Importance	Satisfaction	Gap
Female	5.00	4.04	.96
Male	4.93	4.29	.64

At one point, DeVry was a wholly male institution, and the remnants of that are seen in the Commons' menu which is mostly short-order fast food – high in red meat, and grease; and also it is seen in the male oriented nature of many of the student activities that are offered, such as paint ball and ocean kayaking. Women feel welcomed on to campus by the male majority, but once there, they find it to be an environment designed more to meet the interests of the men. Might this affect the female students' sense of authenticity as part of this technical community?

VI. Women's Issues Focus Group Results, No. Brunswick DeVry, Summer, 2000 ³

As a follow-up to a summer 1999 focus group on women's issues, another focus group was conducted in late summer 2000 and revealed a continuation of a pattern of sexist behavior significant enough to create an environment uncomfortable to the female participants. It must be noted that although all full-time female students were invited to attend, only a small articulate and assertive percentage participated. As a result, it is possible that the findings of the group may be somewhat skewed.

Nevertheless, the participants indicated that they did encounter a number of problems particular to them as women. They spoke of having to prove themselves academically over and over again and having to deal with the attitude of "Oh, you're a woman... so you're going to drop out."

They spoke also of being disrespected by male students by the manner in which they're stared at and the comments made about them. The participants singled out their first semester as the time they had to especially speak up as male professors tended to call on male students more than female students. After the first semester though, the women indicated that their male peers usually accepted them.

What seemed to be a problem to the female students were not the low number of females on campus but rather the lack of community and support among female students. In fact, participants talked about the high level of competitiveness and, in some cases, even "spitefulness" among female students. They indicated that the "environment is not conducive to meeting people" but were very happy at having been invited to the focus group and asked for more opportunities to get-together. They spoke about how empowering the meeting had been and how much better they felt about the college as a result.

When asked if they preferred having more female faculty, counselors, advisors, and staff on campus, what was of importance to them was competence and professionalism, not gender.

As a result of the focus group, all of the following recommendations presented to the administration were adopted as official policy on campus:

1. A school-wide initiative to establish zero tolerance for sexism on campus through the introduction of DeVry's policies on sexual harassment during New Student Orientation and reinforcement during subsequent terms.
2. The establishment of a coffeehouse, as an offshoot of the student organization, Women in Business and Technology, to foster friendships among female students.
3. Development of additional organizations to provide forums for women to express and have their concerns addressed.
4. Development of a women's leadership course designed to support women during their student and professional lives.
5. Continued reinforcement of behavior and dress appropriate to a professional work environment.

VII. Women's Issues Focus Group Results, No. Brunswick DeVry, Summer, 2001 ⁴

The findings of this focus group revealed a somewhat different pattern than last year's group. While many of the participants indicated the presence of sexist behavior and harassment on campus, many also spoke of the strong support they have experienced, especially from some female General Education faculty and tutors. The participants indicated that they were very pleased at having the opportunity to meet and discuss their concerns. Unfortunately, though, this year's group spoke more adamantly about the lack of support and encouragement in their technical areas, in fact, an attitude of discouragement by a number of male faculty and even some female faculty. The challenge of having to prove themselves to male peers continues. In all, while some progress has been made to provide an environment welcoming and supportive to female students, more change is still needed.

Recommendations as a result of these findings were:

1. Continuation of effort to build a stronger support system for female students through Women in Business and Technology (WIBT), Women in Leadership and Learning (WILL), and possibly other forums to build a more nurturing community along with a more aggressive publicity campaign about campus activities for women.
2. Initiation of a first semester mentoring program providing one-on-one mentors to entering female students.
3. Reestablishment of a “true” College Hour, that is a block of time with no scheduled classes to allow for student activities available to all students.
4. Acknowledgment of successful female student accomplishments, perhaps in the WIBT website or newsletter.
5. Addition of more female tutors and faculty assistants who could act as contacts to female students as well as additional female technical faculty.
6. Provision of harassment prevention/sensitivity training for both faculty and students.

Although all full-time day North Brunswick female students were invited to attend the focus groups, only a relatively small number self-selected to come. While it is possible that these women may have had stronger, more polarized opinions, or more negative experiences than the female students as a whole, their responses did allow the identification of the most pressing gender inclusion issues on campus.

VIII. Gender-Inclusion Survey Data, Long Beach DeVry, Spring 2001 ⁹

At Long Beach follow-up research focused on assessing the prevalence of these experiences. A gender-inclusion survey was developed and administered to a gender-mixed group of 36 seniors majoring in Computer Information Systems who were in a Motivation and Leadership class (a graduation requirement for their program.) Males were included to compare the perceptions of male and female students. The surveying of seniors provided information on those who have been successful in navigating the system. As noted in the North Brunswick focus group findings, the first year is a proving ground for the females in establishing the legitimacy of their academic talent in the eyes of their male professors and male peers. The female students looked at in this survey were the ones who had succeeded in doing this and who had come to terms with the environment in which they found themselves.

The following are the similarities and differences found to exist between the perceptions of the female and male students and their experiences in the male dominated environment:

1. Senior female students report a higher level of personal assertiveness than their male peers. While the North Brunswick findings indicated that females in the focus groups felt this level of assertiveness necessary and wanted support in increasing their assertiveness, the Long Beach survey revealed that women who succeed aren't just as empowered as the male students, they are often more so. This was evidenced in self-reports of class participation. Females reported significantly higher participation in class discussions involving the professor and the entire class. On a 4 point scale, 4 highest, neutral being 2.5, the female mean was 3.29 while the male mean was 2.89

This also concurs with Tinto's findings on student engagement and college retention ¹⁴.

2. While senior females may consider themselves to be more assertive in large class discussions, the majority of senior female students seem to have navigated the system by submitting to playing less assertive roles when they find themselves in a gender-minority position in project work groups. 58% of females reported that their role in the group changes when they are in a gender minority position compared to only 5% of males.

The following are sample comments of women who have acquiesced:

"Some men seem to dominate by dictating and ordering".

"I usually have to write cuz the guys says, "Girls have better handwriting". I only get to be group leader if the males in the group are loafers"

"I was left with the documentation aspect of the project when the gender ratio was 1:5".

"Males see females in maintenance roles, as helpers. Females and males have different outlooks and I am usually the outsider because the males have consensus and I see things differently"

Several of the women who stated that their role did not alter when in male dominated groups indicated that it was because they were usually the leader in any group they joined.

Some representative comments by these non-acquiescing women are:

"I tend to want to manage the group to make sure things run smoothly"

"I have never had a problem taking charge when needed".

3. Both male and female students reported perceptions of differential treatment based on gender. The survey asked about treatment as academic equals by professors and by peers. Interestingly, male perceptions parallel female perceptions regarding the existence of inequities. There was, however, considerable variation with some women as well as some men feeling that women have a level playing field.

In looking at averaged ratings:

Both male and female students rated faculty as "almost always" treating male and female students as academic equals (3.1 out of 4)

Both male and female students rated male students as only treating female students as academic equals "some of the time" (2.8 out of 4)

Both male and female students gave more favorable ratings to females, saying that female students treat male students as academic equals "almost always" (3.2 out of 4)

Students' comments can be subdivided into four areas: those perceiving equality and those perceiving inequality, and those of females and males. The following are representative of each group:

Those perceiving equality:

Females:

"I haven't been treated any differently"

"Most people take others on their achievements, not gender"

Males:

"My observation is that it depends on physical looks, degree of participation, and teacher to student relations"

Those perceiving gender bias:

Females:

"Most of my classes have male professors who predominantly focus on male students"

"Male instructors usually act as if a female student is less superior, assuming she doesn't know anything about computer technology"

"Male students think they are smarter"

"I think many believe that CIS (computer information systems) is a man's field and women are looked down upon"

Males:

"I have seen male students talk to female students differently than they would to male students"

"CIS is predominantly male and has a stigma associated with it as a male occupation"

"Teachers treat equally, but male students treat females as less proficient".

"Men sometimes get in that mode of 'cave man' so views by women are ignored."

Males justifying gender bias:

"Fewer females here than men. If it was the other way around, things for me would be different."

"Technical stuff is not a female favorite subject and DeVry is a technical school"

"Guys usually spend more time with computers (gaming or messing around) than girls".

4. When students were asked to rate their own academic superiority or inferiority in comparison to opposite gender peers, more self-doubt was evident in the females' responses:

21% of females rated themselves as superior compared to the male students
37% of males rated themselves as superior as compared to the female students

21% of females rated themselves as inferior as compared to the male students
0% of males rated themselves as inferior as compared to the female students

It should be noted that female students do not receive lower grades than the males, nor are their post-graduation placement rates in anyway inferior. Yet, one fifth of the women in their senior year rated themselves as inferior.

5. In the area of real interest (or lack there of) in academic programs, when identifying factors posing significant ongoing challenges for them:

45% of males indicated a lack of real interest in academic programs
7% of females indicated a lack of real interest in academic programs

The above is a very curious finding. Not only do these women like what they are studying, they apparently like it considerably more than many of their male peers.

6. When asked to indicate what adjustments they would like to see made on campus to enhance the inclusion of female students, students responded quite differently. Females indicated that they wanted more active recruiting of more female students, the development of clubs on campus to support women in the computer field, the hiring of more female instructors (their most frequently made comment), and, finally, feminine hygiene dispensers in restrooms. In contrast, males responded that they would like "more women" (their most frequently made comment), the inclusion of images of women in institute PR material, more motivation from professors, and that the CIS industry needed to change to make the work more appealing to females.

Conclusions drawn from the findings of this study indicate that:

Traditional occupational role expectations (which label technical professions as male) still prevail.

Women pursuing technical majors evidence greater interest in their studies on average than do their male peers.

Women willing to break with tradition and become the pioneers may be the ones with exceptional levels of motivation and subject matter interest.

Women as a group enter college with less self-confidence and experience higher stress than their male peers which leads them to desire more effective academic support and counseling services.

It is likely that a substantial portion of the women who do successfully complete their technical programs may still have comparatively lower self-confidence regarding their abilities than do their male peers.

Women are aware that institutional structures (such as food service and student activities) were designed to satisfy the interests of their male peers. This adds to their perception that they are in a male domain.

In the classroom, many female students report they are not given but must earn intellectual respect equal to that accorded their male peers. If they accomplish this, they usually are treated as equal by their professors. This is usually accomplished by their being more assertive than their male peers.

When women are treated with equal respect by professors, they are still frequently accorded less respect by many of their male peers.

To survive in work groups where women have gender minority status, two strategies are reported. One strategy is for the female student to assert herself and bid for the role of group leader. The other strategy, (or if she is not successful in her bid for leadership) is for her to accept a role notably subordinate to the male members of the group, frequently serving as the equivalent of group secretary. Female students finding their group roles constrained by their gender-minority status is the most frequently reported experience.

IX. Suggestions for Enhancing the Inclusion of Female Students

What can we deduce from this, and how can we tie this back to the existing knowledge base in the field? More importantly, what can we now suggest regarding enhancing the inclusion of female students.

A significant body of research has been undertaken to examine motivational variables contributing to academic achievement of females and males, especially that based on expectancy-value and self-efficacy theories of motivation. Findings indicate that individuals' expectations influence a wide range of achievement behaviors such as task choice, task persistence, and performance measures^{5,7}. Self-efficacy, one's belief about one's capacity to perform given behaviors, is central in the prediction of educational and occupational choices. Additionally, student self-perceptions have proven to be better predictors of academic performance than objective measures of ability². Confident individuals, who expect to succeed, perform and persist at high levels. Thus, the existence of comparatively low levels of confidence in so many competent women is then, indeed, a matter of significant concern..

Socialized gender differences have had significant implications for women in technical fields. Certainly the different cultural styles of women and men contribute to this challenge. Generally, women value group affiliation and collaboration more than men¹. Instructors will need to do more than treat both genders equitably for as Betz indicated the negative effects of an absence of support, a null environment, may actually have discouraging effects, especially on females⁵

Certainly, classroom practices can affect student success and positive perceptions. Colbeck, Cabrera, and Terenzini found that students perceived gender equity in faculty-student interactions but gender discrimination between students ². What is most significant is that collaborative learning is positively associated with gains in confidence for both men and women. Clarity and organization of classroom activities and instructor expectations appear to be of far greater importance to female students compared to male students.

So what can be done to enhance the inclusion of female students? Five key areas are addressed:

1. Recruitment:

A. Expand recruitment efforts with a preliminary target of increasing female student and faculty levels to at least 20% in all programs. According to Pettigrew and Martin, research on group dynamics has shown that individuals are treated as tokens until their numbers equal a minimum of 20% of the group's membership ¹⁰.

B. Retrain recruiters and academic advisors to counter any de-facto (and possibly inadvertent) tracking of female students into non-technical careers.

C. Re-examine and alter the gender image the institution presents of itself. Look at who is being used to represent the 'faces' of the institution. Who are the spokespersons? It may be necessary to increase the number of female recruiters, the number of photos of females in the catalog, particularly in views of students at work in laboratories, and the number of images of females in any promotional literature or advertising.

2. Institutional Support:

A. Strengthen the effectiveness of and access to academic support and counseling services. Train personnel in how to avoid inadvertent tracking. Train personnel in the importance of validating student goals and abilities. The need for academic validation is considered a prime ingredient in the success of nontraditional students ¹¹.

B. Adjust campus environment including food, activities, pre-professional organizations, and restroom amenities to equally accommodate both genders.

C. Provide both formal organizations and informal opportunities for female students to develop a supportive environment.

D. Develop leadership courses for women to enhance personal skills.

E. Provide mentors from both the academic world as well as industry.

F. Provide summer bridge programs.

G. Increase the number of female faculty.

- H. Establish an advising center especially focusing on the needs of first-semester minority students.
- I. Make overt the institution's commitment to and standard of conduct regarding inclusion of all diverse groups. Clarify for all incoming students the institution's standard for diversity inclusion as modeled by Harvard's use of a booklet sent to all first year students before the term begins ⁶.
- J. Add diversity inclusion training to the curriculum for new students in College Success courses as well as Student Orientation. This training should not be limited to combating overt discrimination and official judicial procedures but deal also with the issues of combating re-segregation with intellectual respect for others and issues of equity regarding work group roles.

4. Classroom practices:

- A. Incorporate collaborative learning, especially that related to real world situations, into the curriculum.
- B. Provide clarity and organization to female students to increase their confidence levels.
- C. Educate faculty regarding issues associated with male dominance in work groups and the need to facilitate role equality.
- D. Educate faculty regarding the need to bolster student confidence and to validate the talents and successes of all their students.
- E. Address, if needed, the issue of the suitability of women for technical careers.

5. Peer Support:

- A. Facilitate the success of all students by providing training in the effectiveness of peer study groups. A recent Harvard University study found that student migration away from physical science majors was most prevalent when students did not join study groups. When a program was implemented to raise student awareness about the importance of joint studying and to facilitate the formation of study groups, however, the migration away from those majors decreased markedly ⁶.
- B. Provide a variety of opportunities for students to develop a supportive academic community.

Hopefully, raising the awareness of what it's like to be a woman in a predominantly male technical program along with the inclusion of practices designed to increase equity may serve to enhance the acceptance and inclusion of female students and to increase the number of women in technical fields.

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