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Retaining Diverse Groups in STEM

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Retaining Diverse Groups in STEM

Abstract: Colleges across the United States must produce more engineering graduates in order to keep up with demands in the engineering workforce. Population trends indicate that women and minorities are highly underrepresented in the STEM fields therefore recruitment and retention of these populations is critical to closing the predicted gap in the workforce. Perkins Peer Advisement is a grant funded program at New York City College of Technology (City Tech) committed to increasing enrollment and retention of nontraditional students in engineering technology programs. Program activities include professional development, mentoring, and community outreach. Participants of the program have higher retention rates than the average reported for these majors. For female students, the one-year retention rates were 85% for participants compared to about 51% for all female students in fall 2017 and 78% for participants compared to about 60% for all female students in fall 2018. For Hispanic students, the one-year retention rates were 52% for participants compared to about 44% for all Hispanic students in fall 2017 and 76% for participants compared to about 46% for all Hispanic students in fall 2018. The program provides a successful model for mentoring, recruiting, and retaining females and minorities in STEM; empowers students with the resources to succeed academically and professionally, provides positive role models, and engages participants in community outreach.

Introduction

The U.S. Bureau of Labor and Statistics reports the employment of architecture and engineering occupations is projected to grow 6 percent from 2020 to 2030; with most job growth in this group for engineering occupations [1]. Recruitment and retention of women and minorities is critical to closing the predicted gap in the nation's STEM workforce. Women make up about one half of the population and Hispanics about 19%. More so, the projected number of Hispanics in the United States is expected to double by 2060 [2]. Representation of these groups is not reflected in the STEM fields, and we must take action to promote STEM as career options among them. Women and minorities are traditionally underrepresented in the STEM college student population and general workforce. At the college level, about 22% of Bachelors' degree recipients are women and 12% are Hispanic. In the workforce, women account for only 15% of the engineering and architecture workforce; Hispanics account for only 9% [3]. This indicates that not only is there a problem with recruiting Hispanic and female students in STEM but retaining them from graduation into the workforce.

Perkins Peer Advisement is a grant funded program at City Tech committed to increasing enrollment and retention of female and nontraditional students in engineering technology programs. Program activities include professional development, mentoring, and community outreach. Participating departments include Architectural Technology (ARCH), Construction Management and Civil Engineering Technology (CMCE), Computer Engineering Technology (CET), Electrical Engineering Technology (EET), and Mechanical Engineering Technology (MET). This paper will focus on the benefits to female and Hispanic student participants.

Background

As an open access institution, City Tech's mission has been to offer opportunities for educational advancement to students regardless of financial circumstances or prior academic achievement. In Fall 2020, student enrollment was reported as 14,276, of which 33.8% identified as Hispanic, 27.7% Black, 20.7% Asian, 10.9% White, 2.8% Other, and 4.1% Nonresident. Approximately 62% percent are the first in their families to attend college, and 61% report household income less than $30,000. Eighty percent (80%) of incoming first-year students and 67% of returning students received need-based financial aid. Twenty-seven percent (27%) of students reported working 20 or more hours per week [4]. The College is a federally designated Hispanic Serving Institution (HSI).

In Fall 2020, the College reported enrollment of 54% male and 46% female; yet the percentage of women enrolled in the associate degree technology programs is much lower. Table 1 and 2 provide the percentage of female student enrollment and Hispanic student enrollment for the participating majors in the program.

Table 1. Fall 2016 Enrollment of Female and Hispanic Students by Department

Department	Total Enrollment	% Female Enrollment	% Hispanic Enrollment
ARCH	697	33.6%	41.8%
CMCE	661	15.4%	31.3%
ETET	576	5.9%	30.0%
MET	803	8.6%	34.1%
CET	1073	9.1%	37.1%

Table 2. Fall 2020 Enrollment of Female and Hispanic Students by Department

Department	Total Enrollment	% Female Enrollment	% Hispanic Enrollment
ARCH	699	42.9%	43.3%
CMCE	667	17.1%	30.6%
ETET	539	8.5%	32.3%
MET	774	9.7%	35.1%
CET	864	11.1%	35.4%

Retention in STEM

Data indicates that although there is still underrepresentation of women and minorities in STEM, degree attainment is increasing within both populations [5]. As population trends indicate continued growth, we need to provide programs and support to ensure that the degree attainment continues to rise. A strong sense of belonging, a supportive college environment and mentoring has been identified as positive influencers in retention of underrepresented minorities in STEM fields [6,7,8,9]. Community outreach and engagement also promote student retention in STEM

fields [10]. Perkins Peer Advisement is committed to providing students with role models that look like them and providing an environment conducive to personal and professional growth.

Peer Advisement Program Organization

The Project Director administers the program and oversees the activities across all five departments. There is a faculty liaison for each participating department whose primary role is to recruit peer advisors, coordinate space and scheduling, and advertise the program throughout their department. A student is hired as the Peer Coordinator to assist in the administrative tasks required for coordinating the program. The Peer Coordinator works 10 hours per week and their responsibilities include monitoring sign-in sheets, timesheets, event planning, registration and reimbursement procedures, and staffing all program events. Peer advisors work six hours per week and their responsibilities include advising, mentoring, and tutoring students during their scheduled hours. See Figure 1 for the organizational chart of the program.

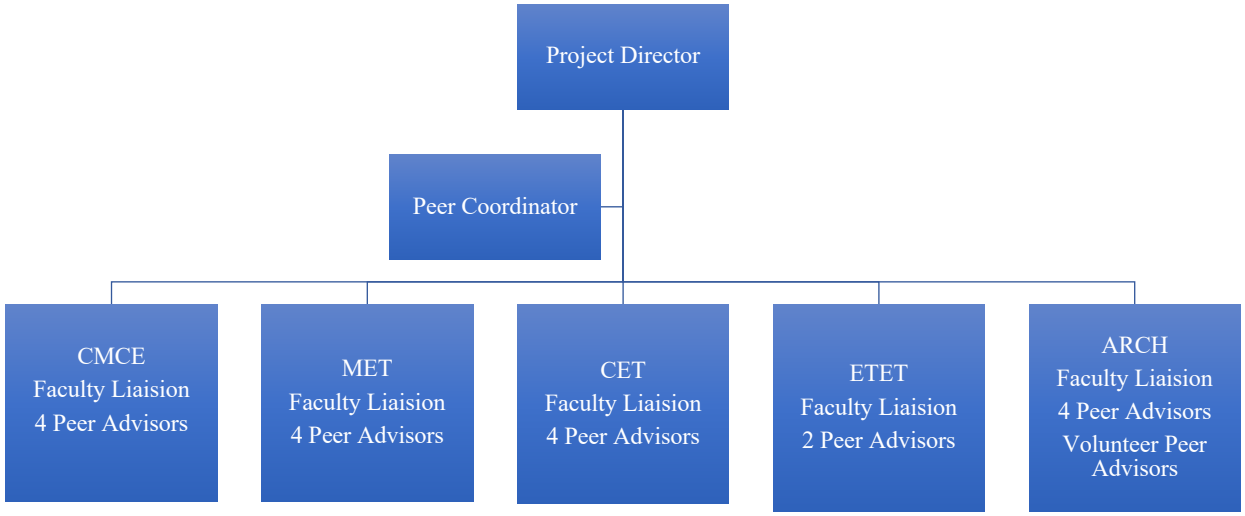

Figure 1: PPA Organizational Chart

Program Activities

The activities offered by the program are listed below. All program activities are open to all students and both male and female students attend. Attendance is recorded for the peer advisement sessions as well as the professional development workshops. A student is considered to have participated in the program if they have attended peer advisement at least once.

Peer Advisement

Peer advisors are available seven days a week during morning and evening sessions. During peer advisement, peer advisors primarily provide tutoring. In addition, they provide advice regarding classes and registration, time management, and study skills. The schedule is posted and distributed at the beginning of the semester by faculty and through the Open Lab site. The schedule includes a list of subjects available for tutoring by each peer advisor.

Professional Development

Professional development workshops are offered monthly to provide students with role models and an increased awareness of the relationship between academic studies, job skills, and employer expectations. These workshops are open to all students and include speakers from diverse backgrounds, industry, and professional societies. The grant supports student participation in local and regional conferences for women in STEM fields such as the Society of Women Engineers and the Scientista Symposium.

OpenLab

The OpenLab is a state-of the-art digital platform that everyone at City Tech can join. It promotes an open environment enabling communication and connections within the College and beyond while simultaneously providing a space where students, faculty, and staff can work together. The PPA Page serves as a centralized location housing information on resources, events, and opportunities for students.

Outreach

The project promotes communication, recruitment, and awareness of females in STEM. We developed promotional materials highlighting female and minority students, the engineering technology majors, and the PPA program. We participate in outreach activities including monthly family STEM workshops at the local elementary school, hosting an annual girl day event for high school students, and attending local events at museums and schools.

Results

The overall one-year retention rates of PPA program participants are typically higher than those of all students in the participating majors. Tables 3 and 4 provide the retention rates for the majors, including overall, female students, Hispanic students, and PPA participants.

Table 3. One-Year Retention Rates for Participating Majors (2017-2018)

	Overall One-year Retention Rates (2017-2018)					
Department	All students 2017	PPA participants 2017	Female students 2017	PPA female participants 2017	Hispanic students 2017	PPA Hispanic participants 2017
ARCH	64%	82%	77%	-	55%	-
CMCE	60%	NA	71%	-	65%	-
ETET	51%	82%	0%	-	30%	-
MET	60%	75%	67%	-	41%	-
CET	64%	80%	39%	-	31%	-
Total	**60%**	**80%**	**51%**	**85%**	**44%**	**52%**

Table 4. One-Year Retention Rates for Participating Majors (2018-2019)

	Overall One-year Retention Rates (2018-2019)					
Department	All students 2018	PPA participants 2018	Female students 2018	PPA female participants 2018	Hispanic students 2018	PPA Hispanic participants 2018
ARCH	63%	77%	64%	-	54%	-
CMCE	54%	82%	50%	-	8%	-
ETET	62%	NA	67%	-	64%	-
MET	62%	69%	50%	-	63%	-
CET	68%	87%	67%	-	42%	-
Total	**62%**	**79%**	**60%**	**78%**	**46%**	**76%**

The one-year retention rates for female participants and Hispanic participants are greater than their comparison groups. For female students, the one-year retention rates were 85% for participants compared to about 51% for all female students in fall 2017 and 78% for participants compared to about 60% for all female students in fall 2018. For Hispanic students, the one-year retention rates were 52% for participants compared to about 44% for all Hispanic students in fall 2017 and 76% for participants compared to about 46% for all Hispanic students in fall 2018.

Conclusion

The PPA program provides a supportive college environment, empowers students with the resources to succeed academically and professionally, provides the participants with positive role models, and creates an open and inclusive community within the department. Recruitment and retention of female and Hispanic students is feasible once higher education institutions recognize the reasons for attrition rates and create and support programs that counteract their existence. Modeling the PPA program components will result in positive outcomes for recruitment and retention of female and Hispanic students in STEM.

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