AC 2010-2242: CALWOMENTECH PROJECT: RECRUITING AND RETAINING WOMEN IN TECHNOLOGY PROGRAMS

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CalWomenTech Project: Recruiting and Retaining Women in Technology Programs

Abstract

The Institute for Women in Trades, Technology Science's (IWITTS) CalWomenTech Project is being highlighted by NSF following an expert panel review at the three year mark in December 2008 for demonstrating significant achievement and program effectiveness to the Committee for Government Performance and Results Act (GPRA) Performance Assessment, where it has also been very well received. Project outcomes show that colleges that proactively recruit women into their technology programs will show a significant increase in the percentage of women students in those programs in a little over a year. Of the four community colleges participating in the Project's first cohort, the two sites that implemented recruitment strategies within recommended timelines experienced a significant increase in women in targeted programs: City College of San Francisco's (CCSF) Computer Networking and Information Technology (CNIT) program went from 18% to 30% female students and San Diego Mesa College's Geographic Information Systems program rose from 35% to 50% female.

The retention strategies implemented by CalWomenTech colleges have also led to a significant net increase in the completion rates of not only females, but also males, in several of the colleges. Both colleges that saw the largest increases in female completion rates, from 81% to 100% in 15 months (San Diego Mesa College) and from 57% to 100% in 9 months (Evergreen Valley College), also saw a 20% increase in male retention. CCSF's CNIT program saw a significant improvement to completion rates after repeated focus on retention with both full-time and adjunct faculty. Female baseline completion rates increased from 64% in 2006/2007 to 90% in spring 2009. CCSF's male retention rates also increased from 72% to 88%.

In addition to providing an overview of proven CalWomenTech recruitment and retention strategies and the online CalWomenTech tools available to all educators, the paper also shares the newly compiled results from surveys of 60 female students in technology courses in which they are underrepresented and describes how the results have been used to evaluate and inform recruitment and retention strategies employed by the colleges.

CalWomenTech Project Model

The intent of this NSF initiative is to broaden the participation of girls and women in Science, Technology, Engineering, and Math (STEM) education. In particular, the extension services are to "provide consulting services to educators and institutions, to enable them to adopt and embed proven gender-inclusive policies and practices in pedagogy, the design of curriculum materials, student support programs, educator, and faculty development."[1] The first goal of the CalWomenTech Project is to increase the number of women enrolled and retained in STEM education in the eight selected CalWomenTech community colleges. The second goal is to institutionalize gender equity strategies in each participating college to make sure that the successful recruitment and retention strategies are used beyond the life of the project. The third goal is to illustrate to the California and national community college system that STEM gender

equity strategies increase recruitment and retention of women in STEM courses, through both state and national dissemination of the project.

Anticipated outcomes include:

- Increased enrollment of women by an average of 10% to 15% in targeted STEM classes.
- A retention rate for females that is comparable to males in targeted classes.
- CalWomenTech recruitment and retention strategies incorporated directly into the college's regular practices.
- Dissemination of successful CalWomenTech strategies statewide and nationally via the mainstream education system.
- Increased focus of the California community college system on recruitment and retention of females into STEM.

CalWomenTech project activities are organized into two tiers:

Tier One: Intensive extension services provided to eight CalWomenTech community colleges with technology programs in which women are under-represented. Extension services are provided via CalWomenTech leadership teams made up of eight to ten educators and administrators at each college.

Tier Two: Making web-based strategies available to the California community college system as a whole, including the eight CalWomenTech community college leadership teams.

In order to increase the enrollment and retention of females in targeted STEM courses at the eight CalWomenTech colleges, the Project trains the colleges in best practices related to recruitment and retention, helps them develop recruitment and retention strategic plans and then provides supportive training and technical assistance to the colleges as they implement their plans and institutionalize successful strategies. To measure the Project's progress towards meeting the stated outcomes of the CalWomenTech Project, provide the colleges with "real time" data on their outcomes, and to inform Project strategies Evaluation & Research Associates (ERA), the external evaluator of the CalWomenTech Project, collects enrollment and completion data for the targeted courses each quarter for analysis. Each college provides the total number of students enrolled, females enrolled, males enrolled, females completing, and males completing. ERA uses the raw data from the colleges to calculate the percentage of females in course, percentage of females completing and males completing, retention rate difference between females and males, and the increase from baseline in percent female enrollment and retention. [2]

The CalWomenTech Project embodies two core beliefs of the IWITTS organization. The first is that the vast majority of educators are eager to recruit and retain women in STEM; however, they don't know how and lack the time and resources to figure it out on their own. IWITTS believes that the more off-the-shelf, turnkey solutions can be provided, the faster the colleges will implement those elements that the CalWomenTech Project results show will result in successful outcomes. It is for this reason that each of the eight community college sites in the Project were provided with template marketing collateral already customized to the colleges' technology programs, rather than assistance in developing marketing materials and websites from scratch. Similarly, in the classroom, the CalWomenTech Project provides colleges with as many off-the-

shelf tools as possible. For example, the Project Learning Library mission is to provide building block technology skills to female (and male) students who may come with less experience than their classmates. One example of a library holding is a CD and workbook on spatial reasoning that NSF research has shown improves retention of women in engineering by teaching them this skill.[3]

The second core belief is that change will happen faster and be institutionalized if it is supported from the top down. To this end, IWITTS's focus is not just on STEM instructors, but also includes the key leaders, staff and administrators of the colleges in a variety of functions. For a more detailed description on the resources provided to educators and their female students through the CalWomenTech Project, please refer to a previously published paper on the Project.[4]

The IWITTS CalWomenTech Project Model utilizes a top down leadership team approach that has been used successfully in three of the organization's multi-site national projects. In the CalWomenTech Project each college has a key leader and a co-leader, along with a leadership team of about ten key players. The key leader, in many cases, is the dean that oversees the technology programs, the dean of workforce development, or is the head of the technology department. The co-leader is often a key instructor. The leadership team is made up of the dean or chair of the department of the targeted program, a minimum of two instructors in targeted technology courses (with one being an adjunct instructor when possible) and the director of counseling. Other possible members include the learning center director, tutoring center director, curriculum developer, articulation officer, recruitment director, outreach coordinator, public information officer, an equity/women's center coordinator, a school-to-career director, a research and planning officer, and other key stakeholders.

The leadership team model ensures that the entire college will work together to make sure women are recruited and retained in STEM programs, and that the STEM program will not be expected to take on functions outside of its normal duties. For example, in many of the colleges the public information officer has assisted with distributing a press release about the project, which has resulted in popular press including television coverage in two communities. In most of the colleges, the counselors and the outreach staff (when they exist) are involved in distribution of the posters and flyers and introducing students to the CalWomenTech section of the school website. Having a dean or chair of the department involved facilitates bigger picture changes, such as the introduction of a spatial reasoning course at one of the colleges on an accelerated timeline, the hiring of female lab assistants, and creating additional open lab hours at another. The leadership team model also increases the likelihood that the changes that come about as a result of the CalWomenTech Project will be institutionalized and persist beyond the life of the project. While IWITTS has seen positive results based on the individual efforts of an instructor or administrator, those results are usually lost if that person leaves the institution or their responsibilities change. The CalWomenTech Project has successfully weathered the turnover of five key leaders/deans in two years in eight colleges, an indicator that the leadership team model is critical to success in community colleges that often see much turnover in key positions.

CalWomenTech Community College Site Descriptions

Eight California community colleges were selected in a competitive process. The community colleges were brought into the project in two groups of four, with the first cohort of colleges coming on board in June 2006 and the second in January 2008. Colleges had to choose particular programs such as game development and target specific courses in which they wanted to improve the recruitment and retention of female students.

The first four CalWomenTech community colleges and their targeted programs brought on board in June 2006 include:

- City College of San Francisco Computer Networking and Information Technology Program, with a focus on the new Digital Home Integration Technology Certification
- San Diego Mesa College's Geographic Information Systems Program
- Cañada College's new 3-D Animation and Video Game Art Program
- El Camino College's Air Conditioning and Refrigeration Program

The second cohort of colleges and programs, brought on board in January 2008 include:

- Evergreen Valley College's new Hybrid-Alternative Fuel Program
- Irvine Valley College's Electronic Technology Program
- Las Positas College's Welding and Automotive Technology Programs
- San Jose City College's Facilities Maintenance Technology Program

CalWomenTech Project Results and Strategies

In the CalWomenTech Project funded by the National Science Foundation (NSF), early indicators (increases in enrollment and completion numbers) show that community colleges that proactively recruit women into technology programs will have a significant increase in the percentage of women students in a little over a year's time. In the first year, the two sites participating in the CalWomenTech Project's first research group (a cohort of four colleges) that implemented project recruitment strategies within the recommended timelines had an increase in women in their targeted programs of 10% to 15%. In addition, a third college that was able to complete one of the four strategies (posters) before the fall semester had a smaller increase of 5%, while the fourth college that did not implement any of the strategies saw a decrease of -3%. After two and a half years of participation for the first cohort and one and a half to two years for the second cohort, six of the eight colleges have had increases in female enrollment with two colleges having significant increases of female enrollment. These two sites continue to implement recruitment strategies and to experience an increase in enrollment: City College of San Francisco's CNIT program went from 18% to 30% female students and San Diego Mesa College's GIS program went from 35% to 50% female (data through spring 2009).

Some of the recruitment strategies include:

- Printing and distributing posters featuring role models who were program graduates in the college's occupational area.
- Creating a website section devoted to recruiting women into the college's targeted program with role model, program, and labor market information and links to women in technology associations.

- Printing and distributing tear-off flyers with program contact information and a link to the website.
- Printing and distributing a tri-fold brochure highlighting role model graduates, and program and labor market information.

The retention strategies implemented by CalWomenTech colleges have also led to a significant net increase in the completion rates of not only females, but also males, in several of the colleges. Both colleges that saw the largest increases in female completion rates, from 81% to 100% in 15 months (San Diego Mesa College) and from 57% to 100% in 9 months (Evergreen Valley College), also saw a 20% increase in male retention. CCSF's CNIT program saw a significant improvement to retention after repeated focus on this with both full-time and adjunct faculty. Female baseline completion rates increased from 64% in 2006/2007 to 90% in spring 2009. CCSF's male retention rates also increased from 72% to 88%. All retention strategies were implemented in the classroom right away and did not require significant lead time, so their impacts could be seen at some colleges in only six to eight months.

The retention strategies that were implemented in the colleges with the biggest gains included:

- On-campus faculty trainings focusing on teaching to female learning styles and integrating female students into the classroom.
- Revising the program's curriculum to be more female friendly. Some changes included using more contextual examples that appeal to women, more collaborative projects, and ensuring female students spent equal time using the equipment in the labs.

The improved retention of both women and men in the classroom across the community college sites has been a major highlight of the CalWomenTech Project, which IWITTS attributes to classroom strategies employed by instructors that have positively impacted female and male students alike. Interestingly, none of the CalWomenTech sites have focused on implementing traditional support strategies for retention—such as developing a Women in Technology club or support group—at this point in the Project, making it easier to identify what caused the increase in retention rates. The evidence and cause of the improved retention strategies are taken from the following sources: 1) college completion data available through spring 2009 across colleges; 2) the results of a survey of female students in targeted programs across seven of the eight colleges (n=60) asking them which retention strategies they have experienced and asking them to rate them; 3) the retention strategic plans of the colleges; and 4) retention training provided to the college sites.

The IWITTS Project model is to provide CalWomenTech Leadership Teams made up of eight to ten technology faculty members, counselors, and administrators with training on recruitment and retention, exposing them to a wide menu of strategies. The CalWomenTech teams then select which strategies they want to implement in the coming year—selecting a minimum of three strategies in each area. By the spring of 2009, none of the colleges had chosen to focus on implementing support strategies for women—such as creating a Women in Technology club or providing mentoring. Instead all of the colleges focused on classroom strategies to increase retention. All of the colleges received initial training on retention and almost all the colleges had a follow-up training with faculty, conducted by CalWomenTech during a site visit. The CalWomenTech Project was successful in getting both permanent staff and most adjuncts to

attend by paying for a working lunch and by paying adjuncts their customary hourly rate to attend at need.

The results of the female technology student survey administered in spring 2009 by Evaluation & Research Associates (ERA), the external evaluator of the CalWomenTech Project, are invaluable in determining which classroom strategies the women are currently experiencing, those they find most helpful, and those they would most like to experience going forward. Fifty percent or more of the survey respondents reported exposure to 12 of the 20 classroom retention strategies listed in the survey. It appears that instructors in the targeted classes have implemented over half of the 20 recommended strategies in their classrooms at this point in the Project, and after seeing the survey results many instructors have committed to making those strategies female students would most like to experience a part of their regular teaching strategies.

Further evidence that classroom strategies are among the Project's most effective strategies is that they have impacted the retention of both women and men. If the colleges had chosen female-only support strategies (e.g. Women in Technology clubs) the data would not show such a positive impact on the retention of male students.

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Survey of Female Technology Course Students on Successful Implementation of Classroom Strategies

The CalWomenTech college/site completion data provided by the external evaluators and the results of the "Survey of Female Technology Course Students" administered to women in the targeted classes across seven of the eight colleges provides evidence that classroom strategies (e.g. learning style, appealing to female interests, a positive classroom environment, etc.) appear to be succeeding in improving retention rates of female (and male) students. This is the first time as far as the CalWomenTech PI knows that female students in technology courses have been surveyed on what retention strategies they have experienced in their courses and which ones they feel are most helpful. Sixty female students responded to the anonymous survey out of the 121 female students enrolled in the targeted courses at the seven colleges that distributed the survey. The CalWomenTech Project has no way of determining the unique number of female students enrolled in the targeted courses as some women take multiple courses and the college data collection systems are not set up to take this into account. All female students were instructed to take the survey only once.

One of the most important outcomes of the female student survey has been that the leadership teams at several colleges have incorporated the survey results into their strategic plans (e.g. Evergreen Valley College is working on adding more hands-on elements to an introductory course curriculum). Colleges were provided with the female survey data filtered for their college to start. At the annual Project Partner Meeting in September 2009 attending Leadership Team members saw the compiled survey results across colleges.

Instructors exposed to the results during a site visit or monthly conference call came up with ways to start incorporating the strategies female students requested in their classroom. For example, a San Diego Mesa College instructor came up with a plan to start assigning leadership roles in group projects randomly by drawing straws to avoid men taking the leadership role in groups more often than women after she saw how many women wanted to try out a leadership role in class.

Important to note is that the factual data from the female student survey results did not always match the preconceived ideas of the leadership teams when it came to what they considered the most important strategies, and in some cases the results caused the team to go in a different direction with their college's strategic plan after seeing what the female students really found most helpful. For example, as part of their recruitment strategies many of the colleges chose to focus on recruiting high school students to their technology program and put some emphasis on recruitment events at local high schools. After seeing how few students entered the technology courses after attending an event at a high school (only 2% across seven colleges) and seeing how effective word of mouth can be in recruitment (88.7% of female students said one way they heard about the program was from a peer, instructor, or counselor), several colleges deemphasized their efforts to recruit at high school events and came up with new word of mouth strategies internal to the college. For example, instructors at Evergreen Valley College encouraged their female students to recommend the program to a female friend and City College of San Francisco posted a recruitment message to Facebook to take advantage of online word of mouth through social media.

The results from the recruitment portion of the "Survey of Female Technology Course Students" are important because they allow the colleges to see exactly how female students learn about and become motivated to try out a technology course, and this has affected the recruitment strategies the colleges have chosen to focus on going forward. In the recruitment section the female students were asked, "Prior to enrolling in technology courses, please indicate the activities you attended or information you saw or received about technology courses or programs at your college." Students were allowed to mark multiple recruitment activities with a "yes," "no" or "not sure." After word of mouth, the other top strategies include the "CalWomenTech Role Model Posters" (18%) and "Other" (40.5%). The 21 responses under "Other" vary from the "college class schedule and web site" and "Google/online" to "was inspired by my father and the need to support my daughter" and "looked at a game education magazine." The recruitment portion is the smallest section of the survey because the larger focus of the survey is to inform instructors and administrators what retention strategies students are experiencing, which they find most helpful and which strategies they are not experiencing but would most like to experience.

What follows in Figure 1 is the "Retention Activity/Strategy" portion only of the "Survey of Female Technology Course Students" (aggregate across seven colleges of the eight colleges, as City College of San Francisco did not participate).

Figure 1. An Excerpt from the "Retention Activity/Strategy" Section of the Survey

Please indicate the level of helpfulness the following activities or strategies have had on your decision to remain in your courses or program. If you have <u>not</u> experienced the choice, please indicate whether you are interested in experiencing the activity or strategy in the future, by selecting either "Have not experienced, and I am not interested" or "Have not experienced, but I am interested." Otherwise, indicate how helpful the activity or strategy was.

Note: Activities and strategies are ordered by fre*quency of "Helpful" and "Very Helpful" responses. Items total 100 percent within "Have Experienced" and 100 percent within "Have Not Experienced."*

Retention Activity/Strategy	Have Experienced			Have Not Experienced		
	Rated Helpful or Very Helpful	Rated Not helpful	Count	Interested	Not Interested	Count
Learned basic skills needed for the course during the first few weeks of a course	100.0%	0.0%	49	50.0%	50.0%	6
Instructor demonstrated or modeled before we did lab activities	98.1%	1.9%	52	66.7%	33.3%	3
Was taught modules or small sections of instruction focused on one aspect of a course	97.4%	2.6%	39	53.3%	46.7%	15
Used software to help me with problem-solving	97.0%	3.0%	33	54.5%	45.5%	22
Helped with tool identification and use	96.9%	3.1%	32	60.0%	40.0%	20
Participated equally with males during hands-on activities	95.7%	4.3%	47	44.4%	55.6%	9
Taught the process of problem-solving	93.8%	6.3%	32	56.3%	43.8%	16
Personally received encouragement	93.2%	6.8%	44	54.5%	45.5%	11
Female role models (examples) used in my courses	92.6%	7.4%	27	62.1%	37.9%	29

Retention Activity/Strategy	Have Experienced			Have Not Experienced		
	Rated Helpful or Very Helpful	Rated Not helpful	Count	Interested	Not Interested	Count
The "big idea" or theory was given before starting to learn specific concepts	91.5%	8.5%	47	100.0%	0.0%	8
Took an extra course(s) that helped build my skills needed for the course or program	89.3%	10.7%	28	66.7%	33.3%	27
Worked in small groups	87.8%	12.2%	41	86.7%	13.3%	15
Provided with lab time with female staff or extra lab time	83.3%	16.7%	24	54.8%	45.2%	31
Had a mentor (virtual or in-person)	83.3%	16.7%	30	64.0%	36.0%	25
Partnered with other females in courses	77.8%	22.2%	27	51.7%	48.3%	29
Participated in exercises that reward guessing and intuition	76.7%	23.3%	30	43.5%	56.5%	23
Received tutoring or extra help with math used in the course or program	66.7%	33.3%	15	43.9%	56.1%	41
Put into a leadership position (in a small group or large group)	66.7%	33.3%	18	60.5%	39.5%	38
Other strategy, please specify below.	66.7%	33.3%	3	41.7%	58.3%	12
Used software to help me with math used in the course or program	62.5%	37.5%	16	35.9%	64.1%	39
Subscribed to an email discussion group related to women in technology	46.2%	53.8%	13	63.6%	36.4%	44

Some general observations about the female survey follow:

- 50% or more of the respondents reported exposure to 12 out of the 20 retention strategies.

- Of those females who experienced the strategies, 19 out of the 20 strategies were rated as helpful or very helpful by at least 63% of the female students. Half of the strategies were rated helpful or very helpful by 90% to 100% of the students.

- Many of the students who did not experience the strategies wanted to do so. Of those strategies the female students did not experience, the top three strategies they most wanted to experience included learning the "big idea" or theory before specific concepts (100%), working in small groups (87%), and taking an extra course to build skills for the program (67%). The top two strategies that the largest n of female students had not experienced—and most wanted to experience—included being put in a leadership position (73% of women had not experienced this strategy and 61% of those 38 wanted to) and subscribing to an email discussion group related to women in technology (63% of women had not experienced and 64% of those 44 wanted to).

- Overall, most of the female student respondents had experienced many of the instructor classroom strategies and found them helpful and those that hadn't experienced them wanted to. This indicates that these instructor classroom strategies for retention are welcomed by the women that they are intended to impact.

Figure 2. Excerpts on Classroom Environment from the Retention Section of the Survey

Question 3) Overall, how would you describe the classroom environment in your technology course(s)?

Choice	Number of Respondents	Percentage of Respondents
Very positive	43	72.9%
Slightly positive	8	13.6%
Neutral	8	13.6%
Slightly negative	0	0.0%
Very negative	0	0.0%

Not answered = 1

Question 4) Have you ever had a negative experience in a technology course?

Choice	Number of Respondents	Percentage of Respondents
Yes	13	22.4%
No	45	77.6%

Not answered = 2

Question 5) Would you recommend another female enroll in your technology-related course or program?

Choice	Number of Respondents	Percentage of Respondents
Yes	59	100.0%
No	0	0.0%

Not answering = 1

The survey indicates that overall females feel that their technology classrooms provide a positive classroom environment—73% find it to be very positive and none rated the classroom environment as negative; however 22% had some kind of negative experience in a course (mostly a poor teacher) that they did not extrapolate to their experience as a whole. One hundred percent of the female student respondents would recommend another female enroll in their technology program. Three students did report a gender issue: 1) "My teacher called me gal." 2) "One of the guys asked me what was I doing in a [course type] class because I don't know to [skill] at all." 3) "Verbally harassed by other male classmates while attending [course and college]."

When the Project's external evaluator did a cross tabulation between those "female students that had a negative experience with those that had ever dropped out of a technology course they discovered that of those (22%) who reported a negative experience, 69% dropped out compared to the dropout rate of 6.7% among the population of respondents who did not report a negative experience. The fact that 69% of the female students that dropped a technology course had a negative experience at some point may indicate how important a positive classroom environment is when it comes to retaining female students.

The women who took the female technology survey are a racially diverse group, reflective of California's community college population.

Figure 3. An Excerpt from the Demographic Section of the Survey:

Question 12) What is your ethnicity?

Choice	Number of Respondents	Percentage of Respondents
Caucasian/European American	19	32.2%
Latina/Hispanic	15	25.4%
Multi-racial	10	16.9%
Asian and/or Pacific American	8	13.6%
Black/African-American	3	5.1%
American Indian/Alaskan Native	2	3.4%
Other	2	3.4%

Not Answered = 1

Conclusion

The CalWomenTech Project, in a relatively short period of time, has assisted community colleges in increasing the number of women in STEM programs in which they are underrepresented and in retaining them. The first cohort of colleges has been involved in the Project for two and a half years; the second cohort has been involved for one and a half to two years. Six of eight colleges have had increases in female enrollment with two colleges having significant increases of female enrollment. Five of eight colleges have increased female and male completion rates substantially, with four of the eight colleges having nearly equal retention rates for female and male students. It is expected that by the end of the Project's five years, all of the colleges will have had considerable increases in female enrollment and equal retention rates of female and male students.

The CalWomenTech Project is one of very few gender and STEM Projects to have succeeded in showing an actual increase in female enrollment and completion in STEM, as measured by an external evaluator. Many of the project elements and principles that have proven successful in the CalWomenTech Project for recruiting and retaining women to STEM would be similar whether working with two year or four year colleges. One of the few differences might be the types of building block skills that women at two year versus four year colleges may need extra instruction in; however, something such as 3D spatial reasoning can be taught in either automotive technology or engineering.

In year four, the CalWomenTech Project conducted a survey of female students in targeted technology classes across seven of the eight CalWomenTech colleges on what recruitment and retention strategies have proven most effective and helpful (n=60) to gain qualitative insight into what female community college technology students find most helpful and effective in their recruitment and retention. To the Project's knowledge, this type of research on what community college female technology students and community college technology programs need in the areas of recruitment and retention has not been conducted before and provides a unique source of strategies to the wider educational and gender equity community.

In spring 2010, the CalWomenTech Project intends to redistribute the survey to the female students in the targeted technology courses at all eight of the CalWomenTech colleges, and to include incentives to instructors for distributing and female students for filling out the surveys (no incentives were provided for the spring 2009 distribution).

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