AC 2007-2185: PROVIDING A SUPPORT COMMUNITY FOR FEMALE ENGINEERING STUDENTS THROUGH A PEER COACHING PROGRAM

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Providing a Support Community for Female Engineering Students Through a Peer Coaching Program

Abstract

Although women earn 20% of the engineering degrees conferred, only 8.5% of the engineering workforce is comprised of women[1]. Studies report that stress, travel and the long hours associated with engineering related careers are among the reasons women feel discouraged from continuing their career in engineering; a discrepancy exists between the percentage of women in similarly demanding careers, such as in medicine and law[2] [3]. It is likely that male-dominance and lack of confidence are the primary culprits for the attrition of women in the engineering pipeline and in the engineering workforce. Considering that 47% of the general US workforce is comprised of women, continued and increased efforts are needed to amplify the number of women entering the engineering workforce. Like many institutions, Embry Riddle Aeronautical University (ERAU) has struggled to attract and retain women in its engineering programs. The university is working to increase female participation in all aspects of the College of Engineering through the EmpowER (Empowering Women at Embry Riddle) program. One component of the comprehensive program EmpoWER is to provide peer-aged, female mentors to warm the climate and to provide the support network in which women thrive.

For women to succeed in a demanding and vigorous program such as engineering, it is essential that they feel part of a community, are encouraged, supported, and feel successful[4] [5]. ERAU's CoE, (College of Engineering), 2+2 Coaching Program initiated this academic year, 2006-2007, provides those elements.

ERAU's CoE Coaching Program provides the opportunity for female engineering students to meet, to network, and to support one another. The program pairs upper level students with incoming freshmen. They are divided into groups of five or six, split into two to three mentees and two to three coaches. The grouping was random unless a coach or mentee placed a specific request for a teammate.

The coaching groups are to serve as a social, academic, and support network for any female student that wishes to participate. Many of incoming freshmen female students are overwhelmed by the lack of female peers. It is quite common at ERAU to be the only female student in a class of 30-40 students, regardless of their degree program. It is also quite common to complete four years of engineering education at ERAU without ever having a female professor. As a new student into college that can be a sobering and frightening four year journey. The coaching program has been developed to facilitate female students establishing that much needed network of peers and faculty as early as possible. As the program evolves, mentees will return to become the coaches to a new class of freshmen. Participant will spend 2 years as a mentee and then 2 years as a coach. This will establish a much needed open and sustainable network for the

success of our students.

The 60 first year female engineering students who enrolled for the fall 2006 semester were assigned in pairs to, at minimum, two upper class coaches (in junior or senior standing). This provided a team atmosphere and provided the first year students with several contacts, both same-aged and older, for academic and social support.

The program was initiated with a kick-off event that consisted of a teaming ice-breaker in the form of a clue oriented race and a science "trivia" game. The turnout for the event was a success, with over 40 female engineering students in attendance – roughly 20% of the female engineering students on campus. In addition to the initial event, the program consisted of monthly events throughout the semester (to which all coaches and mentees were invited to attend) and monthly meetings with the coaches and supervisors. The coaches are encouraged to meet with their mentees on a weekly basis. Although the weekly meetings between coaches and mentees was not regulated, the feedback for the program has been encouraging, with many coaches meeting with their mentees on a consistent and frequent basis. This paper will provide the details of the program, including the large and small scale events and how to implement a similar program at any university. An assessment of the program and how well it meets the program objectives of the EmpoWER Program will also be discussed.

Background

Like many institutions, Embry Riddle has struggled to attract and retain faculty and students from underrepresented groups. One goal of the EmpoWER (Empowering Women at Embry Riddle) program is to implement permanent and effective institutional transformations necessary to attract and retain women faculty and students in the College of Engineering (CoE), and STEM (Science, Technology, Engineering, and Mathematics) programs, which in turn will directly increase the number of female students in the engineering programs at Embry Riddle Aeronautical University (see Figure 1). The EmpoWER program is designed to increase interest and participation of women at all academic levels from middle school through graduate school and beyond.

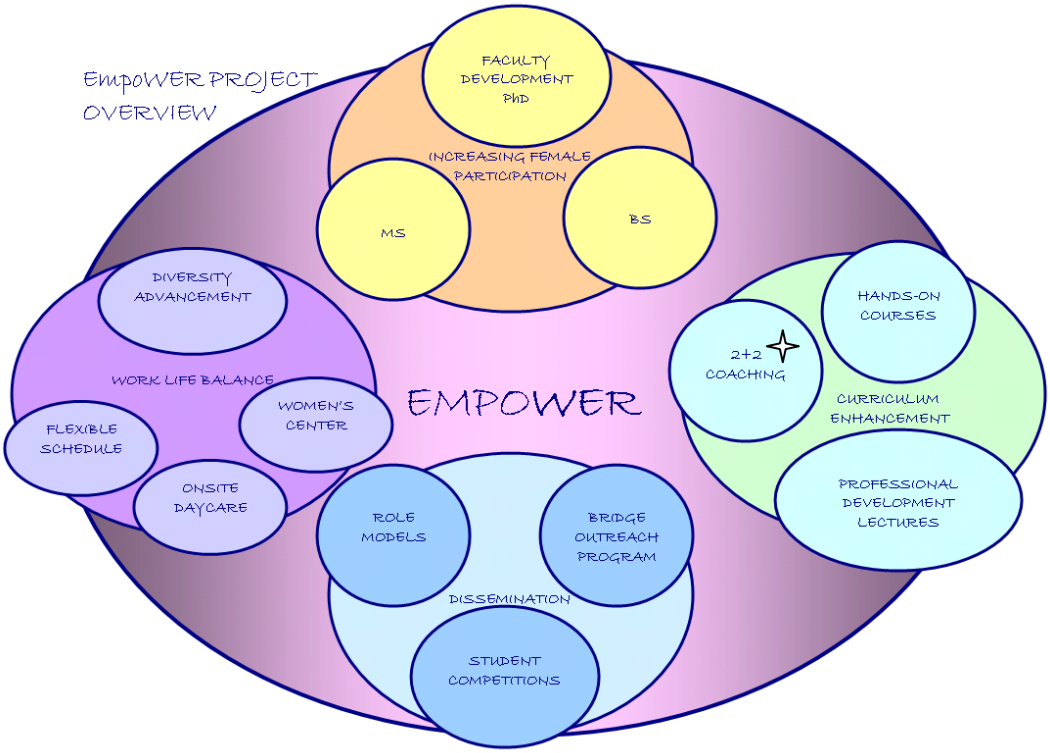

Figure 1: Components of EmpoWER Program

The CoE Coaching program is one component of the EmpoWER curriculum which focuses on the retention of the female students enrolled in the College of Engineering. Students from all disciplines in the College of Engineering are included in the coaching program. The majority of these students are currently enrolled in the Aerospace Engineering program; they represent 85% of our engineering students. Like most engineering disciplines, the Aerospace Engineering field has very poor female representation nationally[6] [7]. ERAU has even lower levels of participation (see Table 1). The goal of the CoE Coaching Program is to increase these numbers for ERAU by improving recruitment and retention of female engineering students.

Table 1: Female Representation in Engineering

	Undergraduate	**College/University Faculty**	**Workforce**
National	18%[6]	21%[6]	6%[6]
ERAU	14%	0%*	-

* 7% are non tenured instructors, 0% are tenured/tenure track faculty

It is difficult to attract young women into STEM fields, engineering in particular, and once they begin their academic career in a STEM field, it is quite easy to lose them. One reason for this is a lack of connection they feel towards their classmates, teachers,

college and university[5]. The goal of this 2+2 coaching program is to create a more welcoming and accepting environment for female engineering students to improve their success and retention in the engineering field. It has been demonstrated that when offered an improved academic environment, women are able to persevere and succeed more than when in traditionally "chilly" academic environments[4]. In order to facilitate an improved connection between female engineering students as well as between female engineering faculty and students, the CoE 2+2 Coaching program was initiated. The CoE 2+2 Coaching program provides female students a vehicle to network with each other and with the few female engineering faculty, bond outside of the classroom, and create a support network that will increase the likelihood of their success here at ERAU, in the classroom, and in the engineering workforce.

CoE Coaching Program Description

The concept of the CoE 2+2 Coaching program was included in the EmpoWER Program proposal written for NSF. The entire EmpowER program has yet to be implemented (pending grant approval), however, it was decided to implement the coaching program on a pilot basis during the 2006-2007 academic year.

The objective of providing the venue to improve connections between female engineering students as well as between female faculty and students was accomplished through two facets of the program: large group meetings with all Coaches, Mentees and Female Faculty and small individual team meetings between Coaches and Mentees.

To ensure success of the program, several departments from across campus were also involved in the design and implementation of this program: First Year Programs, the Women's Center, the College of Engineering, Freshmen Engineering, and the University Provost.

First Year Program (FYP) was able to provide a complete list of names with contact information of all first year female engineering students. This increased the chances of early contact with the new students. All of our first year students received a personal letter from two female faculty members and the freshmen engineering department welcoming them to campus and informing them of the coaching program. The letter also contained information about the two faculty members and encouraged the students to call or email if they had any questions or concerns. Emails containing the same information were also sent. Student response was immediate, they began to call and email within days. All respondents were able to RSVP for the coaching program and ask questions about Embry Riddle and its College of Engineering.

FYP also stressed the importance that the initial activities be fun and educational but in no way contain a heavy agenda. As this program was to be purely voluntary, it was essential that students were well informed, excited and engaged by the activities, and not pressured to join or be lectured to. FYP helped to generate ideas of activities that would keep the program fun but still provide the much needed networking skills, an avenue to establish study groups, an opportunity to bond with faculty, and establish a

guided social network.

The Freshmen Engineering Department supplied all funding required for the initial event; the initial budget is included in Appendix A.

Large Group Meetings:

The Coaching Program was initiated with a kickoff event, Mentoring Madness, all female engineering students (first year, sophomore, junior, and senior levels) were invited. Mentoring Madness was comprised of 2 events – a clue based race (patterned after the TV show "*The Amazing Race"*) and a science trivia game (patterned after the TV game show *"Distraction"*). Food and beverages were available to help establish a social atmosphere. This event was held the first week of classes and was announced prior to the start of classes via an email and a letter to the students. Students were sent out a reminder email the week of the event. Most of the women, faculty and staff, associated with the College were involved in the implementation of the event (in particular, the race). This allowed all of the first year students to meet these women and establish initial contact in a fun, social context reducing the sense of isolation and increase the sense of community.

The mentoring groups, which would be maintained throughout the semester, were formed at this initial event. Two or three Coaches (sophomore, junior, or senior level students) were randomly grouped with two to three Mentees (first year students). Coaches were also able to request certain Mentees they already knew (i.e. athletes who already were acquaintances). To prevent a lengthy and awkward method of grouping, color coded name badges were made up prior to the start of the event. Each individual group of five students (Coaches and Mentees) had the same color badge. Tables were designated for each group with a matching color sign.

As previously mentioned, the event consisted of two parts. The first part was a team race modeled after *"The Amazing Race"* television show. The Coach/Mentee Teams were handed an initial clue card which lead to various locations on campus; locations were hidden within riddles the teams had to decipher. Sample riddles have been provided in Appendix B. It was essential to get the teams interacting immediately, in order to break the ice and create immediate relationships, so the race served as an ideal means to get the students talking and working together.

Once the location was determined and the team arrived, an additional clue card was given for the next stop on the race. Each team had five locations to visit; each team had a different combination of locations so as to prevent teams from following each other. Clue cards were also color coded to match the team colors so staff personnel could determine which card to hand out. The race was a huge success - engaging the young women with an event requiring mental acuity, teaming, and campus involvement.

One of the stops for the all teams in the race was the Dean of the CoE, most students will spend four years here and never really get the opportunity to meet the Dean. Of

those who do, few will feel comfortable interacting with the Dean. This race afforded the opportunity to establish this important relationship early with the first year students while introducing them to the important survival skill of networking.

The race also served to orient the first year students with the campus, the faculty, and the staff in a more interactive way than the typical tour. The Dean of the College of Engineering, the director of the women's center, and the director of the first year program were a few of the participants involved in handing out the clues. The winning team was awarded a gift certificate for dinner.

The second half of the event consisted of another competition modeled after the television game show "*Distraction*." During the race, all teams selected a random card with an engineering symbol on it at one of the race locations. Matching cards were then drawn from a hat to select the team, Coaches and Mentees, to compete in the game show.

The two supervising faculty of the Coaching program served as the "game show" hostesses. The students were asked science and engineering related questions (relevant to a first year engineering student) while being "distracted". Sample questions have been provided in Appendix C.

The first round distraction required the three contestants to hula hoop while being asked questions; the Coaches were required to buzz in for their Mentees. The contestant with the least number of correct answers at the end of the first round was eliminated.

The second round was much more challenging. While asked questions the two contestants had eggs cracked over their heads by their Coaches. Goggles and ponchos were provided to protect the students' eyes and clothes. The winner of the round was awarded an Apple Nano iPod. Though this component of the event didn't require as much teaming it created a fun environment for the students to let their guard down and truly get acquainted. The audience members were kept engaged by taking turns spraying silly string on the contestants for each wrong answer. The three "*Distraction*" contestants were interviewed after the competition and all three agreed that they truly enjoyed it, despite the raw eggs and silly string. In a survey taken at the end of the semester, 89% felt that the kickoff event was a fun, useful event and served the goal of breaking the ice very well.

Throughout the semester, two additional large group events were held to further facilitate bonding and networking between students as well as faculty outside of the classroom. The other two events consisted of elimination poker tournaments. Participants (students and faculty) were grouped into tables of four or five participants and then given 40 minutes to play as many hands of poker possible. The style of poker played was left to the discrimination of the dealer, and all players who wanted to deal were given the opportunity. Beginner players were given guidance by the more experienced players. Absolutely no money was exchanged during the tournament. Poker chips were used as an indication of the tables' winners.

At the end of 40 minutes, the winners from each table were then gathered to one table to determine the ultimate winner of the tournament. Playful prizes were handed out to each participant. Light snacks and refreshments were also served at these events. Based on the survey given at the end of the semester, the poker tournaments were also a huge success and the only complaint was that there were not enough offered; 89% agreed that more mid-semester events should be provided so that more students would have the opportunity to participate more often.

Small Team Meetings:

The small team meetings were not supervised and left up strictly to the discretion of the Coaches and Mentees. The objectives of these meetings were to provide academic and personal support to the Mentees by the Coaches, as well as to serve as a bonding experience. The purpose of having more than one Coach per team was to prevent the possibility of the Coach from being overwhelmed or simply too busy to help. It also facilitated new friendships among the existing upper level students. The fact that each team had more than one Mentee also improved the likelihood that each Coach would have at least one student to help and to facilitate friendships among the first year students.

Assessment

Based on informal conversations between the supervising faculty and the CoE Coaching participants, the program was a success. Many of the students had suggestions for improving the experience, such as: grouping the Coaches and Mentees more thoughtfully rather than randomly, holding more mid-semester events, and holding bi-weekly Coaches and faculty meetings. Some Coaches did experience a difficult time trying to reach their Mentees, or felt the Mentees did not really need to meet with them. This was to be expected, however, as some students are more independent and make friends very easily. The targeted students were those that needed help, or just needed to know there was help available when it was required. To this end, the program was successful.

At the end of the term all program participants completed a survey about their experience in this pilot program. Several of the questions and associated results are provided below in Table 2 and Figure 2.

Table 2: Survey Questions

Questions:
Q1. The coach helped a mentee / the mentee was helped by a coach
Q2. Consider their coaching teammates their friends
Q3. Liked having two or more coaches (instead of just one) per team
Q4. Liked having two or more mentees (instead of just one) per team
Q5. Plan on participating next semester
Q6. Spoke often with their coaching teammates
Q7. Mentoring Madness was a fun and constructive event

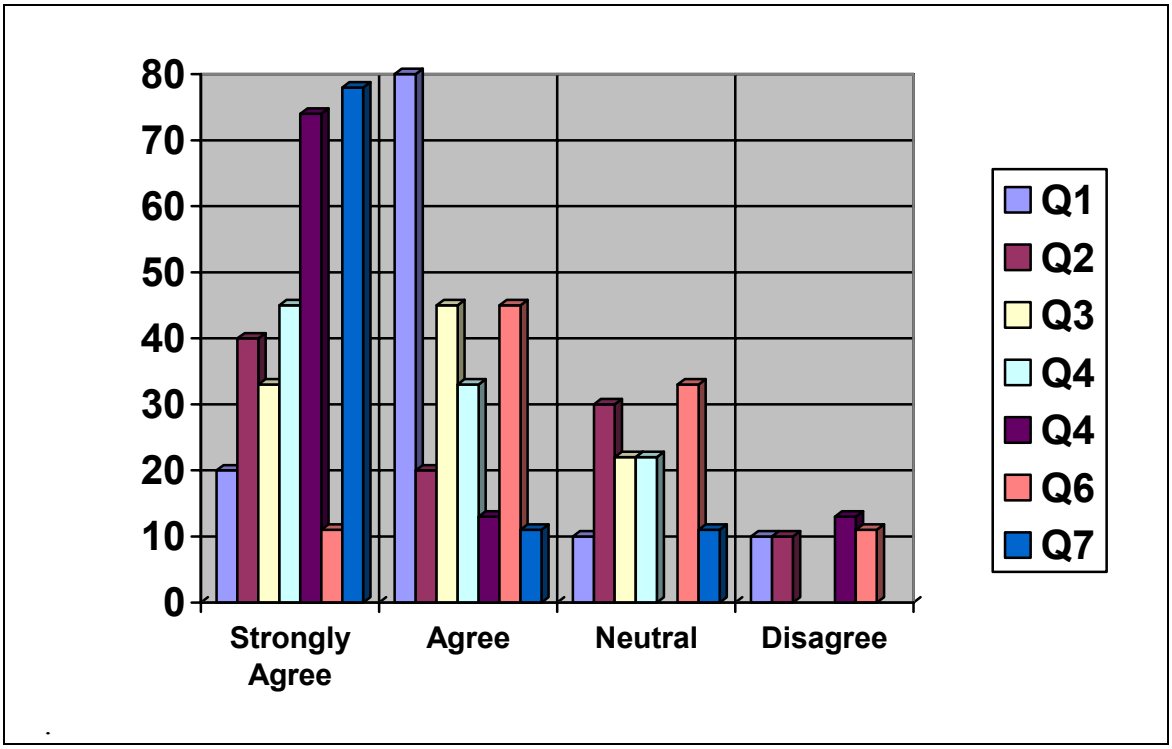

Figure 2: Survey Results

As the positive trend in the results indicate the participants of this program benefited from the experience. Many felt part of a community and had a sense of belonging at the end of their first semester. Many of the participants established critical relationships with upperclassmen and faculty. Both are strong indicators of success in retention of these students.

The program has continued through to the Spring 2007 Semester. The first scheduled

event for the Spring 2007 semester was Pictionary Pandemonium on the 13th of February. The event simply consisted of students and faculty playing Pictionary and socializing. Students also used this time with the faculty to express some concerns about their curriculum and other student activities. This student/faculty interaction is only possible once the students have learned to trust the faculty in order to feel comfortable speaking openly about their issues. This interaction is essential for many of the female students to succeed and it is this interaction which is one of the primary goals of the program.

The 2+2 Coaching Program will be implemented on a larger and permanent scale in the Fall of 2007 regardless of NSF Grant approval, and will be slightly modified to provide a continuous network of female engineering students through the first year to senior year at ERAU. Once established, only junior and senior level students will be coaches; junior level students will be assigned to first year students and senior students assigned to sophomores. As each student progresses, they maintain contact with their coach/mentee until the coaches graduate and the mentees themselves then become coaches. This is the concept of the 2+2 Coaching Program. Through this method, students will have a point of contact they can go to for the first two years, not solely the first year. They also have the opportunity to give back once they become the upper-level student and remain connected to the program, their peers, the faculty, and the University. It is also intended that once a strong program is established, the recruitment of female engineering students will be improved. Women considering engineering as an option may be more easily persuaded to choose engineering as their degree program if they are assured they will have this support network. The 2+2 Coaching Program members can also serve as a vehicle for outreach to elementary and middle school students, thus initiating the recruitment at a much earlier and more critical age.

Appendix A – Semester Budget

Event		Cost
Mentoring Madness/Distraction Game Show		
o Food/Beverages		$200
o Props for Entertainment		$50
o Prizes	Ipod Nano $200	$300
	Gift Certificate $100	
Mid Term Events		
o Miniature Golfing		$240
o Game Night		$100
o Poker Tournament		$110
o SoDuKu Tournament		$115
o Bowling		$150
End Term Event		
o Pot Luck Dinner/BBQ Banquet		$130
TOTAL		$1245

Appendix B – Sample Riddles

Riddle:

At the top of the circle, by the Wright flyer's Plane
You can't make a Sound to continue the game

Find a computer here; type in the keywords
You'll find them above, even the third

Once you find the lone entry, you'll know where to walk
To find the next clue, and to whom you must talk

Answer:

The Wright Flyer's Plane is directly in front of the Jack Hunt Library, which has a circular drive in front of it for cars to drop off and pick up students. The students needed to type in "Wright", "Plane" and "Sound" using a keyword search (notice these words are the only ones capitalized other than at the beginning of the sentence). Only a single record is listed at our library with those keywords, and the record is in videotape form. Students would then know they need to go to the audio-visual department of the library to obtain their next clue. The on-duty librarian handed them their next clue in lieu of the video when they asked to check it out.

Riddle:

As a first year student
You will have to do little
To unscramble this clue

Find RANDI CHIRCOLS
He'll know what to do

Answer:

The DooLittle Annex houses the First Year Programs Office, which is supervised by Richard Nicols (Randi Chircols unscrambled). First year students are required to meet with their First Year Programs Counselor three times during their first semester at ERAU. They cannot register for the following semester until they have met with their counselor; thus, it is important they know where to find this building.

Appendix C - Sample Distraction Questions

Round 1:

How many sides does a cube have?	6
What is one half of one half?	1/4
Which atomic particle is negatively charged?	Electron
What substance has the molecular formula H -2 -O?	Water
What is the nearest star to earth?	The Sun

Round 2:

Is pi rational or irrational?	Irrational
e raised to the natural log of 5 equals what?	5
A vector has magnitude and what?	Direction
What year did a human first land on the moon?	1969
What force always opposes motion?	Friction

[1] U.S. Department of Labor
[2] http://www.abanet.org/legaled/statistics/stats.html,
[3] http://www.aamc.org/data/facts/2005/factsgrads1.htm
[4] Ginoria, Angela. Warming the Climate for Women in Academic Science. American Association for Colleges and Universities, 1995.
[5] NSF and Goodman Research Group, Inc., Cambridge , Mass. – USA Today Article, Aug. 2003
[6] http://www.nsf.gov/statistics/seind98/access/c3/c3s2.htm
[7] http://www.nsf.gov/statistics/wmpd/tables/tabb-10.xls