Peer Mentoring Program: Providing early intervention and support to improve retention and success of women in engineering, computer science, and physics

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The College of Engineering (COE) and Montana Space Grant Consortium (MSGC) Peer Mentoring Program at Montana State University began as a pilot program in 2013 with two upper-division female peer mentors. Each of these women was assigned about 35 freshman female engineering, computer science or physics students. The program was an overwhelming success, and a survey at the end of the year indicated that 90\% of the freshmen women felt they had benefitted from the program and all the students wanted it to be offered to them during their sophomore year. Fall semester, 2014, the COE and MSGC implemented an expanded program jointly funded by the college and the consortium. The program was designed and managed by a female faculty member in Mechanical Engineering, the Associate Dean for Student Success in the college, and an academic adviser from the Department of Education. All eligible freshmen and sophomore females were included in the program and in all information and invitations sent out by the program, but their responses and participation were voluntary. In parallel with establishing a peer mentoring program, data has been collected to track if the program can improve retention of female students in engineering, computer science, and physics, and to inform decisions for improvement. Fall of 2014, 909 freshman students entered the College of Engineering. Of these, 123 (13.5\%) were women. In regard to ethnicity, Montana has a difficult time attracting ethnically diverse students: of the 909 entering students, 38 were international students, 36 were Hispanic, and 16 Native American, with only a handful of students with other ethnic backgrounds.

Research has established the value of peer relationships in the success of student satisfaction, integration and retention in higher education (Light, 2001; Newton & Ender, 2010a; Pascarella & Terenzini, 2005; Tinto, 2006). Largely as a response to increasing student populations, decreasing budgets and the expectation of higher student retention, peer programs (specifically peer advising/mentoring) have become increasingly popular strategies within universities to connect Freshman-Sophomore class students and provide the support they need. (Andrews & Clark, 2011; Colvin & Ashman, 2010; Monte et al, 2007). Both the literature and a review of current, successful peer advising/mentoring programs at other higher education institutions were important components to the design, purpose and strategic implementation of this College of Engineering (COE) and Montana Space Grant Consortium (MSGC) Peer Mentoring Program.
Colleges and Universities across the country and abroad have reported success in improving student retention both for mentee/advisee and also peer advisors/mentors (Andrews & Clark, 2011; Halpin & Halpin, 2012; Marra et al, 2010; Monte et al., 2007; Newton & Ender, 2010b). Specifically, Colleges of Engineering, mostly at large universities such as Cornell, UC-Davis, and University of Washington, have funded, developed and implemented dynamic peer advising/mentoring programs which provide helpful models for the field (Davis & Engineering, 2015; Engineering, 2015; Washington & Engineering, 2015). Key factors to the success of peer advising/mentoring programs are good planning, program oversight, ongoing training, funding, and strategic implementation (Attarzadeh et al., 2011; Minor, 2007; Newton & Ender, 2010b). Research shows the benefits of programs such as these in producing positive results in all disciplines, but specifically in regard to retention of women in engineering (Gattis & Farver, 2006; Gattis & Lachowsky, 2007). Additionally, research supports the benefits to under-represented minorities as well as the students who provide the advising/mentoring services to their peers (Halpin & Halpin, 2012; Johnson et al, 2011; Marra et al, 2010,). Even if mentoring programs have not shown a positive quantitative effect on retention, most mentoring programs have shown a qualitative positive effect on mentees (Colvin & Ashman, 2010; Johnson et al, 2011; Meyers et al, 2010).

Description of the Peer Mentoring Program

The College of Engineering and MSGC Peer Advising Program addresses retention of women in the STEM fields by assisting first- and second-year female students in engineering, computer science, and physics in skill building, personal networking, and learning inside and outside of the classroom. The overall goal of the program is to create an environment in which first- and second-year female engineering, computer science and physics students feel welcomed, prepared, and connected. More specifically, the program has the following objectives:

- Ensure that 1st and 2nd year female students see positive role models.
- Provide a well-informed, well-connected “helper” for 1st and 2nd year female students.
- Get 1st and 2nd year female students involved in study groups.
- Get 1st and 2nd year female students involved in student clubs and organizations.
- Get 2nd year female students involved in research/internships/study abroad programs.
- Increase 1st and 2nd year and 2nd to 3rd year retention of female students in engineering, computer science, and physics.

Experienced students were chosen to serve as guides for new students around campus and their departments. These Peer Mentors were paid $1,000 for the semester. The responsibilities of the Mentors were clearly defined:

- Assist students in self-understanding and self-acceptance.
- Assist students in skill building (decision making, study habits, interpersonal).
- Provide accurate information about institutional policies, procedures, resources, and programs.
- Refer students to other support services.
- Attend bi-weekly meetings/further training sessions throughout the semester.
- Accept that advisees are the final decision makers.

Each Peer Mentor was connected with approximately 20 mentees. Mentees were expected to
Active participation.
Remain open to considering the advice of others.
Be clear about personal responsibility.
Complete final course scheduling and make progress towards completing graduation requirements.
Assess and evaluate information for personal use.

Together, the Mentors and Mentees had the following shared responsibilities:
- Set the mentoring agenda (discussing clear expectations and boundaries).
- Practice honest communication and interaction.
- Accept the “take it or leave it” option without fear of diminishing the helping relationship.

Over the summer, the Peer Mentors participated in group training sessions involving reading, writing and discussion-based assignments in order to prepare to be successful Peer Mentors. Training materials used for the Peer Mentors included:


The weekend before Fall semester, 2014, all Peer Mentors participated in a half-day training session led by an adviser from the MSU Education Department and a networking session with department heads and key administrators in the college. The training session served as a method of connecting Peer Mentors to training materials selected to provide mentoring foundations including: the Peer Mentor/Advisor Model (Newton and Ender 2010b), the Proactive Advising Method (Varney 2013), and Student Development Theory (Newton and Ender 2010b).

Additionally, the training strengthened self-awareness by leading Peer Mentors through a temperament education curriculum. Throughout the semester, the Peer Mentors met as a group every two weeks with the faculty mentor. During these meetings, the mentors discussed anything that had arisen during their one-on-one meetings with their mentees. One regular theme was ways to improve the number of responses they were getting from their mentees. In addition, during these meetings, the mentors heard presentations from the following key campus support services: the Dean of Student’s office, the Study Abroad office, the Office of Student Success, Montana Space Grant Consortium.

Each week, the mentors would email reminders to their mentees about their availability and willingness to meet, or update them of activities at the university that they thought they should attend. They would meet with their mentees, provide information, help facilitate small groups of learners, serve as role models and organize the occasional professional development events.

**Program Assessment**
At the end of the semester, the program facilitators, along with the college’s assessment specialist, designed two surveys to assess the success of the program in meeting the program objectives. The surveys were vetted and approved by MSU’s Institutional Research Board. Eleven mentors and 54 mentees responded to the web surveys, although only 53 mentees answered most of the questions.

The 54 mentees who responded to the survey were from several programs:

<table>
<thead>
<tr>
<th>Program</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioengineering</td>
<td>8</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>7</td>
</tr>
<tr>
<td>Computer Science</td>
<td>6</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>7</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>10</td>
</tr>
<tr>
<td>Mechanical Engineering Technology</td>
<td>1</td>
</tr>
<tr>
<td>Financial Engineering</td>
<td>2</td>
</tr>
<tr>
<td>General Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
</tr>
</tbody>
</table>

Mentees were asked about frequency of contact. Most mentees were contacted via e-mail by their mentors between 5 and 10 times during the semester and responded to that contact once or twice. Most mentors met with mentees in person once. Many mentees commented that lack of time precluded more frequent contact.

Mentees were asked to indicate their level of agreement with a list of statements. Means were calculated for these responses, with the following values for the rating scale:

<table>
<thead>
<tr>
<th>Strongly Agree = 5</th>
<th>Somewhat Agree = 4</th>
<th>Neutral = 3</th>
<th>Somewhat Disagree = 2</th>
<th>Strongly Disagree = 1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Statement</th>
<th>Average</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>My Peer Mentor was well informed about resources on the MSU campus.</td>
<td>4.38</td>
<td>53</td>
</tr>
<tr>
<td>My Peer Mentor was a positive role model.</td>
<td>4.21</td>
<td>53</td>
</tr>
<tr>
<td>My Peer Mentor was a good listener.</td>
<td>4.36</td>
<td>53</td>
</tr>
<tr>
<td>My Peer Mentor gave me good advice.</td>
<td>4.26</td>
<td>53</td>
</tr>
<tr>
<td>My first semester at MSU was a more positive experience because of my Mentor.</td>
<td>3.42</td>
<td>53</td>
</tr>
<tr>
<td>I think I’ll get better grades this semester because of my Peer Mentor.</td>
<td>2.91</td>
<td>53</td>
</tr>
<tr>
<td>My Peer Mentor helped me feel like I belong in my chosen major.</td>
<td>3.53</td>
<td>53</td>
</tr>
<tr>
<td>I would recommend a Peer Mentor to female friends I have in engineering.</td>
<td>3.89</td>
<td>53</td>
</tr>
<tr>
<td>I understand the purpose and benefits of this program.</td>
<td>3.94</td>
<td>53</td>
</tr>
<tr>
<td>My Peer Mentor motivated my involvement in a student club or organization.</td>
<td>3.43</td>
<td>53</td>
</tr>
</tbody>
</table>
The survey indicated that most mentees were not involved in a study group (36 of 53). More students were involved in a student club or organization (30 of 53). The most common clubs or organizations mentioned were: Engineers Without Borders, Association of Women in Computing, and the Alpha Lambda Delta Honor Society.

Mentees were asked about suggestions for improving the program. Most responded that they thought the program works as is; however, a few responded with suggestions:

- Maybe the peer mentors and their peers can all meet up sometime and get to know each other.
- Maybe more meetings with our mentors or more groups activities
- Don't do it just for women.
- I would recommend to keep the program, but to hold more events and create study groups and resources available.

The 11 mentors also responded to a web survey. The mentors indicated that they had spent between 1 and 4 hours a week being a mentor—more mentors responding on the low end of the time range. The majority of the mentors (8) said they contacted mentees between 5 and 10 times. The remainder (3) said they contacted mentees between 10 and 15 times. Seven of the mentors said that between 10 and 15 of their mentors had responded to their e-mail. Four said between 5 and 10. Mentors indicated that the most active of their mentees met with them in person once or twice.

Mentors were asked to indicate their level of agreement to a series of statements. Means were calculated for these responses, with the following values for the rating scale:

- Strongly Agree = 5
- Somewhat Agree = 4
- Neutral = 3
- Somewhat Disagree = 2
- Strongly Disagree = 1

<table>
<thead>
<tr>
<th>Statement</th>
<th>Average (N = 11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I felt prepared to be a Peer Mentor.</td>
<td>4.64</td>
</tr>
<tr>
<td>I enjoyed connecting with younger female students.</td>
<td>4.82</td>
</tr>
<tr>
<td>I think I gave my Mentees some good advice.</td>
<td>4.18</td>
</tr>
<tr>
<td>I think I contributed in a positive way to at least most of my Mentees' first semester at MSU.</td>
<td>4.55</td>
</tr>
<tr>
<td>Most of my Mentees seemed happy about their choice of major.</td>
<td>4.27</td>
</tr>
</tbody>
</table>
Mentors were asked if mentees had voiced thinking about changing majors and, if so, what reasons they had given. Some of those reasons are listed below.

- I had many General Engineering mentees, and those were the ones that thought about changing their major. Most changed to either civil or chemical, but I had one that was thinking about changing out of engineering because she wasn't sure it was the right fit for her, material wise.
- They felt that engineering wasn't right for them.
- A lot of my girls were really stressed at too many things going on and the immense workload of engineering.
- Wanting to pursue Medical School instead of Engineering
- I met with a couple girls who were on the fence between Mechanical and Electrical.
- One girl really enjoyed her Text and Critics class and considered switching to English, but she decided to wait and see if she likes Chemical Engineering first. Another girl is planning on switching to metallurgy because she has a passion for it, but thought she would give Chemical Engineering a try first.
- Not sure if the major was the right fit for her
- I have a large number of mentees who are in General Engineering. I also have a few mentees who have considered changing from civil engineering to mechanical or industrial engineering.

We also wanted to know how being a mentor added value to their college experience. Clearly, the comments indicated that the program benefits not only the mentees, but also the mentors.

- I have learned a lot more about the opportunities and resources provided to students. It has also helped me think about all the assistance I have had throughout college and made me try to mimic this for my mentees. It has also been nice to see that I can really help these girls either get ahead in their planning for school and career.
- It has given me a fresh perspective on the challenges the students go through during their first year.
- I feel like a great role model. I feel respected and praised for the work I do. It makes me feel like a vital piece to the COE and this university as a whole.
- I really enjoyed meeting the younger female students and feeling like I was making a difference for some of them. I like to believe that it was encouraging to them to talk to someone who has been where they are now and made it through the frustrations of transitioning from high school to college life and the challenges of the engineering curriculum. It was rewarding to feel like I was giving back to and supporting the community of female engineering students.
- It has been an opportunity to connect with some of the younger students that I now see and talk to around campus. Also, an opportunity to give back to the program. I was in the same place and wasn't sure about my major at some point as well, and I was able to relate and advise these women.
• Having positive role models was crucial to my experience and success at MSU. I've loved the opportunity to fulfill that role for some of these girls.
• It has opened me up to more of what MSU has to offer and has made me more aware of the needs of other students and ways I can help them. After I graduate, I will leave MSU more prepared to help those who are entering their first year of college; to encourage them to continue pursuing their degree and to help them stay in college.
• I am gaining so much more experience in communicating with others on a more personal level rather than a professional level.

When asked about the most challenging aspect of being a mentor, the most common response was getting mentees to participate. All of the mentors indicated that they would recommend being a peer mentor to other upper-class women in computer science, engineering, and physics.

The mentors had some good suggestions about improving the program. Some of their responses are listed below:

• More talk about methods of successful methods of contact and communication.
• I would say that the biggest thing that could improve the program would be a way reach out to the girls better. I think that all of the girls I met with were really on top of things and had their lives in order. I think that it is more likely that the girls that never responded to me are the ones more swamped with schoolwork and potentially more overwhelmed. I know it is not really possible to coerce people into participating in the program, but it was hard to mentor and help when so many never responded to my countless emails.
• It would be nice to have minutes of the meetings so when mentors cannot make a meeting they can still be kept in the loop of what was missed. Further information about the peer mentoring program should be given at orientations with encouragement to participate in meeting the peers who want to be there for the students, as well as engaging in the social events as a freshman to meet more people (or females) within their major.
• I think visits from some of the people that are resources on campus like the people from Student Success, or the Counseling office would have been more useful at the beginning of the program. Maybe the training could be a 2 day retreat or 1 full day rather than an afternoon and those sorts of people could present at that.
• Provide more advice on when to contact mentees about certain things. I liked having a specific goal to complete after our biweekly meetings. Also I think having smaller group sessions, maybe with the two or three mentors in the specific engineering fields might make it easier to have a thorough discussion of what is happening with our mentees.

**Changes for Spring 2015 and Beyond**
Overall, we consider the program a success. The value for the mentors is clear, and those mentees participating indicated that the program is working. However, the assessment results offer good guidance in regard to improvements for the future. For example, it was evident during from the Fall 2014 semester that many students who should have been targeted by the program were not included in the database of students identified as female.
freshmen/sophomores. For the Spring 2015 semester, this problem will be eliminated. The new list is likely to include some non-engineering majors; however, students can easily opt out of the program.

Based on the mentor comments, it seemed their biggest frustration was the ability to put all their skills to use, as it seemed that only about 25% of the women they contacted by email responded to meet with them. We are addressing this concern in two ways. Champ Change, a university participation reward system, will be offered to students who meet with their mentor (the assessment survey indicated that about half of the mentees would be motivated by Champ Change). The number of assigned mentees per mentor is being increased up to 60 students for some mentors to see if they feel busier and more useful with more students responding to their requests to meet.

The participation in the program seems lower than the previous year. The previous year it was run as a pilot program and official surveys and data were not collected. Based on an informal focus group meeting, the decision has been made to revert to the use of the titles Peer Advising Program, peer advisors, and advisees. We believe that the title change may have the subtle effect of making the program seem to be more of a useful information tool, as opposed to helping the students find their way. There was a sense from the survey responses that some students resist admitting they need a helping hand. A higher percentage of respondents expressed enthusiasm about then program than the percentage that actually participated. This implies that there may be barriers to students in setting up an initial meeting, or even have been students that did not get information about the program despite the best efforts of the college.

Perhaps the most exciting change anticipated for next year is the plan to expand the program to all students, male and female, in their freshman year in the college. Additionally, we would support a special transfer student advisor and continue to include the sophomore women in the peer advising program. We anticipate that these changes will help with the perception that “women need special help to succeed in engineering” and mitigate negative feelings associated with gender related programs. If this is a resource for all freshmen, then everyone will be at the same level. This will also allow for increased visibility and advertising of the program, as it can be presented and discussed in all freshmen and sophomore engineering classes. Behind the scenes we will control the ratio of advisor to advisee, providing more support for the women, however this would not be transparent. Nearly all students struggle or have questions when first entering college, preliminary results from our peer advising program have shown the value of expanding this to program to all entering freshmen.


