

Gender in the Workplace: Peer Coaching to Empower Women in the Classroom and as Professionals

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Gender in the workplace: Peer coaching to empower women engineering students in the classroom and as professionals

Abstract

Formal coaching approaches within higher education is a relatively new concept and holds great promise as a way for students to make decisions and to outline action items and means of accountability while facing challenges and/or moving forward through transitions such as successfully moving from an undergraduate degree program to the workforce. In this study, the concept of coaching is integrated into a women in engineering senior seminar class at a large Midwestern university in order to empower the students and to provide skills to navigate their experiences in an engineering workforce. Peer coaching is introduced and implemented through examples, training on key coaching skills, and five opportunities for the students to practice these skills with one another.

Mixed methods design is employed to identify emerging themes which can form the basis of future theories and research as well as to assess the effectiveness of integrating peer coaching into the classroom. Data analysis includes reflective journals from the perspective of serving both as the coach and coachee, pre- and post-course surveys, as well as weekly post-class surveys. While qualitative analysis aids in identifying theoretical frameworks for future studies, results employing quantitative methods are likely of most interest to practitioners who would want to evaluate the effectiveness of this pedagogical approach before implementation in the classroom. As a means of identifying future possible frameworks for further investigation on the impact of peer coaching on female engineering students, this study explores the following research questions: (1) How does student opinion about coaching transform through this class? (2) What new or revised perspectives do students gain, as both coach and coachee? (3) How does coaching equip engineering women for the transition to the workforce? Findings indicate that students' initial apprehension about coaching progresses into recognition and experience of broad potential impact during their remaining academic studies and into the future. Students espouse that coaching skills could be utilized in many aspects of their personal and professional lives. Finally, connections are made between their coaching experiences and research related to gender, leadership, and women in engineering retention issues.

Introduction

In spite of decades of interventions and strategies to support women pursuing engineering careers, more studies are needed to explain national statistics and to increase these numbers. Although women account for over half of the population pursuing a college education, only 18% of engineering degrees are granted to women each year¹ and approximately 10% of engineering jobs are held by women.² These numbers have remained relatively stagnant for over two decades and some evidence suggests that half of women trained to be engineers leave the field as compared to only 10% of men leaving engineering.³ Various factors are attributed to these disparaging statistics from pre-college years onward, including the negative perceptions of what engineers do and who can be engineers, implicit bias, stereotype threat, and the absence of a sense of belonging in the engineering community.^{3,4} Specifically for retention of female engineers in the workforce, an uncivil workplace climate has been cited as a primary reason women choose not to enter or choose to leave the engineering profession and includes for example, the expectation to put in long hours of face time in the office and the perception of little

opportunities for advancement. Conversely, a positive workplace climate also helps to explain why women stay in the engineering workforce.^{3,5}

For women in engineering careers, those who persist were found in one study to possess high levels of self efficacy, to describe themselves in terms of their identity as an engineer, and to be motivated by the innovations and challenges afforded by engineering. This study also reasoned that those who persist possess an ability to adapt and thrive “despite working in a male-dominated culture characterized by difficulties associated with the workplace, including discrimination”. In contrast to this, women who left the engineering profession were “less likely to recognize options in navigating the workplace...”.⁶ Recommended strategies for retaining female engineers in industry and academia include the influence of key supportive people in the organization, such as supervisors and co-workers, recognition of and value for employee contributions, and investing substantially in employee training/ professional development.^{3,5-7} Another study points out that some women who persist in engineering face the same challenging work conditions and cultures; they persist because they are engaged in their work and this can overcome the difficult work environment.⁸ This same study makes the following recommendations for supporting and retaining women in STEM professionals: professional and leadership development for women in STEM professions (e.g., formal process for a personal development plan; development programs for women leaders, framing said leadership development as identity work⁹; emphasis on factors which contribute to work engagement (e.g., opportunity for ongoing challenges, novel experiences and continuous learning as well as work matched to women’s interests and background); and supporting relationships (e.g., mentors and sponsors).

Fewer programs and studies appear to be available which specifically address how to prepare female engineering *students* for the transition beyond the bachelor’s degree with regard to the psychological and systemic barriers they will face. Such studies and programs for this preparation to enter either the workforce or engineering-related graduate programs comprise a relatively untapped retention strategy for increasing the number of women remaining in the engineering profession. While such courses are available in disciplines such as management, women’s studies, psychology and sociology, there would be great benefit to engineering students taking a class together which speaks specifically to engineering situations and utilizes engineering role models. This is similar to a recommendation for engineering professionals⁹, but starting earlier, for students in late stages of their engineering degree. Such a class would also reflect sentiments described in another study which recommends a “move beyond individual reflection and behavioral changes to begin discussing issues of privilege, gender schemas, and micro-messaging with engineering colleagues and students”.¹⁰

Most recently, a similar approach in the form of career management courses, is recommended for all engineering students, and not just women.³ A course was introduced at the Women in Engineering ProActive Network (WEPAN) 2015 Change Leader Forum entitled “Empower and Ignite Future Women Leaders”.¹¹ Another group of researchers created an extracurricular offering, entitled “Gender and Engineering” for interested students and faculty. One goal of this offering is to provide female students “with a framework to understand their experience has the capacity to transform their individually internalized messages of personal inadequacy or not belonging into a larger contextualized experience that they can name”.¹⁰

Furthermore, information presented in such classes should move beyond “equip the women” strategies of Frame 1 from “A Framework for Promoting Gender Equity in Organizations” to information contained within Frames 2 – 4 (create equal opportunity, value difference, and revision work culture, respectively).¹² Courses should also introduce gender bias and other “powerful, yet invisible barriers to women’s advancement that arise from cultural beliefs about gender, as well as workplace structures, practices, and patterns of interaction that inadvertently favor men”.^{9,13} All of this was taken into account during the formation and subsequent implementation of the course mentioned in this study; however the focus of this study remains on the coaching component of the course. A future conference submission will cover the course itself as a model using the “Four Frames” framework.

One approach upon which to overlay the recommendations above for helping female engineering students to transition beyond the bachelor’s degree is coaching. Coaching in the business arena has long been shown to improve work performance, time management, and team effectiveness in individuals and organizations. Coaching clients also note greater self-confidence, enhanced relationships, more effective communications skills, better work-life balance, and improved wellness.¹⁴⁻¹⁹ Drawing parallels between executive or corporate coaching and applications in higher education, a coaching approach can likewise empower faculty, professional staff, and students in skill-development relevant to successful careers (e.g., taking initiative, embracing risk, navigating resources, honing innovation skills, critical thinking, and self-reflection). The use of academic coaching is beginning to spread across college and university campuses nationwide,²⁰ in large part because coaching has been shown to improve student retention and/or GPAs.^{15-19,21} Using coaching skills in the classroom can also promote active and engaged learning.^{17,19,21}

In the case of underrepresented student populations (e.g., women and underrepresented minority students in engineering), a coaching approach can help these students see negative assumptions they might be making about themselves that are actually a result of cultural/societal norms, gender stereotypes, implicit bias, or double binds.⁹ With that understanding, the student can then progress with the coach to come up with goals and action plans to persist in spite of bias. For example, coaching has been shown to foster increased levels of grit/resilience, feelings of wellbeing, self-efficacy, self-esteem, and self-advocacy^{23,24} and coaching is recommended for helping women in business to better navigate gendered organizations.¹³ Finally, coaching provides a safe framework in which to challenge assumptions and to shift perspectives (e.g., that one’s failing to identify as an engineer is her fault vs. a cultural construct) and provides effective support during transitions, including preparing individuals for new posts, developing leadership skills, and for returning from maternity leave.²⁵

Important differences do exist between coaching approaches/techniques and mentoring at a conceptual level.^{21,26} LifeBound Inc., an organization which leads training in academic coaching describes coaching, in its purest form, as remaining curious and free from judgment and helping the person being coached (who can be an advisee, mentee, employee, student, etc.) through asking of powerful open-ended questions to 1) explore the problem to be solved or goal to be set, 2) brainstorm possible solutions while considering resources, constraints, etc. and 3) to formulate

an action and accountability plan. In the context of higher education, academic coaching is defined by one author as follows:

*“Academic Success Coaching is the individualized practice of asking reflective, motivation-based questions, providing opportunities for formal self-assessment, sharing effective strategies, and co-creating a tangible plan. The coaching process offers students an opportunity to identify their strengths, actively practice new skills, and effectively navigate appropriate resources that ultimately results in skill development, performance improvement, and increased persistence”*²⁰

In addition, the author postulates that two distinguishing characteristics of coaching include *“skill development and performance improvement.”*²⁰

As exemplified in this study, coaching skills and approaches can be integrated into existing programmatic structures for female engineering students, including Living-Learning Communities and mentoring programs. This preliminary analysis, to set the stage for future research, details the incorporation and impact of coaching in a seminar course while also laying groundwork for addressing multiple research gaps in these areas: gender and coaching,¹³ application of coaching in higher education,²⁰ development of self-confidence within professional roles and how educational programs can foster this,⁸ and preparing female engineering students for the transition to the workforce/graduate school with the aim of increasing their retention in said professions. As a means of identifying future possible frameworks for further study of the impact of coaching on preparation for this transition, the following research questions were explored: (1) How does student opinion about coaching transform through this class? (2) What new or revised perspectives do students gain, as both coach and coachee? (3) How does coaching equip students for the transition to the workforce?

Methods

Course curriculum – brief overview

A future conference publication will cover the course itself as a model using the “Four Frames”.¹² Relevant course components for this study are explained in this section. The class was developed based on the premise that early understanding of and adapting to the culture and climate of a new environment will improve our engineering graduates’ workforce experience, promotion and professional growth opportunities, and overall retention of women in engineering and related fields. Through identification, study, and practice of key professional development skills involved in a successful transition, enrolled students will 1) become aware of and discuss solutions for internal and external barriers which can prevent women from reaching their greatest potential in the workforce; 2) enhance professional development and transition skills required to move successfully from an academic to professional environment; and 3) acquire skills and knowledge to serve as engineering role models/ambassadors for diverse populations. Another course goal is for enrolled students to utilize coaching skills developed in class to assist themselves and others in making decisions and taking action and comprised 20% of the overall course grade with additional contributions to the final grade from journal reflections related to coaching. For the first offering of this small, discussion-based class for the 2015 spring semester, 12 students enrolled - 5 classified as juniors and 7 as seniors from these engineering disciplines: Aero/Astro (1); Agricultural (1); Biological (1); Biomedical (2); Civil (2); Computer (1); Environmental and Ecological (1); Industrial (1); Materials (1); Mechanical (1).

For this one-credit course, meeting weekly for 50 minutes, three parts governed its structure: Part 1- Identifying barriers: internal/external barriers to success and retention for female engineers; Part 2 – Addressing barriers: putting knowledge & skills/techniques to work – what works best for you? Part 3 –Supporting colleagues/the next generation of engineers (engineering stewardship opportunities). In addition to peer coaching sessions (5 total) and journal entries (8 totals), the final grade was also based on class participation and a final project (chosen by the student based on their interests related to a course topic). Class was structured so as to be mostly discussion-based with students reading articles and completing assignments before class to aid in discussion led by the instructor or a content-expert guest facilitator. The course was taught with the Four Frames¹² as an overarching lens to view topics such as imposter syndrome, stereotype threat, implicit bias, gendered communication, sponsorship, advocating for one’s self, leadership and negotiation strategies.

Course curriculum - as relates to coaching components of this course

Specifically, for the coaching components of class, the instructor utilized methodology adapted from LifeBound, Inc Academic Coaching training (www.LifeBound.com) and incorporates theories from emotional intelligence,²³ strengths-based reflecting,²⁴ and Self Determination Theory,^{27,28} as well as these non-coaching specific theories which have been used by others in academic coaching approaches: Brené Brown’s empathy, Art Costa and Bena Kallick’s Habits of Mind, Carol Dweck’s mindset, Martin Seligman’s positive psychology, and Robert Sternberg’s Successful Intelligence.²⁰ During weeks 2-3 of class, students were introduced to coaching through videos and training materials to view before class and through in-class discussion of these materials and a sample coaching session. Additional training was provided periodically over the course of the semester and included learning and practicing key coaching skills of asking powerful questions and intentional listening. Resources were also provided to assist students in determining topics for coaching sessions – e.g., listing and ranking key aspects of life in order of need to address (e.g., academics, leadership opportunities, spirituality, finances, professional development, etc.) and utilizing course activities and readings to identify skills to improve. Students could choose to partner with one person for the course of the semester or to rotate through a different pairing for each of 5 sessions. Four of the 12 students chose to remain within the same pair. For each of the 5 coaching sessions, spaced throughout the semester, students were asked to commit one hour to the coaching session whereby 30 min would be dedicated to coaching of one person and a debrief of the coaching which just occurred before switching roles for the next 30 min.

Guided reflections on the coaching experience comprised a portion of 5 of the required 8 journal reflections (one reflection for each coaching session). Optional guiding questions for the reflection included: What did you find difficult about coaching? What came naturally to you? What would you most like to work on to improve your coaching skills? What did you learn about yourself through the coaching session? What questions do you have about coaching? Where else can you apply coaching in your life? What about coaching do you want to know more about? Optional suggested topics for coaching included the following, though students were encouraged to come up with their own coaching topics: exploring areas for coaching each other; identifying short term, long term, and career goal statements; how to make the most of this semester/upcoming summer; one new challenge to overcome or new skill to acquire through

coaching; any class topic; steps to take now to manage your career; how to evaluate positions and companies for the career/culture you desire; how can you advocate for yourself and your needs; how can you advocate for others and their needs; in what ways can you use the coaching skills and tools and experiences from this course; how might coaching assist engineering students in their college and professional career; if you had to design a course or program with coaching integrated in some way, what would it look like (e.g., what goals would you set; what barriers/challenges might arise and how would you address them); what causes ignite your passions and how can you work on confidence, networking, etc. through these passions.

Data analysis

Qualitative methodology was employed in the analysis of reflective journals pre- and post-course surveys, as well as weekly post-class surveys. For quantitative analysis, some survey questions on both the pre- and post-course surveys as well as weekly post-class surveys distributed online, included Likert-scale questions and an average was calculated from student submissions. Open-ended reflections of journal entries and the weekly post-class surveys were analyzed to identify common themes which categorize the students' experiences with coaching. Excerpts and quotes which are representative of the entire class are presented to illustrate these themes and common experiences.

Additional procedures employed in the class which relate to coaching but the results of which are not discussed in this particular study include: (1) Examples of questions which are stellar or weak coaching questions related to the assignment "Final course project peer assessment". This assignment involved a student reviewer coming up with coaching questions to help guide the final project submission of a classmate; (2) Coaching contract which lists students' expectations for coaching in the course and possible topics which they want to explore through coaching for future comparison to coaching session content – e.g., did students come to a better understanding of the topic through the course/coaching; (3) Topics of interest written in the pre-survey for future comparison to coaching session content – e.g., did students come to a better understanding of the topic through the course/coaching; (4) Coaching session observed by instructor – one coaching session was required to be observed by the instructor to provide feedback to the coaches.

Results

Results of quantitative methods

For the post-course (summative) survey, the results of this question "How does each class topic resonate with you? Keep in mind not only usefulness of the topic for you at this time but predicted helpfulness for the future" was an average overall topic rating 3.76 out of 4 maximum rating; the average for coaching activities was 3.75. Additionally, 63% completing the final survey indicated that coaching was covered "just right" vs. "too much" and 100% of respondents completing the final survey said the coaching component of the *final course grade* is "just right". Weekly surveys included Likert-scale questions related to coaching when a new coaching topic was introduced in order to assess teaching methods and student comprehension (Table 1). Finally, Table 2 shows a comparison of the same questions related to coaching which appear on overall course pre- and post-surveys.

Table 1. Coaching questions from weekly post-course surveys answering this question: How well did today’s course meet these objectives? (using Likert scale 1- 4 with 1 = Very poorly and 4 = Very well; Number of respondents in parenthesis)

	Average rating	Week of class
Understand coaching at an elemental level	3.83 (12)	2
Identify how coaching fits into the objectives for this course	3.5 (12)	2
Outline requirements for the coaching component of this class	3.83 (12)	3
Define and identify examples of powerful questions for coaching	3.83 (12)	3
Coaching: Provide some suggestions for improving listening	3.27 (12)	8

Table 2. Coaching questions from course pre/post evaluations; Likert scale 1- 5 with 1 = Strongly disagree and 5 = strongly agree; Number of respondents in parenthesis.

	PRE (12)	POST (8)
I am familiar with coaching practices.	3.0	4.875
I believe that coaching is a tool I can use to develop and implement personal and professional goals.	3.985	4.875

Results of qualitative methods

Note that the significant majority of responses about coaching were positive and comments approaching a negative tone are summed by these two quotes from students and G and J, respectively (names of students are replaced with letters to protect their anonymity): “I was a little wary of the coaching and the potential benefits in the beginning but I am really glad that we are doing it now!” and “The first session was less difficult than I thought it was going to be, but it was still somewhat awkward being coached and being the coach”.

The following tables show answers to open-ended questions which relate to coaching on the final course survey (Table 3) and in weekly post-class surveys (Table 4). Excerpts and quotes which are representative of the entire class are presented to illustrate these themes and common experiences.

Table 3. Answers to open-ended questions on the final survey which relate to coaching.

Q14. How will you apply what you have learned from this course?
“Coaching is certainly an area I'm looking to implement in my daily life. It's been very helpful already and an insightful learning experience. It has also helped me in terms of improving my listening skills.”
“I will try to use coaching skills and gender communication aspects when working with a diverse group of colleagues and clients.”
“I can apply the coaching from this course to some other organizations I am involved in, as well

as the corporate culture and related topics to my job this summer.”
“I also believe that coaching will be a valuable skill that I will be able to utilize in the future. It has 100% made me a much better listener”
“I will definitely use my coaching questions in almost everything I do. Whether it's personal interactions, meetings, learning new material, interacting with a professor to learn new material, or asking myself what I really want. I also learned a lot about how I interact with others and how I think.”
“I will try to use coaching skills and gender communication aspects when working with a diverse group of colleagues and clients.”
Q16. What aspects of the class format should not change?
“...Coaching was also a valuable part of the class.”
Q22. Please comment on any of the criteria (e.g. how did you grow from each of them? What challenges did each present for you? How can the instructor or course structure better assist students with obtaining the full experience for each?)
“As mentioned earlier, the coaching sessions were a valuable way to help others and myself especially with situations that may not have had the most straight forward way to go about them at that point from the coachee's perspective.”
“The coaching helped but more in a way of getting to know the girls in the class but I also feel that I did improve my coaching skills as the year went on”
“Coaching was great, as it allowed me to enhance my listening skills and how to guide others. I also liked having one of the sessions assessed by [the course instructor] so as to make sure we were on the right track.”
“I think the coaching sessions or journal entries were more worthwhile than the course project.”
“I loved coaching and I feel like I've beat that to death in my journal entries so I'll refrain from telling you about it once again.”
I loved the coaching sessions, it allowed me to be accountable to myself and to another. Later on I felt a personal joy when the other succeeded because I felt as though I could have made a difference.

Table 4. Sample quotations from weekly post-class sessions. The number of times a similar comment was made are shown in parentheses.

Week 1	<i>Class session focus: introduction to course topics and to the syllabus</i> I am still unsure of what the coaching aspect of the course is, but I know that will be addressed further in the next class.
Week 2	<i>Class session focus: coaching and coaching example as well as going over course syllabus in detail</i> <u>What did you like best/and or find most effective about today's class:</u> The example of coaching was extremely helpful (6 and includes those marked with *) Today clarified the coaching pair assignment a lot I became super excited about the coaching aspect of the class. I'm looking forward to enhancing my coaching skills and getting another perspective on my goals and obstacles *What I found most effective was sharing our ideas about how the example coaching session was effective and what we can do on our own end in the future for coaching

	<p>sessions</p> <p>*I liked seeing a real coaching example to get a better understanding of how the coach and the coachee interact.</p> <p>*I found that the coaching example was most effective for this class. After watching the videos about coaching for homework I felt that I had a basic understanding of what coaching was but I think that the example was what really helped me to understand how coaching could be applied to any situation.</p> <p><u>What questions, concerns, confusion, etc. do you or others in the class have related to today's topics?</u></p> <p>I feel that we don't know each other very well yet. I'm a little worried that the coaching will be awkward without getting to know each other more first.</p> <p>I'm concerned that I will be paired with one of 2 people for coaching who I don't think I will work well with (because I already know them)</p> <p>Im [sic] a little concerned about how coaching will fit into mu [sic] actual life. It seemed a bit awkward.</p> <p>What is the purpose of coaching within the context of this course? Why do you think it is a useful tool for this course?</p>
<p>Week 3</p>	<p><i>Class session focus: powerful questions and coaching as part of course grade as well as discussion of Four Frames for Gender Equity in Organizations</i></p> <p><u>What did you like best and/or find most effective about today's class</u></p> <p>I found the Goal Wheel handout very helpful, as I'm not sure which goals to talk about in coaching sessions.</p> <p>Avoid using why & but in questions. Interesting factoid that makes sense but never crossed my mind.</p> <p>I felt excited to start the coaching sessions.</p> <p>I thought the example questions provided will be very helpful, and were some I had never thought of asking myself before. (3)</p> <p><u>Additional comments:</u></p> <p>I'm really excited to learn more about coaching! At first it kind of seemed a little odd and out of the obvious but now that we're learning the strategies and skills behind it I'm realizing what a great tool this will be!</p>
<p>Week 6</p>	<p><i>Class session focus: not related to coaching</i></p> <p><u>What questions do you have for the Managing Your Career presentation by a guest speaker?</u></p> <p>.... one of the questions that came across the coaching session is how to deal with uncomfortable situations, such as when an inappropriate comment or topic is made within a group setting by a male individual (and the comments seems to affect mainly the females present, which in some cases, may be a minority)?</p>
<p>Week 9</p>	<p><i>Class session focus: not related to coaching; however topic of how to find a topic for</i></p>

	<p><i>discussion for coaching arose.</i></p> <p><u>What did you like best and/or find most effective about today's</u> I liked learning more about the coaching topics that other people were deciding between as it helped me establish what I wanted to do next.</p> <p><u>For anyone having a hard time coming up with topics on which they want to be coached, how helpful were the suggestions?</u> Very helpful 64%; Somewhat helpful 36% (n = 11)</p>
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Below is a list of sample quotations from journal entries which demonstrate each of the following emergent themes and which are representative of the entire class (the number of total statements which fit each theme during categorizing are in parenthesis): *Receptiveness to and hopes for coaching/being coached* (14) – openness to coaching and how they aspire to use coaching as they gain more experience with coaching; *Coaching technique* (13) - ability to do coaching and associated skills like listening and asking powerful questions; an individual's unique approaches to coaching; *Coaching impact* (15) - how coaching impacts them as coach and/or as coachee; *Applications for coaching* (21) - where individuals can use coaching or coaching skills in personal and professional endeavors. The themes which materialized are similar those in a previous study with a student coaching focus: learning from the training, impact of coaching on self; impact of coaching on the coach's relationships; and the future utility of coaching skills.²⁹

After categorizing into the latter two themes (*Coaching Impact* and *Coaching Applications*), it became apparent that these contained some overlapping sentiments expressed by students through very rich accounts which could serve as examples of both. Therefore, *Coaching Impact* and *Coaching Applications* themes were further sub-divided into 5 sub-categories: *Grit/Resilience*; *General reference to personal/professional growth*; *Empowerment of self*; *Empowerment of others*; *Specific mention of use in future career*. Sample quotes are listed by these subcategories.

In the results below, names of students are replaced with letters to protect their anonymity. The number following the student letter refers to the coaching sessions (1 – 5) which are spread out over the course of the semester.

Receptiveness to and hopes for coaching/being coached

(G, 2) Also, I surprisingly really like participating in the coaching sessions. When I was first introduced to the idea of coaching at the beginning of the class, I thought of it as somewhat of a tedious task and I also thought it would not be very effective at helping me find solutions to problems. However, now that I have participated in a couple coaching sessions I have really started to see the benefit in doing these types of exercises.

(C, 2) I also have really loved coaching- which was another thing that intimidated me in reading the syllabus. Mostly because I had no idea what it meant and what I would have to be doing.

(E, 3) As we finish each session, I'm appreciating coaching more and more, as I think it's an effective way to discuss challenges faced in life, and it really lets you dig [sic] deep within your own thoughts, as opposed to receiving [sic] only guidance from someone.

(F, 3) I am looking forward to getting more practice in coaching so I can be more comfortable with the types of questions that I will ask.

(B, 3) Coaching can certainly be applied in several areas in life. I can already see how coaching can be extremely helpful and learning-promoting opportunity in a professional (work) setting. I am looking forward to further improve my coaching skills.

(G, 4) I am interested to see when/how I will use the coaching skills I have learned in this class throughout my life and how they will help me.

Coaching technique:

(J, 1) After completing [sic] my first coaching session, I found that it was more difficult than I was expecting it to be. While being the coach, I found it very difficult to not express my opinion to the other person and realize that this is something I will have to work on for future coaching sessions.

(B, 2) Originally, even before coaching session 1, I thought that coaching wouldn't be too hard, but I was wrong. Coaching sessions 1 and 2 proved that. It is a task that involves an active and constant use of listening skills, full focus, and concentration. The selection of powerful questions based on the coaching session topic may be challenging since it requires the coach to think fast and be ready in terms of posing a question that promotes the coachee to see the problem/situation in a different way that can lead her to a potential solution. I feel like I need to improve in terms of limiting the amount of talking I do in my role as a coach, considering the coachee must be doing the majority of the talking. I need to time myself better and watch how much I talk. I also want to improve in terms of being able to pick good powerful questions that are relevant to the topic/situation discussed.

(J, 3) This week's [sic] coaching session seemed to go even a little better than the last one did. I feel that each time I complete a session with my partner I learn something new that I didn't [sic] realize in a session before. I was struggling before with trying to find a way to balance helping my partner come to their own conclusion and wanting to give my advice [sic] on a subject. This session I found that I was in a way able to mix the two so that I somewhat gave some of my advice while also letting my partner come to a decision for themselves, and it seemed to work out really well.

(I, 3) Coaching is still difficult to me when it comes to talking about the professional life. I know how to talk about the academic life, and I have found that I'm good at asking questions to make the coachee come to their own decision instead of giving my advice. However, I find it really hard to coach about something that I'm not all that familiar with.

(I, 3) I find that I get better at coaching every session that we do, and like many other things in life just needs practice.

(G, 4) Regarding coaching session 4 I had with [my partner], it really made me realize how much I have improved with coaching since the beginning of the semester. I found myself automatically redirecting my questions to be open-ended and I am also able to listen better because I am more comfortable and not worried about what question I need to ask next.

Coaching impact and Applications for coaching – further divided into subcategories:

Grit/Resilience

(C, 2) I've also found that I am way more likely to stick with my goals when I have said them out loud to another person that shares a similar commitment back to me.

(J, 5) Every semester I always say that I want to change something or fix something, but without having someone to keep me accountable for that it has been hard, but this semester [my partner] has been able to do that for me and I can see how it has made a difference in my life this semester [sic].

General reference to personal/professional growth

(A, 1) Through the coaching session I learned about some of the negativities I place on my thoughts, which hold me back from coming up with positive solutions to my problems. After discussing some of my concerns about my internship this summer, I have found that the imposter syndrome may be part of what's making me so worried and negative about my concerns for the coming up summer. The coaching session helped me to see the assumptions I was making and helped me to look at how I can positively deal with fears.

(K, 2) I also feel that I have been improving in my confidence by realizing what my weaknesses are and what improvements I can make, especially when it comes to improving my listening skills and communication techniques.

(J, 5)...and really feel that it [coaching] has helped me to grow as a person..... It has been really exciting to have done the coaching sessions throughout the semester and see how both [my partner] and I have grown in the process.

(K, 5) I know I can see myself recognize behaviors and attitudes more easily than back in January. Especially when it comes to imposter syndrome or identifying values, these are second nature to me almost. There were a few times in the past month, especially at more stressful moments, that I made myself into an imposter, but I was able to catch it later on. I definitely am more aware of when others believe they are imposters and use my coaching skills to have them reflect on what they are really saying.

(B, 5) Looking back and thinking about all of the coaching sessions, I can now understand how important it is to practice coaching and how helpful it becomes in developing listening and thinking-on-the-spot skills.

(E, 5) Through coaching, I think you get to know yourself better, and this is essential for every aspect of life.

Empowerment of self

(C, 1) I learned that a lot of times you have the answers you just don't think of them the right way or think about the obstacles that are preventing you from overcoming whatever issue you have

(F, 1) Talking about these things in a coaching format was really helpful because I was able to just talk without fear of being judged.

(B, 2) Coaching is helping me better organize myself as an individual in the sense of making wise decisions and reaching the realization that time is valuable and must be used efficiently (as I convince myself that I am capable of making "adult-type" decisions).

(I, 3)However, these coaching sessions really have helped me talk about what I need to, and determine what's important and worth focusing my attention.

(I, 5)...and I don't feel ashamed or embarrassed to say that I messed up or that I could have done something better.

(F, 5) It was a tough semester because of all of the big decisions and life changes I am facing, so it was nice to just talk to someone and know that they were not going to offer any advice unless I specifically asked for it.

Empowerment of others

(A, 1) It is challenging to not offer advice and help them come up with a solution right away; however, it seemed like coaching was more productive when she came to a conclusion of what needed to be changed herself and at least seemed like she'd be willing to follow through with the plan.

(K, 2) I want to create these better relationships by improving both my listening skills and my helpfulness in not outright solving a problem but leading someone else to realize what they would like to accomplish.

(H, 3) I can also use coaching if any of my friends are looking for advice that I don't have. Instead of saying I have no idea what they should do, I can start asking them questions and try to have them figure out the answer themselves.

(A, 4) During this past coaching session my partner had a very specific issue she needed to be coached on. This was somewhat difficult to understand all the barriers to her achieving her goals and included involvement of other people whose actions are out of her control. I think it was helpful to discuss the things that were within her control and (hopefully) helped her to realize all the things she's able to do to help her complete her task.

Shifting perspectives:

(G, 1) I think the most beneficial thing that came out of our talk was the fact that she helped me see the situation from a different perspective that I had not been able to fully grasp before.

(G, 1) It [coaching] can also help with dealing with some of the feelings of imposter syndrome. Learning how others have overcome these situations can also give you great insight about what preconceived notions you might already have about the issue that you haven't even been able to realize until you have bounced the idea off of someone else....

(H, 5) I've also used it [coaching] in situations where I don't agree with someone, so I can try to see things from their point of view.

Specific mention of use in future career

(B, 5) - Coaching is certainly a practice that I want and plan to incorporate into the future as I embark on my career as a women engineer.

(C, 5) In college and in the professional world, it can get you used to asking questions so you aren't hesitant to ask when curious. In addition, coaching questions allow you to better define the end-goals and motives that your supervisor is looking for.

(I, 5) The coaching element of this course can help me in the future when attending big meetings and asking potent questions. It can help me in academia when I want to dive deeper in the material and understand connections in order to really understand the concepts.

Discussion

Insights from Quantitative Analysis

Results employing quantitative methods are probably of most interest to practitioners who might employ a similar peer coaching structure and would want to evaluate the effectiveness of this as a pedagogical approach. For the post-course (summative) survey, the results of this question “How does each class topic resonate with you? Keep in mind not only usefulness of the topic for you at this time but predicted helpfulness for the future” show that coaching is ranked on average as favorably as course topics in the class (average topic rating of 3.76 out of 4 maximum with the average for coaching activities at 3.75). A majority completing the final survey also indicated that coaching was covered “just right” and that the coaching component of the *final course grade* was also “just right”. Weekly surveys (Likert-scale questions) related to coaching when a new coaching topic was introduced showed that teaching methods and student comprehension was adequate (Table 1) and a comparison of the same questions related to coaching which appear on overall course pre- and post-surveys show that substantial gains were made by students in terms of their familiarity with coaching practices and their belief that coaching is a tool to be used to develop and implement personal and professional goals (Table 2).

Addressing the original questions posed in the study

Answers to the original questions posed in this study are provided below and serve as preliminary answers whereby subsequent studies will address these questions in greater detail, as well as new questions, within a theoretical framework. Note that excerpts and quotes presented in this study are representative of the entire class and students did not share negative responses in the analyzed material.

(1) How does student opinion about coaching transform through this class?

Examining the weekly survey and post-course survey statements related to coaching, it is apparent that students gained knowledge about and appreciation for coaching over the course of the semester. Overall, coaching was well received by the students. For example, coaching was frequently cited as something they will continue to use after this class (journal entries, Table 3, and Table 4), when at the beginning of the semester, in answer to open-ended questions on the pre-survey, coaching was rarely mentioned (data not shown); rather, on initial weekly surveys, multiple comments demonstrated uncertainty and apprehension about coaching and its usefulness (Table 4 and journal excerpts). Analysis of written excerpts related to coaching also show students gaining confidence from the first coaching session through the last in skills associated with coaching and in perceived uses and usefulness of coaching. One student who initially thought of coaching as mentoring with nothing new for her to learn shared later in the semester that “I feel as though I should have learned about coaching much earlier in my life. It would have been extremely helpful in high school and during FYE [first-year engineering]”.

(2) What new or revised perspectives do students gain, as both coach and coachee?

Benefits exist for both the peer coach as well and the coachee in terms of enhanced socio-emotional skills and improved interpersonal skills²⁴ and our study confirms this observation. Additionally, a previous study showed in young adults (secondary school students) that coaching improved attitudes toward learning and that coaching training may lead to better study skills, increased emotional intelligence and improved communication skills.²⁹ Benefits of coaching cited by students in ENGR 494 include improved listening skills, ability to talk without fear of being judged, helping/guiding others, helping oneself and being accountable to oneself. Example quotes of helping themselves and helping others include, respectively: “I loved the

coaching sessions, [*sic*] it allowed me to be accountable to myself and to another. Later on I felt a personal joy when the other succeeded because I felt as though I could have made a difference.” and [coaching is a] “valuable way to help others and myself especially with situations that may not have had the most straight forward way to go about them at that point from the coachee's perspective.”

Students also described various uses of and applications of coaching from “personal interactions, meetings, learning new material, interacting with a professor to learn new material, or asking myself what I really want”. Some share how they notice themselves using coaching skills with family and friends and are more aware of coaching happening around them. Excerpts also allude to the use of coaching to challenge assumptions that may manifest in themselves and in others (e.g., imposter syndrome) and the recognition that coaching is different than mentoring and advising.

(3) How does coaching equip engineering women for the transition to the workforce?

Student responses note that coaching helps them to pose better questions and seemingly have the confidence to pose questions (e.g., “with a professor to learn new material”) and is also a means to share success and accountability with others. These uses for coaching can help with the transition to and integration into the workforce or graduate programming as well as the use of coaching “in my daily life”, “when working with a diverse group of colleagues and clients”, and applied “to some other organizations I am involved in”. One student sums up how she sees herself using coaching for success in workplace settings: “I will definitely use my coaching questions in almost everything I do. Whether it's personal interactions, meetings, learning new material, interacting with a professor to learn new material, or asking myself what I really want.” Another shares in her second to last and then last reflection on her coaching sessions: “I now feel like coaching has become almost second nature and I find myself asking these questions to people in my daily life, which I had never done before” and “I have found myself using coaching questions in everyday life without thinking about it ... I can see myself using coaching questions for the rest of my life”.

Analysis of writings from this group of students reveals that coaching brings up issues of empowerment, personal growth, increased confidence, challenging assumptions, confronting challenges like imposter syndrome, having someone for support and accountability, improved decision-making, and ability to gain novel insights from shifting perspectives – all of which make for quality engineers and some of which have even been associated with factors related to retention of women in the engineering workforce. While other key factors are not discussed directly in the students’ works - e.g., impact of coaching on leadership and self-esteem, which have been referenced as topics for strengths-based approaches to coaching in previous studies,²⁴ – one cannot rule out that these topics did not come up in coaching conversations.

Carefully designed subsequent studies can examine a possible link in greater detail between coaching and these topics. Research related specifically to women in engineering demonstrates that their decisions to leave the profession are influenced by a complex range of factors, many of which can be addressed through coaching.^{22,25} Recent evidence shows that maternity coaching is improving retention of female engineers²⁵ where significantly fewer women exit during the 12-

24 months following their return from maternity leave when supported by coaching after a return to work.³⁰

As to coaching and gender and leadership issues, strengths-based approaches are increasingly being used in coaching with different groups, particularly women.²⁴ In one study, coaching helped professional women in leadership positions comprehend and navigate discrepancies between how the women viewed their contribution at work to that of their supervisors, brainstorming with their coach as to constructive ways to respond. This same study shares that “processing 360-feedback with a coach and peers can help participants identify and deal with gender stereotypes and double binds”.⁹ A study on Reciprocal Peer Coaching (RPC) proposed that formative assessment provided by RPC could build self-efficacy through setting short-term goals and receiving feedback to help students believe in themselves and their capabilities.³¹

Possible theoretical frameworks to use in subsequent studies

Based on this exploratory study, themes emerge from the students’ experiences with peer coaching which can inform future studies with theoretical frameworks. Possible theoretical frameworks are those which might incorporate one or more of the following: self-efficacy; challenging assumptions; shifting perspectives; and leadership identity.^{9,13} Possible specific frameworks to use could include intentional change theory,³³ professional role confidence,^{34, 35} women’s leadership development,⁹ and personal vision.⁸ As has been done previously in the 2013 ASEE conference by Dr. Alice Pawley, who wrote “in the spirit of strong objectivity and building trustworthiness in qualitative analysis,”³⁶ readers of this paper are invited to provide suggestions for theoretical frameworks, theories, and/or lenses through which to further analyze the association between coaching and the preparation for undergraduate women engineering students to successfully transition to the engineering profession and be retained in said profession.

Here a few of the more promising potential theoretical frameworks listed above are described based on coaching in general and what it can accomplish as well as specific impacts of coaching from the student experiences in this seminar course.

Women’s Leadership Identity - A framework has been offered for women’s leadership development grounded in theories of both gender and leadership.⁹ This framework accounts for how gender shapes women’s path to leadership “without either victimizing or blaming women, while at the same time cultivating in women a sense of agency”. Coaching can come into play through the recommended use of 360-degree feedback and navigation of key topics of “networking, negotiations, leading change, and managing career transitions in light of impediments posed by second generation forms of gender bias”.

Personal Vision and Intentional Change Theory - A recent study examined how personal vision enhances work engagement and the retention of women in the engineering profession, finding that “women who persisted had a personal vision that included their profession, and that this personal vision enabled them to overcome the bias, barriers and discrimination in the engineering workplace” and that the “ideal self is comprised of self-efficacy, hope, optimism and core identity”.⁸ Coaching can be incorporated to help address the gap between one’s real self and one’s ideal self. Research incorporating coaching could also address a recommendation by

this same study for additional research on “how self-efficacy and self-confidence are developed within professional roles, and how educational programs at the undergraduate and graduate levels as well as workplaces can facilitate their development”.

Self-efficacy – Relevant theoretical frameworks could help advance research on a relationship between coaching and self-efficacy and retention of women in engineering. Three studies focused on the experience of 23 leaders in a year-long leadership development program demonstrated that executive coaching positively enhanced self-efficacy. These results were sustained 6 months later.³⁷ Another study reported an increase in self-efficacy and the ability to achieve goals among an experimental group of 12 college students who participated in weekly coaching sessions over 16 weeks.³⁸

Professional role confidence - Coaching might also be applied to address retention issues in the engineering profession where an individual perceives that her goals and/or values don't align with her current employment situation; however, through coaching this individual might acknowledge assumptions or concessions being made and commit to exhausting opportunities to improve what is within her control before leaving the engineering field. This may relate to concepts such as professional role confidence³⁴ which with regard to gendered persistence in engineering is described as “an ability to not only successfully perform the professional role but to also find enjoyment and fulfillment in this role”. In a study by Cech et al. (2011), the “persistence of undergraduate students in engineering was found to be significantly associated with professional role confidence, where men developed this more successfully than women”. The researchers conceptualize two dimensions of professional role confidence that are active during the credential acquisition process and coaching can certainly help with the second of these: “career-fit confidence, or confidence that the professional role will suit a person's particular interests, needs, values, and sense of self”.³⁴

Addressing an association between peer coaching and the course objectives

While this pilot study was not designed to specifically address the three course learning objective shared in the Methods section, objectives 1 and 2 are partially addressed in student comments about academic coaching. Now that the positive impact of peer coaching has been investigated in this pilot study, future studies will investigate a possible link between peer coaching and meeting the course objectives.

Course objective 1) become aware of and discuss solutions for internal and external barriers which can prevent women from reaching their greatest potential in the workforce – an example of where coaching helped to raise awareness barriers and possible solutions is expressed in this representative quote by student A: “Through the coaching session I learned about some of the negativities I place on my thoughts, which hold me back from coming up with positive solutions to my problems. After discussing some of my concerns about my internship this summer, I have found that the imposter syndrome may be part of what's making me so worried and negative about my concerns for the coming up summer. The coaching session helped me to see the assumptions I was making and helped me to look at how I can positively deal with fears”.

Course objective 2) enhance professional development and transition skills required to move successfully from an academic to professional environment - examples of where coaching raises

awareness of professional development and transition skills are expressed in these representative quotes by students B, H and C, respectively: “Coaching is helping me better organize myself as an individual in the sense of making wise decisions and reaching the realization that time is valuable and must be used efficiently (as I convince myself that I am capable of making “adult-type” decisions),” and “I’ve also used it [coaching] in situations where I don’t agree with someone, so I can try to see things from their point of view,” and “In college and in the professional world, it [coaching] can get you used to asking questions so you aren’t hesitant to ask when curious. In addition, coaching questions allow you to better define the end-goals and motives that your supervisor is looking for”.

Limitations of the study

This study would be strengthened by the administration and analysis of a validated quantitative instrument that could more accurately predict the most important topics. However, doing so would possibly limit the data collected and instead, gathering qualitative data permits a more user-driven experience. With this being a preliminary study, an extensive coding scheme was not employed to analyze written excerpts from students; such approaches will be incorporated in future studies now that some possible themes have emerged for determining a theoretical framework. Another possible limitation is the use of a small population studied to form generalizations about peer coaching in the context of this study. Nevertheless, this study appears to show as proof of concept that peer coaching provides numerous benefits for female engineering students. The author of this paper also acknowledges that as the sole author and sole investigator, validity of future studies can be strengthened and potential bias reduced by utilizing at least two people to conduct qualitative data analysis. To investigate further if students harbor negative thoughts about the peer coaching employed in this study, future survey questions could specifically ask for their ideas about limitations of coaching.

Conclusions

For implementation refinements, based on student commentary, future coaching trainings will emphasize that students need not reference/use the example questions list provided in class (the practice of which is actually discouraged as it is distracting to both parties in coaching); that students need not be anxious during the coaching process as to whether they are coaching, mentoring or giving advice – in application, only professional coaches would remain in a “coaching mode” 100% of the time; and finally that the beauty of coaching is that you can do it even though you aren’t the content expert or remotely knowledgeable about what the other person is going through.

Future directions for research directly related to this preliminary study include the use of a specific theoretical framework, as described in the Discussion section; longitudinal studies which investigate the long-term impact of peer coaching in this seminar course on course alumnae as they enter the workforce and/or graduate school; determining if self-rated increases in other areas for potential growth addressed during course topics (from pre- to post-course survey) are directly linked in any way to the peer coaching; incorporate more feedback and training on coaching into later weeks of semester; and incorporate coaching with engineering professionals who are trained to some degree in coaching methods.

In conclusion, this study provides rich accounts which can serve as a source for future research ideas related to coaching and critical transition stages for the retention of female engineering students and professionals. A tentative practical implication of this study is that coaching of female engineering students appears to be a source of affirmation and agency and a potential resource for persistence in engineering or in any field in which women may feel marginalized and self-critical. On the basis of this exploratory study, anyone with a vested interest in the retention and success of female engineering students (e.g., faculty as instructors and research advisors, staff, academic advisors, mentors, employers, etc.) should consider incorporation of coaching approaches into instructional, advising, mentoring, and related practices and programs. After all, coaching fits so well in achieving the kind of empowerment for which Roosevelt Thomas argued, that something besides affirmative action is needed...something which “consists of enabling people, in this case minorities and women, to perform to their potential”.¹³

This final coaching reflection excerpt from student J appears to echo Roosevelt’s sentiments: “Every semester I always say that I want to change something or fix something, but without having someone to keep me accountable for that it has been hard, [*sic*] but this semester I has [*sic*] been able to do that for me and I can see how it has made a difference in my life this semester [*sic*]. This semester [*sic*] has been one of my best so far and I honestly believe that coaching has helped me to accomplish this. I am really proud of everything that I have accomplished this semester [*sic*] and I am really glad that I got to share this experience with [student I] through our coachign [*sic*] sessions.”

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