Fostering Graduate Student Professionalism Using Developmental Coaching Techniques

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Introduction

Government agencies, professional societies, and other organizations have issued numerous calls to strengthen the nation's engineering workforce [1]. A strong engineering workforce is critical to U.S. competitiveness and prosperity. However, current graduation and employment rates are not meeting this demand [2]. The research described in this paper is sponsored by the National Science Foundation and works to address these needs through the development and assessment of a professional development program for engineering graduate students.

Graduate education marks a critical point in one's professional development, as an increasing number of jobs require graduate degrees [1]. Unlike undergraduate education, graduate school is considered a time to hone human capital skills outside of the technical realm [4]. Developing non-technical or "soft skills" equips students to meet the demands of the workplace. These skills also provide more immediate benefits including increased interest in pursuing engineering graduate degrees and persisting through degree completion [5, 6]. Thus, the current research focuses on supplementing the current focus on technical skills in the relationship between faculty advisors and graduate students with an enhanced focus on the student's broader professional development. Specifically, the current research consisted of a pilot administration of a professional development program among engineering graduate students.

The Professional Development Program

Based on ABET standards as well as recommendations from the organizational sciences and engineering education literatures, nine professional competencies were selected as the structure for the program. The competencies consisted of non-technical skills that are critical to one's employability in most high-level jobs: conflict management, creativity, cultural adaptability, leadership, oral communication, planning, problem solving, teamwork, and written communication (see Table 1). Competencies, or soft-skills, recommended in the literature [7] were discussed with engineering faculty members, industry professionals, graduate students, and departmental advisory boards to determine a final list for inclusion in the professional development program.

The individual competencies can be grouped into three broad categories: technical, communication, and cultural. Technical competencies consist of non-knowledge-based skills that are critical in supporting one's basic technical development. Communication competencies include those that involve conveying information to others. Cultural or collaborative competencies describe the skills that are used in relating to others and working on shared goals or visions.

The program created as part of the current research seeks to promote intentional development within each of the nine competencies. Unlike many other educational interventions, the current program does not focus on offering new training content but instead emphasizes the existing graduate curriculum and the mentoring relationship between advisor and student in a new way. Each of the nine competencies is used in a number of tasks commonly completed by graduate students, such as writing papers, delivering conference presentations, and collaborating with other members of a research lab. Rather than implementing courses to develop each of the nine

competencies, the researchers designed an assessment and advising method to increases student awareness of the extant opportunities for improving one's professionalism.

Table 1. *Professional Competencies*

Competency	Definition
Technical	
Creativity	• Develops and encourages novel ideas or solutions to problems and suggests innovative ways to approach the task at hand • Acquires information from multiple sources and uses it to develop a clear perspective on an issue/topic • Anticipates future trends correctly and can assess the likelihood and credibility of possibilities
Planning	• Prioritizes information and uses that information to set short and long-term goals • Monitors tasks and activities of self and others to ensure objectives are met and goals are accomplished • Is able to accomplish goals and complete work in one area without neglecting other projects
Problem Solving	• Recognizes problems and potential challenges in their work • Identifies solutions or courses of action and evaluates the costs and benefits of each • Makes timely decisions, plans course of action, and carries out action accordingly
Communication	
Oral Communication	• Clearly conveys information with appropriate purpose & detail • Matches communication style with audience • Uses listening to effectively respond to others' input
Written Communication	• Expresses thoughts clearly and succinctly across all written formats • Uses proper grammar and spelling • Follows a logical flow and has a developed sense of style

Table 1 (continued)

Competency	Definition
Cultural/Collaborative	
Conflict Management	• Uses effective strategies for dealing with conflict • Recognizes and openly addresses conflict appropriately • Arrives at constructive solutions while maintaining positive working relationships
Cultural Adaptability	• Maintains a consistent standard of treatment toward all individuals • Values interaction with people from diverse backgrounds • Displays sensitivity to the needs, feelings, and viewpoints of others and expresses courtesy, neutrality, and respect
Leadership	• Guides, directs, and motivates others using regular, specific, and constructive feedback • Balances the interests, abilities, goals, and priorities of self and others with the needs of the group • Commands attention and respect while working toward goal achievement
Teamwork	• Works cooperatively with others to achieve collective goals • Values the contributions of all team members toward meeting the team objectives • Shares information and encourages others to do the same • Is flexible within the dynamics of a group context and can work effectively with almost anyone

Purpose and Goals

The funding for the current research comes from a grant supporting innovations in graduate education. To fulfill the aims of the grant, a professional development program will be launched and evaluated. Prior to administering this program, the research team conducted a pilot during the summer and fall semesters of 2016. The pilot test of the project was intended to highlight any administrative issues with the program, gauge participant reactions, and identify participants' needs. Regarding administrative issues, the pilot tested the usability of the online systems for assessment and professional development. Participant reactions concerning the relevance, helpfulness, and practical utility of the program were sought via surveys and interviews. Additionally, interviews with participants assessed their needs in completing the program. Interviews allowed the research team to understand where students and faculty advisors most need guidance. Such information will be used to inform the full-scale launch of the professional development program, as training materials will be created based on participant needs identified in the pilot.

Participants and Procedure

Prior to recruiting participants, IRB approval was obtained from the University of Tulsa. Graduate students and faculty advisors were then recruited from the Chemical, Mechanical, and Petroleum Engineering departments at the University of Tulsa, as these were the three engineering departments with doctoral programs. Six graduate students, ranging from one to three years of graduate school, and five faculty advisors participated in the pilot program. The structure of the program is depicted in Figure 1.
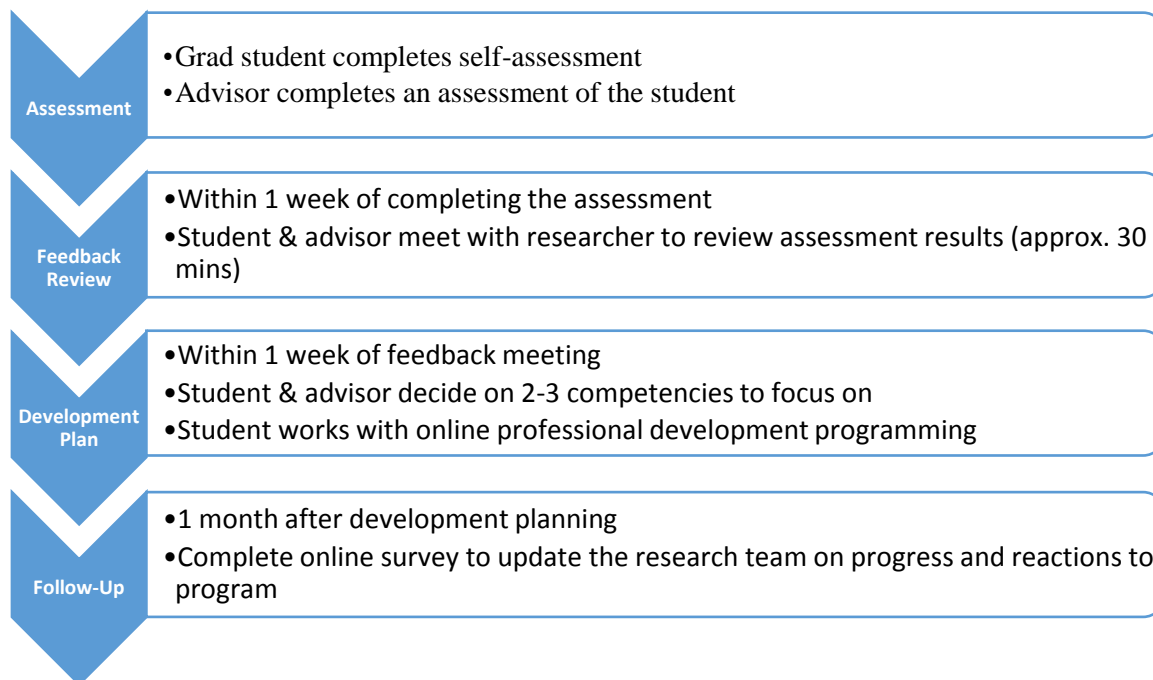
Assessment
- Grad student completes self-assessment
- Advisor completes an assessment of the student

Feedback Review
- Within 1 week of completing the assessment
- Student & advisor meet with researcher to review assessment results (approx. 30 mins)

Development Plan
- Within 1 week of feedback meeting
- Student & advisor decide on 2-3 competencies to focus on
- Student works with online professional development programming

Follow-Up
- 1 month after development planning
- Complete online survey to update the research team on progress and reactions to program

Figure 1. Structure of pilot program.

Program participation began with individual assessments to determine students' current standings on each professional competency (See Table 2 for a sample assessment question). Students completed self-assessments of each competency in which they rated their current standing on a nine-point scale, with a score of nine reflecting expert status. An open-ended question was posed for each competency in which justifications for the rating were solicited. Additionally, advisors completed assessments rating their graduate students on each competency. Individual feedback reports were generated for each student based on the assessment results (See Appendix A for a sample feedback report).

Following the assessment phase, each student and his or her advisor were presented with an individualized feedback report. A member of the research team then met with each student-advisor pair to review the feedback report and discuss the student's most pressing developmental needs. Meetings were approximately 60 minutes in duration and allowed students and advisors to explain their ratings and reach a mutual understanding of the student's current developmental state and future needs.

Table 2. *Sample Assessment Question.*

		Using the following definition, please rate the student's current proficiency level in oral communication:
		• Clearly conveys information with appropriate purpose and detail • Matches communication style with audience • Uses listening to effectively respond to others' input
Growth Opportunity	1	Examples include: • Is not at all comfortable speaking to or in front of others • Is unable to covey information clearly or coherently
	2	
	3	Examples include: • Is somewhat able to covey information, especially in less formal settings, but may not be particularly comfortable in doing so • Has difficulty expressing things concisely; may get caught up in details, but is able to get main ideas across
Standard Performance	4	Examples include: • Can convey information to others so the audience understands the gist, but tends to ramble or struggle to get the point across concisely • Tends to use uncomfortable language or mannerisms and struggles to adjust communication style to suit the audience
	5	
	6	Examples include: • Can convey information concisely with strong content, but doesn't consistently connect with the audience • May dominate conversations or meeting dialogue, but speaks in a clear in compelling manner when doing so
Area of Strength	7	Examples include: • Verbally conveys information with ease and in an engaging tone • Clearly expresses content but sometimes engages in unnecessary gestures or vocal mannerisms
	8	
	9	Examples include: • Speaks clearly and concisely and is exceptionally engaging • Is able to express ideas thoughtfully and articulately when put on the spot

Approximately two weeks after the feedback meeting, each student-advisor pair again met with a member of the research team. The second meeting, which lasted approximately 30 minutes, focused on goal-setting and developing an action plan to advance the student's professional competencies. During the goal-setting meeting, the student and his or her advisor agreed upon three competencies on which the student would focus. For each selected competency, the student worked with the researcher and advisor to identify opportunities for honing his or her skills. For example, if a student selected leadership as an area of focus, he or she may decide to take on opportunities to mentor more junior students in the lab or take more ownership of group projects.

In addition to the action plan developed during the goal-setting meeting, pilot participants were provided with access to an online collection of tools and learning resources provided by a local talent management company. Through the online platform, students and their advisors had access to videos, e-coaching, and other resources devoted to each of the nine competencies included in our program. The online resources were made available to pilot participants as an optional means of supplementing their professional development.

Program Evaluation

Student and advisor feedback was sought throughout the duration of the pilot program. During the feedback and goal-setting meetings, both students and advisors were asked to provide their reactions to the program. The researcher asked questions to assess participants' views on the usability and utility of the professional development program. These questions were designed to tap the overall effectiveness and perceived value of the program in order to tailor it for future iterations. Additionally, participants completed a brief online survey measuring their reactions to the program. The survey consisted of 15 questions assessing level of satisfaction with: the nine professional competencies, assessment process, feedback report and meeting, goal-setting meeting and resources, and the overall program. As Table 2 indicates, participants reported high levels of satisfaction with all aspects of the program.

Table 3. *Program Survey Results*

Aspect of the Program	Sample Item	*M*	*SD*
Professional competencies	The nine competencies are relevant to my career goals.	4.77	0.25
Assessment process	The online rating system was easy to use.	4.53	0.49
Feedback report & meeting	The meeting to discuss my feedback report was useful for my professional development.	4.66	0.83
Goal-setting meeting & resources	The resources provided on competency development were helpful.	4.73	0.29
Overall program	Participating in this program will help prepare me for my future career.	4.93	0.14

Note. All items were assessed with a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Qualitative feedback was also sought from pilot participants during feedback and goal-setting meetings to gauge perceived satisfaction and utility of the program. Consistent with survey results, participant responses were indicative of high levels of satisfaction. Comments revealed that participants were enlightened on their professional reputation through this process. One student stated "The [assessment] comments are really helpful because they let me know exactly where my advisor thinks I stand. This way I actually feel like I have things I can take and work on this semester."

Student feedback gathered during the meetings also highlighted the applicability of this program to employability, as one student noted "this is the kind of thing that happens in the workplace. A lot of companies do these type of evaluations so it's good to think about this now, to know what I need to work on and to think about how to talk about [my experiences] before I go into industry." In addition to reported satisfaction with the professional development program, all six graduate students have elected to remain in the program beyond the pilot phase.

Implications and Future Directions

The pilot administration of the current program indicated that providing graduate students and faculty advisors with a framework for intentionally honing non-technical skills unlocks a new way of thinking about and engaging in professional development. Survey results coupled with comments made during meetings with a researcher revealed the approach of this program to be new for most advisors and students. Advisors seldom emphasized soft skills in working with their graduate students; consequently students rarely set explicit goals related to such skills. These findings confirm a need for professional development within the context of engineering graduate programs.

A larger scale version of the professional development program is in progress at the University of Tulsa. Administration of this program with a larger sample of students and advisors will inform future research and initiatives related to engineering education, as patterns in students' developmental status and needs will be detectable. As the program continues, assessments will be administered once per semester, allowing participants to track their development over time and modify their goals accordingly. The larger-scale program also incorporates 360-degree feedback, in which ratings and feedback will be provided by the self and advisor, as well as peers, other faculty members, and any other individuals who may have insight regarding the student's professional reputation.

Acknowledgements

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Appendix A

Excerpts From a Feedback Report

Chart Key

- Myself
- My Supervisor/Manager
- My Subordinate/Direct Report
- My Peer/Coworker
- Customer
- Overall (not including self)

Feedback Ratings

Oral Communication

- Clearly conveys information with appropriate purpose and detail
- Matches communication style with audience
- Uses listening to effectively respond others input

7.0
7.0
0.0
0.0
0.0
7.0

Overall Percentile 75th=5.75 90th=7.05
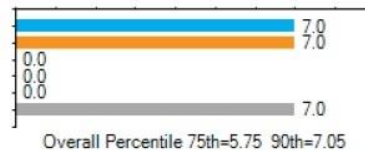
Rater Feedback

1. ▉▉▉▉▉ - I am basing this rating off of your SEM conference presentation this year. That was a good presentation with pretty good style. We discussed this some after the talk, but you still need to work on setting up the "big picture" when you talk. Your practice talk was a bit of a mess, but you made a huge leap forward for that actual talk.

2. ▉▉▉ - I think my oral communication skills are relatively strong, as I have done a lot of presentations for school over the past several years. I usually feel very comfortable and natural in front of a group as long as I'm well prepared. Outside of a presentation-type context, I feel good about my ability to verbally communicate with people in general. I've been told I'm a good teacher, and so far that's just been teaching people in the lab, which involves all verbal communication for the most part.

Conflict Management

- **Uses effective strategies for dealing with conflict**
- **Recognizes and openly addresses conflict appropriately**
- **Arrives at constructive solutions while maintaining positive working relationships**

5.0

0.0
0.0
0.0

5.0

Overall Percentile 75th=7.0 90th=7.55
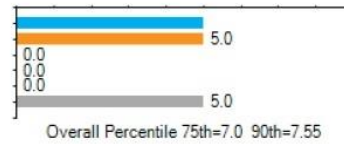
Rater Feedback

1. ▬▬▬▬▬ - I don't have a lot of information to base this rating on, so this is definitely a gut feeling. Most of your conflicts are probably stemming from the crowded lab and shared equipment. You probably have some distance to go in learning how to resolve the inter-lab conflicts without coming to me to help. I know that the second party in many of these conflicts is not particularly receptive to suggestions, but if you can work on being able to resolve that conflict yourself then you can probably handle anything.

2. ▬▬▬▬ - I feel that I am generally good at resolving conflict in the workplace, as long as the other party is respectful and cooperative. If that's not the case, I usually just bring it to my supervisor to deal with. I am usually very aware of other people's attitudes, and if they are positive I can easily feed off of that. But I would have trouble addressing conflict if the other party consistently showed no interest in resolving anything or had a callous attitude.