The Care and Keeping of Graduate Students: An Interactive Panel Discussion for Novice Advisers of Graduate Students

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1. Introduction and Purpose

While most young professors expect to juggle teaching with research, service, and grant writing, the expectation to form and lead an (immediately productive) laboratory group is sometimes surprising and often challenging. Graduate students expect that their faculty mentors will provide "careful, thorough advising and regular supportive mentoring"[1] in areas ranging from the specifics of their dissertation research to broader questions of personal and professional success.[2] This interactive panel discussion will introduce future and new engineering educators—especially those with young or forming research groups—to some best practices in setting the tone for a productive research group and navigating difficult situations related to graduate students. The panel discussion is led by Dr. Katy Luchini Colbry (Michigan State University) and Dr. Catherine Berdanier (Pennsylvania State University). The session will offer theory-based best practices for research group leadership and management in light of graduate education and socialization literature; applied to personal contexts. As a result of this session, participants will be able to approach the "care and keeping" of their graduate students from a literature-based and scholarly perspective, noting elements of graduate socialization that affect student development, success, and persistence.

2. Theories of Graduate Level Education

Community of Practice/Landscapes of Practice Theory: Community of Practice Theory was proposed by Wenger[7] to explain the "legitimate peripheral participation" of novices as they develop the knowledge, skills, and expertise required to be a participating member of a profession. Community and Landscapes of Practice theories are easily extended into graduate level research and education. Past research in higher education that employs Community of Practice/Landscapes of Practice theory include studies in distance and online learning,[8] in promoting active learning pedagogies and pedagogies of engagement,[9,10] and in studying the mechanisms for success in adult and traditional learners at the college level.[11,12] In engineering education in particular, community of practice theory has been used as the theoretical framework by which to study the development of disciplinary communities.[13-15] One way to study the development of students is by studying the ways in which people develop "discursive identity"[16,17] and situated cognition—the idea that learning happens in authentic "situated" settings.[18] The structure of many research groups help to "ease" students into research by introducing them first to well-defined, yet authentic, tasks or by working closely with a more senior student in order to develop the necessary knowledge and habits to succeed in independent research. As graduate students participate more authentically (less peripherally), they become more capable of doctoral level research and eventually join their professors as colleagues.

Cognitive Apprenticeship: Cognitive apprenticeship theory[19] is related to Community of Practice theory through the theories of situated cognition. First introduced as a mechanism to explore the ways in which novices become experts, this theory is easily applied to small research

groups where students work closely under a research advisor. Cognitive apprenticeship has been applied easily to traditional graduate education across multiple disciplines (see Belcher,[20] Stewart & Lagowski,[21] and Austin[22] for examples). With the advent of larger research groups, the integration of postdoctoral scholars into research labs, and the pushes for inter- and multidisciplinary research in engineering may require that theories of cognitive apprenticeship expand to fit these new situations. However, cognitive apprenticeship as a theory describes one way in which students work closely with expert mentors as they transfer their expertise to protégés.

Role Identity Theory and Academic Literacies Theory: While Cognitive Apprenticeship and Communities of Practice Theory have been used to explain the mechanisms through which expertise is translated within a community at a broad level; there are also specific theories that are relevant to the "community" of academia. Role identity theory[4] is one of these, that posits that the transition from undergraduate to graduate competencies has to do with the development of a disciplinary identity and is linked to the students' view of themselves with respect to the generation of knowledge. Undergraduate students are expected to be consumers of knowledge, and mature graduate students are expected to be producers of knowledge. The transition between the two often is a difficult phase for graduate students and for their advising professors, because the graduate student not only needs to develop a new identity, but may also have to switch identities quickly as they are participating in research and also taking classes in a traditional classroom setting. Role identity theory has been studied across a variety of contexts and disciplines in higher education (See Jain, George, & Maltarich's[23] study of academic entrepreneurs and Pierrakos et al.'s[24] study of role identity theory in engineering "persisters" versus engineering "switchers" as examples).   Academic Literacies Theory[3] goes further than Role Identity theory to posit that successful graduate students are able to be "literate" in the expectations and norms of their disciplines—including but not limited to the ability to write, speak, and communicate in ways consistent with their specific disciplinary community. Researchers such as Belcher[20] and Archer[25] have explored this in higher education contexts, and Berdanier[26] recently applied this in her study of graduate level engineering writing.

Theories of Leadership: Changing from a student-centric to an advisor-centric lens, the strategies by which research-active professors manage research groups vary widely across institutions, disciplines, and departments. Most leadership theories do not posit that there is "best" or "optimal way" to lead a group, but that the needs of a group should determine the leadership strategies that are required. Engineering leadership is becoming more of a common curricular priority at the undergraduate level, as engineering industry seeks engineering graduates that have leadership skills and experiences; however, not much curricular emphasis is placed on developing leadership skills through graduate school or for junior faculty members. Recent studies have linked *transformational leadership*[5,6] –the leadership style that seeks to help each individual member of a team develop her or his maximum talent and potential—to innovation success,[27] learning outcomes, and higher productivity.[28] By adopting a "transformational leadership" approach to leading and sculpting a research group, advisors can help students plan their own success. Outlining specific roles for students and helping them to set

goals for themselves at the same time as a research advisor sets overall goals for the team can help to form a productive research group.

In sum, there are several intersecting theories that lend themselves well to strategies for the "care and keeping" of graduate students. By considering the processes and mechanisms by which graduate students develop, faculty members can reform or revise their leadership practices (formally and informally) to better meet the needs of graduate students at various stages in their academic careers. Although these theories may seem disparate, they intersect and overlap in an academic research group context. As we lead the attendees of this interactive panel workshop through the following activities, we ask them to reflect on how these theories impact how they make decisions for their research group and how theory-guided decisions might help them improve or plan for effective and productive research groups.

3. Workshop Activities

Activity 1: Drafting a Team Charter for a Research Group

Effective interpersonal communication skills are essential to the success of a research group, and the most effective faculty mentors listen actively, ensure that expectations are clearly communicated and well-aligned, and foster honest and open relationships.[29] A wide variety of mentoring styles can be effective,[30] including one-on-one interactions, small- and large-group discussions, and electronically mediated communications. The type of interactions is less important than the frequency, as receiving regular feedback from mentors is essential to graduate students' success and productivity.[31]

One way to encourage and model good communications habits among your research assistants is for faculty mentors to lead the group in developing a team charter. Team charters are valuable documents that codify the norms and expectations of the research group, and provide a framework for effective communications and conflict resolution.[32] Key elements of a successful team charter may include:

- **Membership**: At a minimum, the charter should list the names of all members of the research group. Some charters include an expanded "Personnel" section that includes members' contact information, preferred communications methods (email, phone, text, etc.), and information that may impact the member's contributions to the team, such as class schedules or vacation plans.
- **Purpose or Mission:** Why does the research group exist? What research questions are being explored, and what are the short- and longer-term goals of the team? (e.g., experiments, publications, degrees)
- **Ground Rules:** What are the expectations for teammates' behavior and participation? How long is this team charter in effect, and what are the processes in place for reviewing and revising the charter?
- **Policies and Procedures:** Some research groups need explicit procedures to ensure members' safety and/or the reliability of experimental results. Training requirements and/or emergency procedures may also be important to include in the team charter,

depending on the nature of the research environment. Authorship and publication policies may be another important topic to include in the team charter.

- **Communications and Conflict Resolution:** Meeting schedules; participation/attendance expectations; and policies for using electronically mediated communications should be detailed in the team charter to ensure that the expectations for all group members are clear. Conflict resolution strategies should also be discussed; how will team members raise concerns without fear of reprisal?
- **Roles and Responsibilities:** Many research groups assign "maintenance" tasks such as maintaining the group's website or cleaning shared break areas. Other groups will need to identify within their charter the various roles of faculty, postdoctoral researchers, graduate students, undergraduates and others within their research group – whether that means discussing who has authority to make decisions about purchasing materials, or what the "chain of command" is when there is a question about research procedures.
- **Metrics:** How will the team members know if they have succeeded? What are the metrics that can be assessed to determine if the team has reached its goal(s)?
- **Consequences:** what happens if a team member does not follow the groundrules or meet the expectations described in the team charter? What types of interventions or warnings are given, and under what circumstances is a member released from the team?

Developing a team charter should be a group activity, and the charter should be revisited regularly and updated as needed – for instance, when new members join the group or at the beginning of each new semester or academic year. External facilitators may be particularly helpful in guiding the research group through a team chartering process, and many universities make facilitators available as resources through faculty development programs.

Activity 2: Drafting Mentor-Mentee Contracts

One of the keys to successful mentoring relationships is establishing clear expectations between mentors and mentees. A formal contract can be extremely helpful in clarifying the roles and responsibilities of both the faculty mentor and the graduate student, and provides a "neutral" document to refer back to if conflicts arise.[33] Mentor-mentee contracts should be reviewed and updated regularly; in an academic environment, revising once per year at a minimum – or even at the start of a new semester – helps to ensure that mentors and mentees remain focused on their common goals. Specific elements that may be helpful within a mentor-mentee contract include:

- **Goals**. The goals statement should identify (1) the overarching goals for the project or timeframe (e.g., what is the purpose of the research, or what are the key goals to accomplish during the upcoming semester?); (2) the mentee's personal and/or professional goals for the project/timeframe (e.g., to complete certain experiments, to submit a journal manuscript, to draft specific thesis chapters); and (3) the mentor's personal and/or professional goals as they relate to the project/timeframe (e.g., to onboard new trainees, to submit new funding requests, to complete specific aspects of the project)
- **Schedule and Time Commitment**. Mentors should be explicit in communicating their expectations of how, when and where their graduate students should be working on research. In some research groups, mentors prefer to establish standard "working hours" when students should be visible in the laboratory or office; in other groups, students are

free to set their own hours provided that goals are met within specific deadlines. Either approach can be effective, but the key is for mentors and mentees to communicate their expectations in advance. Effective mentors also consider what other time constraints impact their students in a specific semester (e.g., coursework, teaching, studying for qualifying exams, drafting the dissertation) and provide guidance to their mentees on how to balance academic, research and personal commitments.

- **Preferred Communication Methods.** Mentors should let their students know how and when to contact them. Some mentors prefer formal, weekly "reports" by email or during group meetings, while other mentors have a drop-in policy or prefer individual meetings. Making these expectations explicit within the mentor-mentee contracts reduces anxiety for students and allows mentors to clarify the students' responsibilities in the communication process.

- **Feedback Mechanisms.** Many institutions have formal policies regarding annual reports or other mechanisms of tracking students' progress and mentors' feedback. The mentor-mentee contract should reference these policies, if applicable, and/or identify how and when the mentor will provide feedback on students' performance and specific suggestions for how to improve or progress.

If the research group has a Team Charter that specified research policies and procedures, then these may not need to be included explicitly within the Mentor-Mentee Contract. Otherwise, the contract should include pertinent information about expectations for data collection, storage and sharing; authorship or acknowledgement guidelines for publications resulting from the group's research; standard operating procedures for the laboratory; and similar information necessary to ensure the safe and accurate conduct of research.

Activity 3: Communication Case Studies

Case studies for communications between graduate students and their faculty advisors are readily available online – a simple internet search for "communicating with your graduate mentor" brings up thousands of results, many from universities that offer formal guidelines or suggestions for faculty mentors. Many universities also provide resources for graduate students who are interested in developing strong, effective communication strategies to build good working relationships with their research mentors.

Discussing communication strategies and case studies as a research group can be an effective way for mentors to encourage their students to practice interpersonal communication skills.[34] Mentor-mentee dyads can also benefit from practicing active listening and reflection techniques[35] as they work together to strengthen their communication skills and develop an effective working relationship. Specific topics that may be relevant and helpful to consider through case study discussions include:

- The advantages and disadvantages of different mentoring styles (active, passive) and constraints (travel schedules, sabbaticals, teaching loads)
- Common challenges students may experience during the transition to graduate school and getting started in coursework and research activities

- Communication strategies for working with colleagues from different backgrounds, experiences and disciplines
- Balancing academic, research and personal responsibilities
- Research ethics and responsible research practices for the mentor's discipline

4. Conclusion

Through the proposed activities which are grounded in best practices as well as multiple theories, participants will come out of this interactive panel discussion with draft versions of research group charters, plans to enact mentorship contracts, and knowledge gained from other early career faculty through case studies and group discussions. While research mentorship can be a taxing and often overwhelming part of being a junior faculty member, the development of a productive research group is critical to career success. The tools developed in this workshop will be helpful for faculty at all stages as they seek to make their group as productive as possible.

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