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The Flip Side of the Attrition Coin: Faculty Perceptions of Factors Supporting Graduate Student Success

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Abstract

Doctoral attrition consistently hovers around 50% with relevant literature identifying several mediating factors, including departmental culture, student demographics, and funding. To advance this literature, we interviewed 38 graduate faculty advisors in science, engineering, or mathematics disciplines at a research-extensive university to capture their perceptions of factors supporting graduate student success. Using a constant-comparison method, we found that faculty perceptions aligned within three major categories, termed: motivated student behaviors, formative student learning experiences, and essential student knowledge and skills. Student motivation was most prominently represented in findings. This aligns with prior studies showing that faculty tend to identify the cause of graduate student failure as lying within the students themselves and rarely discuss their role or the department's contribution to attrition. Thus findings offer an opportunity to reflect and improve upon practice. The study also highlights actions graduate students can take to increase success, such as developing collegial relationships and early involvement in research and scholarly writing. We encourage graduate faculty advisors and others to identify ways to help graduate students overcome common obstacles to enduring and succeeding within graduate programs. Faculty perceptions are also examined by discipline and faculty rank, and directions for future research are offered.

Keywords: faculty mentorship, graduate student development, graduate student motivation

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Introduction

This study explores graduate faculty advisors' perceptions of factors contributing to graduate student success. Graduate students represent knowledge workers at the forefront of an emerging global, competitive knowledge economy (Durette, Fournier, & Lafon, 2016; Nerad & Evans, 2014) and the future of academe (National Science Foundation, 2015). In light of this, the consistently high rate of graduate student attrition of around 50% (Nettles & Millett, 2006), particularly at the doctoral level, is jarring. Further, it is a long-standing problem, transcending national boundaries (Council of Graduate Schools, 2008; Jiranek, 2010; Johnes & McNabb, 2004).

Not surprisingly, given the above, graduate education experiences and outcomes have garnered increased attention from scholars across the globe (e.g., Lee & Danby, 2012; McAlpine & Amundsen, 2011; Walker, Golde, Jones, Conklin Bueschel, & Hutchings, 2008). The current study advances this literature by examining the perceptions of factors underlying graduate student success of those who work most closely with graduate students - graduate faculty advisors. Further, our emphasis on the factors that support success complements literature focused on reasons for leaving graduate school (e.g., Lovitts, 2001). Examining the 'flip side of the attrition coin' may reveal additional insights about how faculty, departments, and universities can foster graduate student success.

The research question that guided this study was, "What factors do graduate faculty advisors in science, engineering, and mathematics perceive to underlie graduate student success?" As Gardner (2009a) noted, graduate faculty advisors serve many roles beyond that of advisor, including, "teachers … committee members, mentors, role models, and future colleagues" (p. 386). Thus, their conceptualizations of graduate student success, and their perceptions of factors underlying that success, are important. Regardless of their accuracy, faculty perceptions exist and influence faculty behaviors (van den Berg, 1999). Further, understanding these perceptions is a first step in changing them if needed to better support student success (Michael, 2007). Curiously, however, literature on faculty perceptions of graduate student success is notably under investigated.

Given the study's focus and faculty advisors' role as primary socializing agents, we next explore the literature on graduate student success and retention. We do so within the context of the socialization framework, which is commonly used to situate and interpret studies of graduate education (e.g., Gardner, 2010; Hakala, 2009; Holley, 2009; Weidman, 2010).

Conceptual Framework and Literature Review

Graduate student attrition is multi-faceted and not usually attributable to a single cause but more broadly, to a "lack of socialization" (Gardner, 2008, p. 324). Thus, socialization theory serves as our conceptual framework and literature on factors that influence doctoral socialization is reviewed.

Broadly, socialization has been defined as a process in which students "internaliz[e] the expectations, standards, and norms of a given society, which includes learning the relevant skills, knowledge, habits, attitudes, and values of the group that one is joining" (Austin & McDaniels, 2006, p. 400). In the context of graduate education, as Weidman, Twale, and Stein's (2001) socialization model posits, the society noted in this definition refers to multiple, nested contexts including the specific program and department in which the student is enrolled, the institution in which the program is housed, interactions they have with professional communities and practitioners in their discipline, and the student's personal communities. However, as Tierney (1997) noted, it is the "ordinary daily occurrences" that are the strongest socialization forces (p. 3). In the lives of graduate students, the program and department in which the program is located are paramount (Bowen & Rudenstine, 1992; Golde, 2005). It is in these contexts that the policies and practices guiding daily professional practice in graduate education are made and enacted. It is

also within this context that graduate students' decisions to persist within or leave their program are made (Golde, 1998).

Departmental culture is a particularly important contributor to graduate student socialization and, by extension, retention or attrition. As Ferreira (2003) and Hirt and Muffo (1998) note, each university department establishes its own recruitment and admission policies, curriculum, performance criteria, and expectations for how students should spend their time and talent. The extant research on departmental climate has identified several issues related to student socialization and decisions to persist or leave, including the availability of explicit information about program expectations, the use of preliminary and qualifying exams which provide feedback to students early in their programs, opportunities to engage in research early in graduate training, opportunities for diverse skill development to strengthen post-graduation career success, and the propensity for students to work in isolation (Boyle & Boice, 1998; Earl-Novell, 2006; Gardener, 2009b; Golde, 2005; Golde & Dore, 2001; Hirt & Muffo, 1998; Solem & Schlemper, 2009). In addition to establishing policies and practices that influence doctoral student success, "feeling cared about and appreciated at the departmental" level can also serve as a buffer to emotional exhaustion for graduate students and is connected to successful completion (Hunter & Devine, 2016, p. 52).

Graduate faculty define the texture and tenor of departmental culture, and as such, are the primary agents of graduate student socialization (Austin & McDaniels, 2006; Walker et al., 2008). The quality of the relationship between the graduate faculty and the student is instrumental in student success (Barnes & Austin, 2009; Hall & Burns, 2009; Joy, Liang, Bilimoria, & Perry, 2015), to the point that a poor graduate advisor-advisee relationship can result in student attrition (Lovitts, 2001). In successful relationships, faculty act as mentors toward their students, becoming a source of cognitive guidance (Austin, 2009; Walker, et al., 2008). As graduate students develop plans for research, faculty mentors regularly assess students' progress and provide them with explicit and honest feedback for improvement (Barnes & Austin, 2009). Faculty mentors also provide psychosocial support that encourages graduate students to persist in the face of unexpected results (Barnes & Austin, 2009). However, faculty mentors must be cognizant of the balance between giving students support while "providing mentees academic space to form their own research identity" (Bagaka's, Badillo, Bransteter, & Rispinto, 2015, p. 324; Orellana, Darder, Pérez, & Salinas, 2016). Thus, it is not surprising that effective faculty mentorship predicts graduate student endurance and completion (Council of Graduate Schools, 2009) and also influences doctoral student post-graduation employment (Jackson & Michelson, 2015).

Characteristics such as race, gender, and social class can also influence graduate student mentoring and socialization (Barker, 2011; Ferreira, 2003; Felder, Stevenson, & Gasman, 2014; Sallee, 2011). Specifically, underrepresented groups often have disparate socialization experiences, resulting in feelings of isolation and marginalization (Felder et al., 2014; Gildersleeve, Croom, & Vasquez, 2011; Solórzano & Yosso, 2001; Taylor & Antony, 2000). As one graduate student in Barker's (2011) study described, there is a "mentoring, racial hierarchy" and as a black student, she considered herself "second best" (p. 394). Similarly, students who, as Gardner (2008) says, fail to "fit the mold" of graduate school are more likely to receive inadequate socialization within their programs (p. 126). Gardner notes that the 'mold' was created by graduate education's earliest beneficiaries: young, white, single males. She found that those who fall outside this mold, including women, students of color, older students, students with children, and part-time students, are more likely than their traditional graduate student peers to report negative interactions, structural impediments to their degree completion, and feelings of being different.

In addition to demographic characteristics, graduate student attrition/retention literature has highlighted a host of other internal and external student factors, such as motivation, knowledge and skills, and financial resources (Bain, Fedynich, & Knight, 2011; Hirschberg & Itkin; 1978; London, Cox, Ahn, Branch, & Zephirin, 2014; Spaulding & Rockinson-Szapkiw, 2012). In regard to

motivation, for example, Ponton, Derrick, and Carr (2004) asserted in response to a *Chronicle of Higher Education* discussion of doctoral attrition, "Doctor Dropout" (Smallwood, 2004), "… the presence of attributes that are important for successful doctoral matriculation [are] desire, resourcefulness, initiative, and persistence" (p. B4). More recently, Gardener (2009a) interviewed almost 40 faculty from different disciplines at one institution about their conceptualization of graduate student success. She found that, across the disciplines, faculty spoke about the importance of graduate students being motivated. This included being self-directed learners who "have a sense of vision" and take initiative as well as being self-regulating learners who focus on a task through completion and are willing to "work on Saturday and work on Christmas break" (pp. 393, 395).

Of note, faculty in this study who discussed the importance of motivation also described motivation as a characteristic with which students enter graduate school, rather than one that is fostered by their department. However, Woolderink, Putnik, van der Boom, & Klabbers' (2015) work indicates that supervising faculty play a key role in doctoral student motivation. Bain et al. (2011) surveyed 70 Educational Leadership and Counseling graduate students under two faculty members' mentorship to identify factors that they believed supported their success. In contrast to the faculty views espoused in Gardener's study, graduate students in Bain et al.'s study only identified motivation as somewhat important. The authors also noted that motivation should be considered "as both a pre-existing trait and as one that is fostered in the atmosphere of a nurturing academic environment" (p. 3). In contrast to the aforementioned studies, which rely exclusively on self-report to identify factors that predict graduate student outcomes, to our knowledge, Hirschberg and Itkin (1978) are the only researchers who have empirically examined the impact of student motivation. They found that achievement motivation was associated with completion of the Ph.D., time to degree completion, and number of publications.

Depending on the graduate program, students may need substantial disciplinary knowledge and/or academic skills to be prepared to pursue a graduate degree. Prior knowledge may be particularly important in science, engineering, and mathematics related disciplines (Craig, Gordin, Clark & Langendyk, 2004), which are the focus of this study. Research across fields supports that graduate students need a robust skill set in several key areas to successfully complete a graduate degree. Fisher and Zigmond (1998) and Austin and McDaniels (2006) identified knowledge, skills, abilities, and values that graduate students need to be effective faculty. Within both frameworks, communication skills are critical to graduate student success. Interpersonal and social skills are also key competencies in graduate school completion (Austin & McDaniels, 2006; Fisher & Zigmond, 1998) in addition to a number of additional "transferrable skills" such as critical thinking, problem solving, time and project management, and statistical skills that help doctoral students secure employment post-graduation (Johnson, Sampson, Comer, & Brogt, 2016, p. 186).

In the United States, where the current study was undertaken, the cost of graduate education has increased substantially (Peterson's Staff, 2015) and represents about 40% of student loan disbursements (Delisle, 2014). While federal support programs such as Pell grants are used to increase the accessibility of undergraduate education in the United States, they are not offered to graduate students, making graduate education less accessible for students who lack financial means. This is part of the reason that about a quarter of the graduate students in Lovitts' (2001) study identified financial problems as the primary reason why they left graduate school. Graduate students who responded to Bain et al.'s (2011) survey also reported that affordable tuition was very important to their success. While Lovitts' (2001) and Bain et al.'s research was conducted in the United States, the increasing cost of higher education and limited access to funding is problematic internationally (Altback, Reisber, & Rumbley, 2009; Greenway & Haynes, 2003).

Partly to offset the cost of graduate education, many graduate students, particularly in the sciences, complete graduate teaching or research assistantships, often in exchange for tuition reduction

and a stipend (National Science Foundation, 2015). However, in the United States, assistantships alone generally do not provide enough financial support to fully fund a graduate degree; graduate students are not recognized as official employees and thus, standard labor laws do not apply (Ludwig, 2015). As a result, students often need several sources of financial support to fund a graduate degree (e.g., assistantships, fellowships, scholarships, loans, part- or full-time work, and/or financial support from one's family). Research corroborates that graduate students with a broad and consistent base of support are more likely to persist to degree completion (Bowen & Rudenstein, 1992; Ehrenberg & Mavros, 1992; Nettles & Millett, 2006).

In addition to offsetting the costs of graduate education, research assistantships provide a structured method for students to engage in research, which is critical in the formation of future scholars (Bagaka's et al., 2015; Lambie, Hayes, Griffith, Limberg, & Mullen, 2014). Research assistantships provide students with opportunities to interact closely with faculty (Hirt & Muffo, 1998). Further, in the sciences, where research is increasingly collaborative, research assistantships provide rich opportunities to interact with peers and professionals in the field, which can support networking and the development of collaboration skills (Fox & Mohapatra, 2007). Graduate students also report that research assistantships increase their methodological knowledge and skills as well as their ability to write for publication (Austin, 2002) and more generally, graduate research experiences predict students' research self-efficacy (Chestnut, Siwatu, Young, & Tong, 2015).

The above serves as a conceptual and contextual foundation on which to situate our inquiry into graduate faculty advisors' perceptions of factors underlying graduate student success. Based on this, we would surmise that graduate student success will be perceived by those who most closely work with graduate students – graduate faculty advisors – as multi-faceted and not attributable to a single factor. However, while the extant literature identifies how socialization experiences are influenced by a combination of the factors noted above, prior research points to self-esteem, financial support/cost of tuition, professors' commitment to student success, part-time vs. full-time enrollment, career and family changes, and satisfaction with the graduate experience as primary predictors of attrition/retention (Bain et al., 2011; Council of Graduate Schools and Educational Testing Service, 2010). Similarly, among the factors presented in our literature review, we were curious to learn which were most prominent in advisors' responses.

Method

This qualitative study originated as part of a larger NSF-funded study of graduate student research skill development in science, engineering, and mathematics (see Feldon et al., 2011). Within the larger study, science, engineering, and mathematics faculty who served as advisors of record for graduate student participants reported on student progress. They also responded to several questions about their graduate advising practices and expectations, including one eliciting their guidance on achieving graduate student success. Specifically, the faculty were asked, 'What advice would you give to students who want to be successful graduate students in your field?' All faculty were asked this question and it elicited the majority of the data collected for this study. At times, however, additional follow-up questions were posed to provide further clarity. Additionally, disciplinary differences in graduate training have been widely noted (Austin, 2002; Golde, 2005). Further, some literature suggests faculty rank may influence graduate training processes and outcomes (Maher, Timmerman, Feldon, & Strickland, 2013). Therefore, we disaggregated advisor responses by discipline and rank to test for discernible patterns.

The decision to use a qualitative approach to collect data regarding faculty advisors' advice to hypothetical graduate students was intentional. We assumed that as they considered a response, advisors would not draw upon codified rules and regulations, but upon their own individual advising expertise garnered through their experiences of mentoring (in most cases) numerous doc-

toral students over their faculty career. Additionally, we purposely left the term 'successful' undefined, allowing faculty advisors to provide us with their perceptions of this term. A qualitative approach allows experiences and perceptions, and the meaning made from those experiences and perceptions, to be elicited in a manner that recognizes and respects both their individuality and the context in which they occur (Merriam, 2009).

The wording of the question, 'What advice would you give to students who want to be successful graduate students in your field?' was also intentional. In addition to drawing out faculty advising expertise, our aim in requesting advice was to direct advisors' attention away from listing innate qualities that students bring to a graduate program (e.g., intelligence) and toward what students can *do* once enrolled to facilitate their own success, such as purposefully manage their time and efforts (Martinez, Ordu, Della Sala, & McFarlane, 2013). Further, it should be emphasized that when faculty were invited to provide advice, they were prompted to think of students in general and not to consider advice they would offer to a particular student.

Participants

Of the total 38 science, engineering, and mathematics graduate advisors, 6 were female. The small number of female participants reflects the reality that female faculty are underrepresented in the science, engineering, and mathematical disciplines (Hill, Corbett, & St. Rose, 2010). All faculty participants served as tenure-track or tenured faculty at a large research-extensive university (Carnegie Classification Basic, Doctoral Universities: Highest Research Activity) in the southeastern United States (Carnegie Foundation, 2016). Faculty represented a range of disciplines and rank, as depicted in Table 1.

Table 1: Faculty advisors by discipline and rank

Discipline	Assistant Professor	Associate Professor	Full Professor	Total
Science (includes Biology, Chemistry, Exercise Science, Geology, & Medicine)	9	6	12	27
Engineering (includes Chemical, Civil, Electrical, & Mechanical)	-	4	4	8
Mathematics & Statistics	1	2		3
Total	10	12	16	38

Instrument and Data Collection Procedures

The question that generated the data for this study (What advice would you give to students who want to be successful graduate students in your field?) was posed as part of semi-structured interviews with faculty advisors. The interviews lasted approximately 30-45 minutes. The interview protocol addressed topics hypothesized to be relevant to graduate advising mentoring practices and expectations, such as the process of collaborating with students to conduct research and advisors' mentoring philosophy. The question that generated the data for this study was situated within the latter half of the interview; thus, the interviewer had ample time to establish rapport with faculty once this question was posed. Interviews were recorded and transcribed verbatim with faculty permission and all data were stored on password protected computers and any identifying information was removed during reporting.

Analytic Procedures

Faculty responses were analyzed using the constant comparative method (Glesne & Peshkin, 1992) in which study authors compared and contrasted response data to identify emergent themes. The process began with the third author compiling all relevant response data from faculty transcripts into one document. Next, the first and third author reviewed these data and independently identified emerging themes. Each author created and shared analytic memos that identified emerging themes, promising insights, and questions of interest (Corbin & Strauss, 2015). Being familiar with the literature on graduate student development, the research included in our literature review also informed the lens through which we interpreted faculty responses and the emerging themes we identified. The analytic memos informed a conversation about the direction the study would take. The first author then developed a rudimentary codebook that included all emerging themes that had been noted by the first and third author. The first and second author then used the preliminary codebook to conduct an initial pass at analyzing the data.

After coding all of the data, the first and second author met to discuss discrepancies in their coding and made improvements to the codebook, a process regarded as a good strategy for improving accuracy and reliability (Johnson, Penny, & Gordon, 2000; Johnson, Penny, Gordon, Schumate, & Fisher, 2005). These improvements involved organizing the themes and subthemes under 3 broad categories as well as clarifying definitions for themes that showed overlap. For example, given the importance of faculty mentorship, we initially coded responses about the value of interacting with one's advisor to be distinct from interactions with other graduate students. However, we found it was often difficult to parse the data at this level of granularity as participants' responses often moved between discussing interactions with multiple colleagues and its value. The revised codebook was shared with the second author for additional feedback.

The final codebook was used by the first and second author to independently code all data. In addition to coding data that exemplified each theme, we also conducted a negative case analysis (Patton, 2001) in which we identified responses which contradicted our themes (for example, see findings regarding the value of coursework). After the second round of coding was complete, we met again to discuss and resolve any discrepancies. Once coding was complete and the frequency of each subtheme was identified, some subthemes which were less commonly mentioned and shared a conceptual link were combined (such as oral and written communication skills).

Findings

Analytic procedures resulted in the identification of three broad advisor response categories: (1) motivated student behaviors; (2) formative student learning experiences; and (3) essential student knowledge and skills. Each category yielded several distinct themes and, in turn, several themes could be meaningfully further divided into subthemes. Hierarchical structure and frequency of categories, themes, and subthemes are shown in Table 2.

All faculty advisors' responses fit within at least one category. Twenty-eight responses (74%) were coded within the motivated student behaviors category, 20 (53%) were coded within the formative student experiences category, and 19 (50%) were coded within the essential student knowledge and skills category. Most responses (31; 84%) described combinations of behaviors, experiences, and knowledge and skills across categories. While the average number of codes assigned per advisor response was 3.3, many responses greatly exceeded this average. For example, one response was assigned 11 distinct codes across the three categories. We described each category of responses in the next sections including identifying prominent themes and sharing quotes from participants that exemplify or enrich the discussion of themes.

Table 2: Hierarchical structure and frequency of categories, themes, and subthemes

Categories/Themes/Subthemes	Number of Faculty Identifying Theme/Subtheme*	Percent of Faculty Identifying Theme/ Subtheme
Motivated Student Behaviors		
Invest effort/dedication	**13**	**34.2%**
Persist through challenges, work hard, invest extra time	11	28.9%
Immerse yourself in the graduate student experience and lifestyle	4	10.5%
Find passion	**11**	**28.9%**
Be curious	5	13.2%
Take interest in your work	5	13.2%
Find joy in your work	3	7.9%
Manage time and emotions	**7**	**18.4%**
Learn to regulate emotions	1	2.6%
Conduct research immediately and overcome the desire to pursue the 'ideal' research project	4	10.5%
Get started immediately in writing about research even if you don't yet know what you plan to write	2	5.3%
Set goals	**6**	**15.8%**
Set periodic short- to medium-term goals and working toward them	4	10.5%
Identify and focus on long-term career goals	3	7.9%
Take Initiative	**5**	**13.2%**
Own your work	2	5.3%
Take initiative	5	13.2%
Be confident	**4**	**10.5%**
Motivation in general (specific motivated behaviors were not identified)	**4**	**10.5%**
Formative Student Learning Experiences		
Interact with advisor, colleagues, and peers	**16**	**42.1%**
Do and disseminate research	**8**	**21.1%**
Do well in courses	**2**	**5.3%**
Attend conferences, seminars, workshops, and meetings	**2**	**5.3%**
Essential Student Knowledge and Skills		
Communication skills (oral and written)	**9**	**23.7%**
Problem solving and critical thinking	**8**	**21.1%**
Reading and synthesizing literature	**7**	**18.4%**
Organizational skills	**3**	**7.9%**
Mathematical knowledge	**3**	**7.9%**

*Note: The number of advisors identifying each subtheme under a specific theme may or may not equal the number of advisors identifying that theme. This is due to the fact that an individual advisor may discuss more than one subtheme but would only be counted as identifying that theme once. For example, 13 advisors identified the theme "Invest effort/dedication." These 13 advisors identified the subtheme "Persist through challenges, work hard, invest extra effort" 11 times and identified the subtheme "Immerse yourself in the graduate student experience and lifestyle" 4 times.

Motivated Student Behaviors

Advisor responses were most often coded within the category 'motivated student behaviors.' In total, 28 (74%) advisors provided a response or partial response coded within this category. Of these, 16 responses (57%) were assigned more than one motivated student behavior code. In one notable case, a response was assigned seven distinct motivated student behavior codes. Clearly, for this advisor, motivated behaviors were dominant in the narrative of graduate student success. While four advisors offered somewhat vague ideas about motivated student behaviors (e.g., "attitude [is important]"), the remaining twenty-four advisors whose responses were coded in this category provided "actionable" advice, including invest effort/dedication (n = 13), find passion (n = 11), manage time and emotions (n = 7), set goals (n = 6), take initiative (n = 5), and be confident (n = 4).

Invest effort/dedication

About a third (n = 13) of advisors identified the importance of investing dedicated effort. This advice often coupled effort with time, particularly when challenges were encountered. Statements such as, "Never give up because research is a long process" or "It's not easy. If you come in here and think you can work 9 to 5, [then] that is not going to work out" defined this theme. Some advisors described the need for intense dedicated focus, as did one who emphatically stated, "If you want to be a doctoral student, it is very hard to just dabble – it has be a lifestyle."

Find passion

Finding intellectual passion was identified by nearly a third (n = 11) of advisors. This included being intellectually curious, even (or especially) in the face of failure. As one stated, "Always try to investigate the reason of the failures. So if something fails, it doesn't matter how it fails, go and try to investigate." Intellectual curiosity was perceived as fueling deep interest and joy in one's work. Phrases such as, "You have to be really interested – it can't be a backup plan" and "You have to be curious, almost to a fault" were common. As one faculty advisor shared:

> You have to enjoy it [one's degree program] if you want to do it, that old adage: Show me a man who loves what he does and I will show you a person who has never worked a day in his life.

Manage time and emotions

Seven advisors identified the need for students to manage time and emotions. We first attempted to separate time management and emotion management into distinct subthemes. However, we ultimately chose to couple them because they seemed intertwined. Faculty advisors perceived novice student researchers as frustrated and overwhelmed in their search for the 'perfect' research project. However, faculty advised students to engage in research immediately, even if available projects do not appear to 'perfectly fit' their initial research interests. Similarly, faculty advised students to write about their research activities, even if they felt unprepared to do so. Example quotes included:

> … they [successful students] want a project that interests them, [but] it doesn't have to necessarily be their end all that they're going to do the rest of their life; it has to be just something they can get into.

> … after a week or two of maybe asking questions, they [students] have done some data on it. [I say], 'Go ahead and write it down … writing's a big part of your mental ability to see things, ask questions and synthesize things, probably even unconsciously.

However, we note that one faculty participant offered seemingly contradictory advice:

> [I would advise students] not to dive into your project immediately … test the water a little bit, be sure you know what has been done, be sure you are comfortable handling the materials.

Set goals

Six faculty advisors advocated that students set short-, medium-, and longer-term goals. For example, one suggested that students set short-term writing goals and take it "step by step." Examples of advice regarding longer-term goal setting included:

> First, you have to know what you want to do. Why are you in the graduate program? Really thinking about, 'Why am I here? Why do I want to go to graduate school? How's it going to help me advance?' It's really important for maintaining motivation and momentum.

> It is important to look ahead to where you are going to be, whether it is either as a faculty member or in whatever your chosen field is, and then to start acting that way.

Take Initiative

Five faculty advisors encouraged students to be responsible for their own education, including "owning" their research. One professor summed this direction as follows:

> The students who have done well with me are those who work independently, who see graduate school as a series of opportunities that they can grasp, not something that they are going to be spoon fed. I have had some students who are very bright on paper and came in with great scores and just did not do well because they expected to be told what to do. If you think about someone who is a faculty member or any other profession, when you get a Ph.D., you are not going to be told what to do. You are going to be presented with a problem and you are going to have to figure out how to fix it. So I think taking that attitude from the word 'go' is - they need to take control of their own dissertation and make sure it happens.

Formative Student Learning Experiences

Twenty (53%) faculty advisors discussed formative student learning experiences that they perceive facilitate graduate student success. In total, four learning experiences were identified, two with noted frequency (interaction with advisor, colleagues, and peers, n = 16, and do and disseminate research, n=8) and two with less frequency (do well in your courses, n = 2 and attend conferences, workshops and meetings, n = 2).

Interact with advisor, colleagues, and peers

By far the most commonly identified formative student learning experience was communicative interaction within the graduate learning environment. The importance of communication in managing advisor interactions was foremost in many responses, including:

> You got to be totally honest with your advisor. There's got to be no back-stabbing or none of that BS going on.

> The student has a responsibility for seeking the input of their advisor as much as they need. Some of my students have learned that if they need me, they need to ask for time on my calendar and get an appointment, and chastise me if I don't put in the preparation work that I need to prepare for a discussion that we need to have.

However, advisors noted that it was also important for students to seek guidance beyond their advisor. For example, one stated, "Students shouldn't hesitate to approach the more established colleagues, say professors, and talk about their research, and about opportunities." Another stated, "Communicate with other students." Another offered:

> I think a lot of students doing a Ph.D. [think], 'I have to do this all on my own.' That's the kiss of death, don't do that. Again, that's communication, but it's knowing to ask questions and what questions to ask. And it's okay to do that, to seek guidance, to seek advice. … I think a lot of them [students] are intimidated or too afraid … Graduate students choose to be in this intimidating, isolated environment. Maybe that needs to be part of a better training program, just understanding how to handle that environment.

Faculty who described interacting with others as important to graduate student success discussed these interactions as supportive and collaborative. Success does not always have to be a supportive effort, however, and one faculty member briefly described how the competitive interactions that occur between graduate students is another means to fuel their success. As he shared,

> They [publications and grants] are all lines on your CV, it's not necessarily how much money, it is whether you got it or not…And you kind of hope it builds, not necessarily a jealousy but some sort of competition between them [graduate students].

Do and disseminate research

Not surprisingly, graduate advisors identified actually conducting research as a critical graduate student learning experience. Although several faculty discussed the importance of doing research, few described how this would affect students' knowledge and skill sets or motivation. Among those that did so (all science professors), one shared that conducting research can drive graduate students' research interests. Another shared that doing research helps the student "understand the microbio world." A third shared that students should, "work well in the practicum/GA-ship so that [they] build the professional skills that will make [them] a success after [they] leave."

Disseminating research in terms of publishing and grant writing were also discussed. One faculty member who discussed both shared:

> You have to publish. If you can't justify your existence with whatever the basic criteria are for tenure at the institution you think you are going to end up at, then you are wasting your time. So I always tell my students, 'If you are not doing an average of one publication per year, one every two years as a graduate student, good publications, you are going to have a difficult time finding a job' … Although I think grants are a little bit [more] difficult to come by as a graduate student than it is for a PI of a lab … You kind of expect them [students] to try no matter what

Do well in courses

Interestingly, coursework was only described as important by two faculty advisors, one of whom simply stated, "Doing well in your studies [is important to graduate student success]." Although not noted in Table 2, three graduate advisors shared that they did not think graduate student success depended upon outstanding course performance. One said, "It's the adage you know, 'B's get degrees" and another shared the perception that the importance of coursework was overemphasized by graduate degree programs:

> The ones [students] who've done best are the ones who … [do] not focus on just the courses and the dissertation. Part of that is the fault of the department, because that's what we publish in the manual, about what courses you need to take, what you need to do

> for your dissertation etc. In reality, there's a lot more to it to make a polished student come out of the program.

Attend conferences, seminars, workshops, and meetings

Similar to the discussion around coursework, we also saw disagreement about the value of attending conferences, seminars, workshops, and meetings. Two graduate advisors felt these experiences were important for graduate student success, particularly as they related to helping students to gain a broader perspective. As one advised, "Just expand your knowledge as much as you can and go to seminars so that you get those new ideas and even if it is not necessarily directly related to your research." In contrast, two advisors (one from science and one from mathematics) indicated that these experiences are not structured to support graduate student learning and success. One, a mathematician, shared:

> The formal setting in which we communicate mathematics is actually not very effective. It consists of mini-lectures at conferences or seminars. One thing you will notice if you go to a Biology seminar or a Physics seminar [is] that people will jump up and argue and ask probing questions. At a mathematics colloquium, talk or seminar, by and large, it's a lecture and there aren't really any questions, not ones of substance anyway. That's because it takes time to digest this stuff, and any lecture, no matter how carefully paced, is too fast to do that … So, mathematicians look like they are very polite … it just means that they don't know what to ask at that point.

Essential Student Knowledge and Skills

Nineteen faculty advisors (50%) identified at least one area of knowledge or skill perceived as essential to graduate student success. These included oral and written communication skills (n = 9), problem solving and critical thinking skills (n = 8), the ability to read and synthesize literature (n = 7), organizational skills (n = 3) and mathematical skills (n = 3).

Communication skills

The most commonly identified skills were oral and written communication skills. The theme we previously discussed regarding interaction with advisor, colleagues, and peers, shares substantial overlap with this theme. However, responses were coded as "interaction" when advisors described the importance of discussing one's ideas and research with others, while responses were coded as "communication" when they focused on the ability to share one's research orally and in writing. Common phrases included "presentation skills," "conveying results," "lots of writing," and "being able to share what you've done." One faculty member noted, however, that graduate programs may not emphasize these skills enough, saying, "It is one problem we have in the field, we don't train writing very well."

Problem solving and critical thinking

Problem solving and critical thinking skills were identified by eight advisors. One shared, "You are going to be presented with a problem and you are going to have to figure out how to fix it" while another stated, "… For a researcher, it is problem solving, being able to think through a problem. I have noticed that this is a problem for both undergraduate and graduate students alike." Other statements coded in this theme included, "[knowing] how to critique other work is very, very important" and "…you need to be able to think and read papers and critically evaluate them and define an objective for your experiment and define a problem and find a way to solve it."

Reading and synthesizing literature

Reading and synthesizing the literature was identified by seven advisors as important to graduate student success. As one advisor shared, "The main thing [for students] would be to read a lot and apply it to their own research. Another stated:

> I tell everybody the same thing: Read as much as possible, so journal articles, and if you can get on a review committee as a list of reviewers for a journal, then you get kind of advanced notice of what is going on in a field.

Results by Faculty Discipline and Rank

Disciplinary differences in graduate training have been widely noted (Austin, 2002; Golde, 2005). Further, some literature suggests faculty rank may influence graduate training processes and outcomes (Maher et al., 2013). Therefore, we disaggregated advisor responses by discipline and rank to test for discernable patterns.

Faculty discipline

While the sample sizes for this analysis became very small, two disciplinary differences were apparent. First, we noted that graduate advisors from engineering and mathematics were much more likely than their counterparts from science to offer advice regarding the importance of students interacting with their advisor, colleagues, and peers (engineering faculty advisors, n = 5, 62.5%; mathematics faculty advisors, n = 2, 66.7%; science faculty advisors, n = 7, 25%).

Second, while the sample of mathematics graduate advisors was very limited (n = 3), these advisors were much less likely than their science and engineering counterparts to identify student motivated behaviors in their responses. Instead, their responses targeted essential knowledge and skills, such as problem solving, critical thinking, and communication skills. In contrast, science and engineering advisors regularly identified a wide array of motivated student behaviors as important to graduate student success.

Faculty rank

When we disaggregated our data by faculty rank, three response patterns emerged. First, assistant professors were substantially more likely to discuss the role of coursework in graduate student success than were their associate or full professor counterparts. Specifically, coursework was mentioned by four assistant professors (40.0%), one associate professor (8.3%), and no full professors. Interestingly, among the four assistant professors who mentioned coursework, two felt that it was a predictor of graduate student success, while the other two who mentioned coursework did not. Second, more assistant professors than those at other ranks discussed the importance of reading and synthesizing literature. Specifically, four assistant professors (40.0%) described this as critical, compared with two associate professors (16.7%) and one full professor (6.3%). Finally, more associate professors than those at other ranks mentioned curiosity. Specifically, four associate professors (33.3%) mentioned curiosity, compared with no assistant professors and one full professor (6.3%).

Discussion

We surmised earlier that graduate student success would be perceived by those who most closely work with graduate students – graduate faculty advisors – as multi-faceted and not attributable to a single cause. Despite not having a single cause, there is benefit to categorizing elements of success for cohesive understanding and analysis. We categorized advisor responses into three major categories: motivated student behaviors, formative student learning experiences, and essential student knowledge and skills. We found that study findings supported our summation that success

would be perceived as multi-faceted, as over 80% of advisor responses were combinations of motivated student behaviors, learning experiences, and knowledge and skills. Before proceeding to discuss the major study findings and their implications, it should be noted that the study findings only reflect the perceptions of a limited number of faculty at one university. Thus, our study should be considered in juxtaposition to other research in this area when developing programs or policies to improve graduate education. While our findings stem from studying only a few disciplines, the extant literature supports that the factors we identified are critical to graduate student success across fields.

In general, our findings regarding two of our categories, formative learning experiences and essential knowledge and skills, were not surprising. In terms of formative learning experiences, interacting with one's advisor and others within the graduate training environment, doing and disseminating research, attending conferences, workshops, and other professional development opportunities, and doing well in courses are well represented in graduate education literature. For example, it has long been accepted that a positive and productive faculty advisor-graduate student relationship is the bedrock of student success (Bowen & Rudenstine, 1992; Nettles & Millet, 2006: Walker et al., 2008). Further, interactions with peers and others in the training environment are known to be essential to successful graduate student socialization (Jairam & Kahl, 2012; Nettles & Millett, 2006), especially within scientific training environments (Knorr-Cetina, 1999). Engagement in research, particularly early in graduate training, has been linked to several positive outcomes, including increased research self-efficacy (Lambie et al., 2014) and scholarly productivity (Nettles & Millet, 2006: Walker et al., 2008). Attending professional development such as conferences and seminars provides opportunities for professional networking (Johnston, Sampson, Comer, & Brogt, 2016) and has been linked to graduate student success (Flores, 2011). Doing well in courses is, at the very least, needed for retention within graduate training and is essential to foundational knowledge and skill development.

Our faculty advisors identified many of the same essential knowledge and skills needed for graduate student success as have been identified by graduate education scholars. For example, oral and written communication skills have long been noted as critical to success at the graduate level (Austin & McDaniels, 2006; Fisher & Zigmond, 1998). As Surrat (2006) noted, "Obtaining formal presentation and writing skills could be the most important aspect of graduate student education" (p. 1). Oral communication skills are important for formulating and presenting one's research. Strong writing skills are needed to complete coursework and the dissertation, publish one's work and apply for grants (Austin, 2003; Helm, Campa, & Moretto, 2012; Kamler & Thomson, 2014). Further, both oral and written communication skills are also central in career advancement (Fisher & Zigmond, 1998). Knowing how to read and apply primary literature to one's work was also identified by faculty advisors in this study. The practice of reading primary literature in one's field and the ability to situate one's work within the literature has been found to be a predictor of subsequent research skill development (Timmerman, Feldon, Maher, Strickland, & Gilmore, 2013). Further, effectively reading literature also draws upon the critical thinking skills mentioned by faculty in this study, as students discern what literature is most applicable to their own work (McAlpine, 2012).

In addition to formative learning experiences and essential knowledge and skills, faculty advisors in this study targeted the need for graduate students to invest and manage effort, persistence, intellectual passion, time, emotions, and initiative. We collectively categorized these qualities as "motivated student behaviors," which was the most prominent category represented in our findings. This category provided us with novel insight into the components of graduate student success, yet motivation has received the least amount of attention in the literature. To our knowledge, Hirschberg and Itkin (1978) are the only researchers who have empirically examined the importance of student motivation on graduate student outcomes, which included timely degree com-

pletion and scholarly productivity. And, as we previously noted, Gardner's (2009a) study of faculty perceptions of graduate student success also identified motivation as an essential ingredient. More recently, London et al. (2014) identified reasons doctoral degree holders gave for pursing their advanced degree. However, by and large, it is notable that one of the seemingly most critical component to graduate student success – student motivation – appears to receive the least amount of attention.

We also find it notable that faculty in this study generally failed to discuss how the actions they themselves take, or fail to take, support or diminish graduate student motivation. Further, they rarely described how their programs or departments could support graduate students' motivation. It appears that the expectation is that graduate students will arrive at their program highly motivated, and will remain highly motivated, regardless of what occurs within their training environment. Not only are students expected to be zealous about their research, faculty in this study also expected them to immerse themselves in the graduate school lifestyle. However, such expectations often result in graduate students experiencing internal conflicts as they try to balance their graduate work and research with other areas of their life such as employment, teaching, or family responsibilities (Offstein, Larson, McNeill, & Mwale, 2004; Schlemper, 2011).

To be fair, faculty's absented consideration of how they or their programs interact with student motivation may reflect that we did not probe faculty for this information. However, it may also reflect the tendency to propagate the "intimidating, isolated environment" described by one faculty member in this study, perhaps under the belief that this process 'weeds out' the less capable or less motivated students. Regardless of the underlying explanation, this finding is consistent with prior studies, which show that faculty tend to identify the cause of graduate student failure as lying within the students themselves and rarely discuss their role or the department's contribution to graduate student attrition (Lovitts, 2001; Gardener, 2009b). This stands in contrast to the perspective of graduate students who often identify departmental issues as their reason for dropping out (Gardener, 2009b).

Directions for Future Research

While our approach to data analysis (e.g., parsing faculty comments into distinct categories) facilitated our coding and discussion of the data, we also acknowledge that there is overlap and meaningful connections between the categories we discussed. As Haley (2013) noted, even within the category of motivational behaviors, motivational components are highly related. We suggest additional research be conducted around faculty perceptions regarding factors that influence graduate student success and one direction for continued research in this area may be to better understand the connections between the constructs we identified in this study and create a model, for example, of how definitive graduate student experiences contribute to the occurrence of motivated behaviors or the development of specific skills.

In addition to better understanding the relationships between the ingredients for graduate student success that we identified, future research could also examine how these factors influence key graduate student outcomes such as timely degree completion, success in obtaining an academic position upon graduation, or number and quality of research publications. Work that discusses how success in graduate school should even be characterized or measured would also help advance this field (Gardener, 2009a). Additional work that connects training and support practices to graduate student outcomes would also complement the extant literature, which is often either focused on the graduate student experience or on outcomes but seldom rigorously explores the relationship between the two.

Finally, a direction for future research might be to better understand some of the apparent contradictions we identified in our data. For example, a few faculty in this study identified coursework

as important to graduate student success, however, just as many shared that graduate students are better served by placing their focus elsewhere. Researchers, as well as departments, should better understand and articulate the value of coursework in graduate student success, particularly given the cost of tuition and other sacrifices. A similar inconsistency we found in this study concerned the value of attending conferences, meetings, and seminars. Finally, we identified a tension between faculty advice to take initiative and work independently versus the advice that collaboration is critical to success. Future researchers may wish to better understand the role of each in graduate student development as well as the balance between the two.

Conclusion

This study is one of only a few that examines faculty perceptions of factors that support graduate student success. Although faculty reported a number of factors, motivation was most prominent in our findings. This stands in stark contrast to research conducted with graduate students who more often focus on departmental issues as the cause for graduate student attrition (Gardener, 2009b). This may provide evidence that faculty are unaware of the breakdowns in their department's culture and it definitely supports a need for improved communication between graduate students and their faculty. If we are to increase the number of graduate students who successfully complete their degrees, graduate students need substantial support from faculty and programs, and faculty need to be explicit about what they expect from students and how students can succeed in their program. Further, because graduate school is a substantial sacrifice, we recommend that graduate students, especially doctoral students, be honest with themselves about their reasons for pursuing a doctorate, if a doctoral degree is the best way to achieve their goals, and if they are willing to prioritize their graduate education above other commitments.

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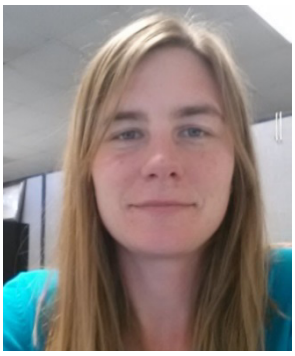
Biographies



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