To Be Or Not To Be:

Doctoral Science Students' Early Experiences

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At each stage of the process, doctoral students are presented with a unique set of challenges and experiences that must be negotiated and mastered. We are just now beginning to understand entering students’ expectations, beliefs, goals, and identities, and how these may or may not change over time within an academic program based on students’ actual experiences. Through interviews with first year doctoral students in chemistry, physics, and botany, this constructivist inquiry examines the first year experiences of students in the natural sciences. Personal narratives indicate that the first year of doctoral study is indeed a year of transition, as Tinto suggests.

Introduction

From the time the first Ph.D. was awarded by Yale University in 1861, the production of doctorates has continued at an almost uninterrupted pace, and serves as a cornerstone of the production of researchers and teachers of the future. Despite the fact that doctoral education contributes to the technical, economic, and cultural development of our nation, until recently, until recently little research had been undertaken in an attempt to systematically understand the world of doctoral education. In the past few years, however, a number of publications have emerged that have begun to increase our understanding of the process of doctoral education and the experiences of graduate students (e.g., Anderson, 1996; Golde, 1998; Golde & Dore, 2001; Golde & Walker, 2006; Kluever, Green, & Katz, 1997; Nettles & Millet, 2006; Walker et al., 2008).

Research on the experiences of graduate students, especially those in science and engineering disciplines, has implications not only for the experiences and training of doctoral students, but can also impact the actual employment prospects that await them after they graduate. Magner (1994, 1996) and Massy & Goldman, (1995) believe that too many PhDs are being produced, and in terms of demand, that there is a rapidly changing situation relative to the types of
positions available to newly minted PhDs. The fact that large numbers of graduates from science and engineering fields have had difficulty finding their ideal job lead the National Academy of Sciences to propose widespread reform in the training and education of scientists and engineers (NAS, 1995).

Through research on doctoral education, we are better able to understand how scholars, researchers, teachers, and professionals are produced, leading to better curriculums, as well as increased effectiveness and efficiency within educational programs. Furthermore, understanding the transition into a doctoral program, what students’ expectations are, and how doctoral students are trained or socialized for particular positions, can lead to better training experiences, more realistic information concerning employment options, and a greater congruence between doctoral training and actual post-PhD job opportunities.

One particular aspect of doctoral education that has recently started to gain attention pertains to the role of graduate students and their pre-professional experiences. Several studies examining the adjustment of graduate students to graduate school (Baird, 1972; Friedenberg & Roth, 1954; Mechanic, 1962) have suggested that there is in fact a "role" that graduate students adopt, complete with its own demands and adaptive patterns. Research also indicates that students may enter graduate school and assume these roles with vague, unrealistic, or stereotypical views (Feldman & Newcomb, 1969). According to Baird (1978), one third of the students in his study revealed that their expectations of what graduate school would be like were not fulfilled.

Tinto (1993) postulates that the first year of doctoral study is a time of transition. It is during this stage that students seek to establish membership in the academic and social communities of the university. As such, it mirrors the development of relationships with other students and faculty and leads to judgments about the nature of those two communities. Thus, the student will be shaped by social and academic interactions. According to a number of theorists (Bragg, 1976; Tinto, 1993; Stein & Weidman, 1989, 1990; Wentworth, 1980), a student’s experience, the form of participation within the department and the institution, and individual goals are dictated by a set of attributes (individual and institutional characteristics, educational experiences, background, and financial resources) as well as expectations and pre-conceived notions about graduate school and anticipated career choices. Events, outcomes, and interactions are continually shaped and influenced by past events, and by expectations of future events.

Knowing that the voices of students have been absent in much of the literature on the process of doctoral education, the purpose of this exploratory study is to examine the experiences of first year doctoral students during their first year. Given the high cost of doctoral education in science fields, the commitments
necessary on the part of students, faculty, and institutions (i.e., time, energy, and resources), and the increasing demands for institutional accountability, institutions need to develop a better understanding of the process of doctoral education. Understanding students’ experiences and helping to develop realistic expectations about those experiences may aid in retention and persistence, provide better organizational fit, lead to appropriate career decisions, and create better expenditures of individual and institutional resources, particularly in the science disciplines. To provide a context for this study, what follows is a summary of the theories underlying this research.

Socialization and cognitive maps

Although doctoral education in the United States composes the smallest portion of our educational system, its influence and power are enormous. Doctoral programs across the country play a pivotal role in shaping business, government, health care, educational systems, and social and cultural organizations. Furthermore, the research activities that are generated through these institutions serve to enrich our country’s overall health and well-being. If we are to understand the nature of doctoral education, then the actual experiences of the students must be examined.

Altbach (1970) uses the term *ambiguity* to describe the particular characteristic of graduate students that surrounds their relationship to society, the institution, faculty, and peers. He maintains that graduate students must continually vacillate between relating to faculty members as an equal and feeling enormous pressure to defer to them or please them as a student. Altbach, Friedenberg (1954), Mechanic (1962) and Baird (1972) have all suggested the existence of a "graduate student role," and student development during graduate education has been referred to as a process of socialization into a professional role (Baird, 1990; Bragg, 1976; Katz & Hartnett, 1976; Golde, 1998; Stein & Weidman, 1989, 1990; Wentworth, 1980). Therefore, it seems one way of approaching the subject of students' expectations and experiences is through the conceptualization of socialization in role-development terms. Brim (1966) defines socialization as "the process by which persons acquire the knowledge, skills, and dispositions that make them more or less effective members of their society" (p.3). Professional socialization has been defined in a similar vein as the acquisition of knowledge, skills, attitudes, values, norms, and interests of the profession that an individual wishes to practice (Bragg, 1976). Gross, Mason, & McEachern (1958) define the social role as the behavior expected of an individual occupying a given social position. According to this definition, all social acts must be thought of as constituting role behavior; that is, an individual is presumed to be responding to perceived expectations of others. From this perspective, socialization refers to the
process by which individuals learn to adopt certain "roles" to be effective group members.

Robbins’s (1994) model of socialization, which focuses on professional organizations that hire individuals as employees to perform specific roles, is useful to examine graduate student role development. First, academic departments are in many ways organizations that are somewhat separate and distinct from the institution as a whole. Academic departments have their own culture, history, norms, and expectations. In addition, academic departments are largely influenced by the culture of the academic discipline, which serves as a foundation for establishing expectations regarding behavior, values, skills, and knowledge. His model thus becomes useful, in that graduate students, like employees, are socialized into particular roles, which at the doctoral level tend to center around research and teaching. Many graduate students experience hands-on training in these areas by serving as research or teaching assistants, particularly in the natural sciences. Activities such as classroom lectures and laboratory sessions are tied to the formal structure, while interactions with faculty members outside of class are considered informal. Within the social arena, Tinto (1993) identifies participation in co-curricular activities as part of the formal structure while everyday social interactions within the institution comprise the informal structure.

According to Clark and Neave (1992), the academic discipline is grounded in ideology, theory, and general laws that govern the behavior of its members. Moreover, Clark and Neave state that within an academic discipline there are shared values, symbols, and a common language. Each discipline also has its own traditions, body of literature, and research methodology. Students are generally socialized into the culture associated with research and teaching through formal and informal contact with peers and faculty, academic coursework, and participation in various professional experiences. Thus, not only are they being socialized into the departmental culture, doctoral students are being socialized into a potential future role as academicians.

Socialization is a complex phenomenon that does not occur in a vacuum and does not depend solely on the strategies being utilized and depends on the individuals being socialized. A number of interactions take place during graduate school that shape both an individual’s experiences as well as the outcomes of the process. Tinto’s interaction model (1993), which is sociological in nature, is useful in examining the interactions that occur between an individual and his/her departments and institutions. The processes within the realms of academic and social interactions can result in feelings of integration or nonintegration into the culture of the institution. Tinto found that when there is a lack of congruency between a student and the intellectual and social climates of
the institution, voluntary withdrawal from higher education is highly likely. By having greater congruence, there is less of a chance for attrition and a greater chance of success by the student.

Proper socialization and integration into the academic and social systems of a doctoral program can be facilitated when students have a clear and accurate cognitive map of the structures, process, people, situations, and events they will encounter as they progress through their program. The second portion of my theoretical base is derived from cognitive-ecological theory. One of the tenants of cognitive-ecological theory is that humans develop a coherent picture of the world based on the interactions of an individual and his or her environment (Brower & Nurius, 1993). Individuals then our prior experiences to create schemas which are cognitive representations of events, concepts, people and objects (Brower & Nurius, 1993). Schemas allow individuals to interpret events or situation, and respond to them based on past experiences. One’s ability to call up schemas, or cognitive maps when either anticipating or entering situations is the basis of our ability to imbue meaning into those situations. In addition, the schemas and cognitive maps that we develop and maintain contain the concepts and rules that we use to understand ourselves and our surroundings (Brower & Nurius, 1993).

These cognitive maps help people make sense of what they are experiencing and tell them where to go and how to get there by creating possible selves, or niches, for the terrain in which they will navigate. One may speculate that the greater the clarity of the cognitive maps, and the greater the clarity of one’s possible self, the greater the chance of successful navigation, and of fulfillment of goals and objectives. Students who do not possess a clear cognitive map of graduate school, who do not have clear notions of the roles they will occupy, or have not created niches for themselves may be more likely to experience isolation within their programs, feel a sense of normlessness, and perhaps feel a sense of floundering about.

Given these models, it can be understood that students who enter a doctoral program with accurate expectations or accurate cognitive maps should become more easily acclimated into a graduate program, and assume the role of graduate student more readily. Likewise, as these models suggest, students who hold unrealistic expectations or imprecise cognitive maps should have greater difficulty becoming socialized and integrated into their programs, due to greater difficulty developing “possible selves.”

**Methodology**
The purpose of this study was to understand the experiences that new doctoral students have during their first year and the meaning derived from those experiences. In order to best explore these questions, I chose a constructivist approach that is naturalistic and interpretive. Such an approach allows the researcher to study subjects as they occur in their natural setting while interpreting various phenomena according to the meaning people bring to them (Denzin & Lincoln, 1994). In short, this approach allowed me to understand participant’s perspectives from their own point of view, a perspective that Anderson (1998) claims is missing in research on doctoral education.

Maxwell (1998) outlines several reasons for conducting qualitative research which are applicable to this study: 1) to understand the meaning for subjects of events, situations, and actions they are involved in and the meanings they ascribe to these events; 2) to understand the particular context within which the participants act and the influence this context has on thoughts and behaviors; 3) identifying unanticipated influences; and 4) understanding the process by which behaviors occur. This is relevant because I am interested in understanding the participants’ own expectations about graduate school and what graduate school means to them as well as the particular academic “worlds” that each of the participants live in and how prior experiences have shaped their thoughts, decisions, and behaviors. Kuh, Whitt, and Shedd (1987) maintain that the naturalistic mode of inquiry is “absolutely necessary to describe and make meaning of the complex and mutual shaping interactions that occur within the campus milieu” (p. 91).

**Departmental and university context**

The sample for this study was comprised of entering doctoral students in the departments of Botany, Chemistry, and Physics at the University of the Midwest (UMW), which is consistently ranked as a top institution for graduate research (University Data Digest 2002-03, March 2004). The departments of Botany, Physics, and Chemistry were chosen based on the research of Biglan (1973). His study sought to systematically examine the similarities among academic disciplines using multidimensional scaling examining: a) the existence of a paradigm, b) concern with application, and c) concern with life systems. According to Biglan’s classification scheme, Botany, Physics, and Chemistry all fall near one another within the same quadrant, that of “pure” and “hard.”

By interviewing students within the fields of Botany, Physics, and Chemistry, I limited the sample to students within a similar cultural context, thereby ensuring some relative homogeneity. Such an approach allowed me to look deeply at the range of expectations and experiences within a confined context and culture, i.e., that of the hard sciences. Becher (1994) argues that awareness of disciplinary
cultures is helpful, and even necessary in higher education research. Each of the departments studied is briefly described below.

**Botany.** The Department of Botany consists of eighteen faculty members and approximately forty-five graduate students and ranks among the top five departments of botany in the country. The Department has an active graduate program leading toward Master’s and PhD degrees. The acceptance rate is less than 10%, and the final matriculation rate is slightly more than one-third of those accepted. Faculty and graduate students work on a wide range of projects in plant biology at all levels of organization within the areas of molecular biology, genetics, cellular and developmental biology, structural botany, physiology, ecology, evolution, taxonomy, and molecular systematics. Women generally make up a majority of the graduate students in Botany, which is slightly higher than the overall percentage of female graduate students attending UMW. The percentage of foreign students (13.3%) is significantly less than that of the university.

**Chemistry.** The department of Chemistry at UMW has a large graduate program and awards both Master’s and PhD degrees. The acceptance rate is less than 44%, and the final matriculation rate is slightly less than one-third of those accepted. Chemistry alumni have distinguished themselves as professors, research scientists, and administrators as well as the distinction of eight Noble Prizes and seventeen Pulitzer prizes. The reputation of the university’s graduates in industry is evidenced by the fact that more than 70 companies send recruiters each year to conduct placement interviews within the department. The research atmosphere in Chemistry is a distinctive feature. Fifty-four of the current faculty are members of the National Academy of Science or the National Academy of Engineering. Collegiality and collaboration appear to be the rule rather the exception. Two or more research groups typically combine for research and literature seminars, broadening students’ exposure to a variety of viewpoints and techniques. Students and faculty work in a wide range of subject areas: analytical chemistry, inorganic chemistry, materials science, organic chemistry, and physical chemistry. During the course of this study, there were a total of 270 graduate students in the department of Chemistry; women made up a minority of the graduate students and the percentage of foreign students (26.3%) was greater than the percentage found within the university overall.

**Physics.** The Physics Department has for many years had one of the broadest research programs in the country. Research is carried out in local laboratories, in national research centers and at numerous international centers, including locations in Europe, Asia, and Antarctica. The physics department offers three graduate degrees, the PhD, the Master of Arts, and the Master of Science. The Master of Arts degree is based on coursework and exams. The acceptance rate is
less than 44%, and the final matriculation rate is slightly less than one-third of those accepted. The Physics department has 49 full-time faculty and Physics department researchers are loosely organized into Research Groups. This unofficial structure helps provide a smaller feel inside a large department. At the time of this study, there were a total of 163 graduate students in the department of Physics. Women made up less than one-quarter of the graduate students in Physics, while the percentage of foreign students in the department was 66%.

Participants

This study utilized purposeful sampling (Patton, 1990) to achieve a representativeness of individuals from the departments. A small sample that has been systematically selected for relative homogeneity provides for greater confidence that the conclusions adequately represent the “average” member of a group. Participants were recruited via fliers and emails over approximately 4 weeks prior to beginning their doctoral program up through the first week of classes. These strategies resulted in a total of 12 final participants: 4 Physics students, 3 Botany students, and 5 students were from the Chemistry department. Six of the participants were male and six were female. One-half of the students were U.S citizens while the remaining six students came from either China or Mexico. Three of the students entered their doctoral program with a master’s degree in their chosen field and two of the students had one year of work experience prior to beginning their doctoral studies.

Data collection

Data collection occurred in two phases. The first phase consisted of face-to-face semi-structured interviews with open-ended questions, either several weeks prior to or within the first week after matriculation into their program. All interviews were conducted by myself, thereby minimizing the need to train others, which decreases the reliability risk (Bok van Kammen & Stouthamer-Loeber, 1998). All initial interviews were audio recorded and transcribed to allow for greater analysis. The initial interview protocol was pilot tested on a group of graduate students from the genetics and microbiology departments.

The second phase of data collection involved interviewing participants six times, approximately every six to eight weeks throughout the academic year via email. These emails posed open-ended questions to the participants to elicit information about the experiences and perceptions of students throughout the year. My interview questions were originally developed to both explore students’ experiences, and to gauge how students were making meaning of their environments. In addition, this phase allowed me to collect information about the shifts, changes, and outcomes that occurred as a result of students’
interactions within their academic and social communities. The questions asked throughout the year served to highlight students’ successes, disappointments, impact on social life and relationships, experiences in research activities, interactions with faculty, classroom experiences, and how students’ experiences overall were supporting, or changing, career goals. The use of email allowed for an ongoing dialogue and provided a means for students to be reflective in their answers. This also resulted in a ready-made transcript.

Data analysis

Throughout the process of data collection, I used a constant comparative approach of data analysis (Glaser & Strauss, 1967; Lincoln & Guba, 1985). This method is a multi-faceted approach that increases flexibility and allows inductive interpretation of the data (Lincoln & Guba, 1985). Identifying themes within and across the interviews were accomplished in two ways: the initial research memos, and through the use of qualitative software, ATLAS. ATLAS was used to identify pertinent units of data and assign appropriate codes. These codes were organized into ten higher order themes, grouped into four clusters. Trustworthiness of the data was ensured through the search for discrepant data, prolonged engagement, peer debriefing, and member checks (Lincoln & Guba, 1985).

A naturalistic research design makes no attempt to generalize the findings or conclusions to the general population. It may be possible to establish the transferability of the findings by demonstrating the degree of similarity between the setting of the study and the setting to which the study may be applied. In either case, it is “not the naturalist’s task to provide an index of transferability; it is his or her responsibility to provide the database that make transferability judgments possible on the part of potential appliers” (Lincoln & Guba, 1985, p. 316). Transferability was achieved through a “thick description” of the data. In this study, every attempt was made to provide detailed information about the expectations and experiences of the participants within their specific environments. The next section details the themes and experiences of the first year students in my study.

The first year experience—common themes

Within the science and humanity fields, many students enter a doctoral program directly out of a related undergraduate program; others enter after receiving a master’s degree. Regardless of whether new students are coming directly from an undergraduate program, a master’s program, or even a fulltime job, the first year is a transitional and at times chaotic experience. The expectations of a doctoral student are significantly different, if not noticeably higher, than what is
expected of an undergraduate. New challenges abound for students and can include such activities as making new friends, harder classes, choosing and settling in to a research lab, choosing a dissertation project, working as a teaching assistant, publishing articles, making research presentations, and navigating the political arena of their respective departments as well as the university at large, as the student interviews have revealed.

Role and status attainment

The first theme that emerged from the students’ experiences revolved around the role or position that they saw themselves occupying within their respective programs. The two roles that students assumed were either Novice (the Student) or Expert (the Professional). Individuals viewed themselves only in the role of Student/Novice throughout the first semester. For everyone, being a student seems to be characterized by attending classes, studying for exams, learning research methodology, being a Teaching Assistant, and “learning the ropes” about graduate school. One student summarized it this way:

I feel like I am more of a grad student, not a professional-in-training, during classes and lab meetings. Graduate courses aren’t much different than undergraduate classes in that they are lecture based, so I still feel like a student. This makes me feel sort of small and insignificant…In lab meetings, I feel like a grad student, since I feel like I have a lot to learn compared to the other grad students. I think my advisor’s authoritative style is part of the reason. This has me feeling overwhelmed (Botany; Jessica).

A second student compared his role as a graduate student to his previous position in a high tech firm.

I’ve been working 80 hour work weeks, and feeling totally like a grad student. I have had full time work experiences in a very high tech industry doing research and development. I feel like this means absolutely nothing, and have been told as much by one of my professors. I have always gotten an A in chemistry in college, but only because I worked really hard. It seems hard work just isn’t cutting it anymore. (Chemistry; Gordon)

While most students believed they were treated as the novice graduate student for much of their first year, several students recognized the duality associated with being in a doctoral program—that one is both a student, and in time can be viewed as a professional. The following comment is suggestive of these dual roles.

Throughout the year I have felt mostly like a grad student. The only time I have felt like a professional was when I turned in a data analysis report for my RAship
to my advisor and got back only minor editing suggestions. To me this indicated that I am capable of producing an acceptable product, even though I am only grad student. (Botany; Sue)

An international student relayed his experience and acknowledged the dual role as well.

I am a graduate student. But I don’t think there is any difference between seniors and us, because I have not started my research yet. But at the same time, I am a TA. So I am in a double role, both a student and a teacher. (Physics; Yang)

As the year progressed, particularly towards the end of the spring term, individuals began to see and experience the shift from being simply a graduate student to being a scientist, or as these students state, an expert.

I can feel me becoming more of an expert in my research area. It’s not that I know more than my advisor or other authorities, but I do feel as if I can meaningfully contribute to their discussions. (Physics; Dave)

As a researcher, my advisor treats me in a very mature and non-condescending manner. I really feel that I contribute to his research and am not a student of his, but a fellow researcher. (Physics; Gordon)

As these students expressed, being a graduate student is not as simple as merely attending to classes. They were often torn between competing roles and expectations associated with those roles. Many of them seemed disappointed that they were not treated as a “professional” or as an “expert.” However, these same students also pointed out how little they knew in relation to their peers. As the students gained experience in their classes and in their research over their first year, they were able to contribute back to their academic and research communities. This in turn led to the belief that they were in fact “scientific professionals,” and not as low on the pecking order as they once were.

First year successes

The second theme that emerged from students over their first year revolved around how they defined success. Students tended to define success in several ways, including attainment of established goals, having a life and career that is enjoyable and fulfilling, and doing well academically. This notion of success often meant setting and reaching particular goals yet, several students felt these goals revolved around achieving good grades or completing lab work in a particular manner.
As I understand it, success means you have reached your goal. You always do something with some purpose. If you reach your purpose, you are successful. As a grad student, my success is simple. For example if I get a good score on an exam, I feel successful; or if I finish the work in my lab perfectly, I feel successful. (Physics; Weiping)

One student noted how her definition of success mirrored that of her field of study. This meant doing well enough in her line of research to publish and bring in grant money. This in turn would lead to more opportunities.

I would define success as completing your goals in a satisfactory manner. I think my definition is basically the same as for my field, which is the only one I have been exposed to. In this case, the goals involve developing original research that will be recognized by my peers and successfully published. That in turn will bring in grants and more opportunities to develop research and to teach. From this, success will mean getting a good job. And being able to balance all of this with a social and family life. (Botany; Maria)

Another student discussed the discrepancy between his definition of success and that of his department’s.

To be successful, you must have some achievements in your area. But those outstanding achievements may be hard to define. For me, it means being a leader in the research area. But for my department, grades are more important, and forming your own thoughts and ideas about your research (Chemistry; Ping)

Not every student saw success as something concrete or the achievement of specific goals. For a few students, success was more about the feeling of satisfaction and enjoyment in one’s work due to the greater impact made on society.

I define success as doing something that I enjoy and benefits society in some way. Money is not the issue, but rather the impact. The department’s views may vary somewhat, but is generally the same. (Physics; Dave)

For me success is enjoying yourself and having fun in your work. If you really like what you are doing, even if in other people’s eyes you don’t accomplish a lot, it is still a success to me. It is a little different to the definition of other people’s success which is according to the accomplishments in this society. To achieve a lot is a kind of success, but enjoying yourself is more important. (Chemistry; Yang)

Students provided some examples of ways that they have been successful their first year. In most instances, success was related directly to their performance in classes and research activities.
Success….well, I haven’t been kicked out. I understand my material so far. I have been published. And I haven’t failed anything yet. (Physics; Dave)

I’ve been successful in that I can discuss papers in my seminar class intelligently. I am also able to present and discuss my research with my lab group at lab meeting and be comfortable doing so. (Botany; Jessica)

My second semester has been going a lot better for me academically. I can actually handle the homework problems, and the material is interesting. On the whole I am working about the same amount, but getting better grades, and I’m enjoying the learning process more since I switched to analytical chemistry. (Chemistry; Gordon)

Not every student was clear about how to measure success for themselves, nor were they clear about what success meant for their department.

So far, I haven’t felt I have done much. My goals are still very diffuse. I am still getting adapted to the different style of teaching so I can keep my grades up. I am just starting to get involved with research. So it’s hard to say how successful I have been. (Botany; Maria)

As the students expressed, success has many definitions and for them was manifest in many different ways. Success can take the form of receiving high grades in a class, getting good results from research experiments, or setting and reaching particular goals. For some, success was much more of an intangible state of feeling pleasure and satisfaction out of life and work. But, not every student was as clear about success; for these students, as with most, defining success will undoubtedly be an evolutionary process.

First year disappointments and challenges

Many students discussed their disappointments and challenges throughout the year. The most prominent areas of frustration were related to research, coursework, social life, teaching assistantships, and overall time management. Students’ experiences within their research labs turned out to be less interesting and more menial than originally expected. For some students, the day-to-day minutiae were a disappointment, as this student relates.

Working towards PhD is a lot more dirty work and frustration than I anticipated… I spend a lot of time doing monotonous brain-numbing tasks. I transplant plants, wash dishes, clean out growth chambers, measure out solutions, over and over again. Many genetic screens could be done by five year olds. Often it’s just a matter of spending hours and hours looking for the short plants, the tall plants, etc. It’s not very glamoruous work on a day to day basis.
Although what you discover in the long run is exciting... But I am keeping in mind the option of quitting after getting a master’s. (Botany; Jessica)

For other students, it was more about the level of involvement or attention from their advisor in lab. This student reflects the sentiment of several others regarding their initial experiences within their labs.

I was disappointed with my initial lab work. I felt pretty ignored and bored. Consequently I am looking for a new lab. I was annoyed with my lab for several reasons. The PI was aloof, and the technician I was working with was so scattered—she was hardly in the lab and didn’t explain things very well. I also didn’t like the PI’s leadership style. He was abrasive at lab meetings and after awhile grad students confided in me that he was usually worse. He regularly drove another female student to tears, and used another student’s temper to get him to work harder. (Chemistry; Jackie)

Research activities weren’t the only academic area where students experienced disappointment. Classes proved to be a negative experience for most of the students. Some students were not used to the format of graduate level classes, as this student explains.

In a way the courses have disappointed me. I expected more difficulty and more new concepts. I am also not used to the idea of grad students taking classes with undergrads... I was disappointed with myself, particularly related to time management, because I feel I could have done more this year and used my opportunities better. (Botany; Maria)

For some students, the disappointment was related to the teaching itself, and the relevance to research activities. Students also expressed concern and disappointment in their department overall. These students felt as if the general quality was much lower than they had originally believed due to poor instruction, apathy on the part of faculty, or in some cases the departure of key faculty through retirement or faculty resignations.

I’ve been disappointed in the quality of the instruction somewhat. Too little of my coursework is really relevant to my research. Much is what I consider outdated and too applied, unlike the pure theory I am interested in. (Physics; Dave)

Since I have been here a year, I have become more familiar with my department. The more I get to know the department, the more that I feel disappointed, because the department is not as good as I expected. Some professors were bad instructors, but they still teach the core classes. Also, I found out that my [research] group doesn’t have a very good atmosphere. (Physics; Ping)
In addition to classroom experiences as a student, a small proportion of those interviewed were disappointed with their teaching assistantships. Some underestimated the amount of time that they could spend in meeting with students, going to lectures, grading papers, or preparing for discussion sections. International students had an especially difficult time as this student relates.

I am very busy, and I spend a lot of time in my TA job. And I am working to improve my English, but I haven’t had the time to talk with American students very much. I know it’s because I am very busy, and everyone else is busy, too. If you are not aggressive, nobody will spend time with you to help you improve your English. (Physics; Yang)

For one student in particular, his stress was due to the apparent differences in his approach to teaching compared to his peers.

In all the academic stuff, I am reserving judgment until my exams, because that will determine whether or not things are going well. The only real difficulty I am having is with teaching right now. As stressful as teaching is, I’ve been enjoying it. The problem, though, is really the kind of person I have to be when I am teaching. Another TA working for the same professor really enjoys exhibiting a lot of disdain for the students in her class, and she does it in such a way to highlight how smart she is relative to them...What really surprised me was that my professor seems to have a lot of confidence in her. Does this mean that her mindset towards teaching is more effective than mine, which is basically to respect that everyone learns differently, some people tend to be slower than others, and if they don’t work enough, that’s their problem, and there’s not much I can do about it. (Chemistry; Gordon)

The result of taking too many classes was felt in numerous ways by students. Some students were impacted because they weren’t able to do necessary reading for their dissertation proposal.

There have been ups and downs this semester...I guess my greatest disappointment is that there is so much to do for classes and my RAship that I have had no time to do background reading for my dissertation. It doesn’t look like things will let up any time soon either. (Botany; Sue)

For other students, lack of time prevented some experiments from being conducted.

Time went by too quickly. I wish I had taken fewer classes. I had to divide my efforts and I didn’t do as well as I wished this year. Also, some of my experiments could not be implemented, and some did not work (e.g. my seeds did not germinate). (Botany; Maria)
One student expressed disappointment in her inability to stay focused and motivated in order to meet her goals and deadlines.

I haven’t been successful in gaining the level of independence I would like to be at right now. It’s too easy to rely on my boss to tell me what to do next. I have been unsuccessful in motivating myself, too. I have been having problems getting things done on time and meeting deadlines I’ve set for myself. (Botany; Jessica)

Numerous students expressed a disappointment in their social life. For most of them, their time was taken up by class work, research, or teaching assistantships.

I have been disappointed in how little of a ‘real life’ I have had this year. I was also surprised at how much people still see grad school as a competition. (Physics; Jen)

For the international students, the greatest barrier to their social life occurred because of the language barrier. Many international students connected with students from their home countries via various student groups, such as the Chinese Student Association.

I don’t feel as free as in China in some aspects. The main problem is still language. And I can’t find a lot of friends to do things with; it is hard to make new friends. (Physics; Bin)

Just as students experienced a series of successes, everyone experienced their share of disappointments and challenges. These disappointments were related to poor classroom instruction, unsupportive lab environments, inadequate time management and course overload, and limited social outlets. Such negative feelings were a direct result of either unrealistic expectations (e.g., amount of time spent on homework), or expectations that were not fulfilled (e.g., quality faculty and instruction in the classroom).

Development & refinement of future goals

The last area that students discussed throughout their first year pertained to their career goals and objectives. Initially, many students had a vague interest in pursuing a faculty position upon graduation. As the year progressed, students’ goals started to become clearer. As these students relay, the university environment is the best place to engage in true basic, theoretical research.

Now I’m sure that I want to study theory in academia. Pure theory is always more interesting than anything applied. I’ve seen what students are doing in the more applied fields and I just can’t imagine doing it. It would be far too boring to
me...Academia is the only place one can study non-practical, non-applied physics and not starve to death. It's really the perfect institution for a theoretical physicist. I hope very much to earn a position in academia. (Physics; Dave)

Industry is aimed at technology—making science useful. Academia is aimed at science for the sake of science—just discovering how things work. The second outlook is more satisfying to me personally. (Botany; Jessica)

While some individuals wanted a faculty position for the research opportunities, others realized that it was the teaching that interested them more.

I’m still in a quandary about my career goals. They haven’t really changed since they never really existed to begin with! The only big change in my attitude is that teaching at a small college is looking more interesting than before. (Botany; Jessica)

Now that I look back, I don’t really remember what my specific career goals were at the beginning of the year. I’m not even sure they were really there...I guess my general goal of obtaining a PhD, doing research and teaching is still there, but little details, like wanting to teach first year students, are new. (Botany; Maria)

Although many students envisioned assuming a faculty position at some point after graduation, a small minority of students realized that the academic setting was not the best place for them. As this student summarized, graduate school made him rethink his goals based on his strengths and limitations.

I came in with a definite set of goals, and failed at most of them...I’ve given up on the idea of being a professor. I was already leaning towards industry, but now I’m certain of it. I’ve also gained a much clearer sense of my own limits. Until now, I’ve been able to do whatever I put my mind to. Being unable to handle my classes last semester taught me a lot about how to choose my battles. I won’t be able to do everything I want, but I’ll still be able to do things I enjoy. (Chemistry; Gordon)

Not every student was set on one career path. At least one student planned on allowing the opportunities available in her program to help guide her career choices. This student also acknowledged that her attitude at the time of graduation would impact her decisions.

My goals for graduate school haven’t changed, and I still have the attitude that my career may or may not follow the academic route, depending on both opportunities available and my attitude come graduation. (Botany; Jessica)

In general, concrete specific experiences throughout their first year allowed students a chance to reassess their career goals. Students were able to more
clearly see themselves as teachers, as researchers, as scholars, and as one physics student said, as a scientist.

My goals are very similar to what they were at the beginning of the year, but now I see them as much more real than before. I am beginning to see myself as a scientist, not just a college student, because I am actually contributing in a real way to the progress of scientific knowledge. (Physics; Dave)

Students also made choices that they knew would allow them to be more successful in reaching their dreams and goals. One student acknowledged that his research group was not the best fit for him, and took the risk of leaving it at the end of the year, thus setting the stage for a more successful experience.

I decided to leave my research group this year, because I didn’t like the atmosphere. It hasn’t changed my career goals, but I think it will allow me a stronger chance to achieve my goals. (Physics; Ping)

An individual’s goals, dreams, and vision for his or her future are rarely set in stone. Choices, decisions, opportunities, internal factors, and external events all help to shape and guide the direction of our lives and our career. So too, were the goals of these students influenced by a myriad of forces. Some students held their initial career goal even tighter, while others abandoned it in favor of a different avenue. And a few were allowing themselves to stay open to all the possibilities that presented themselves over the course of their entire program.

Discussion

As seen throughout the first year of their doctoral program, the nature and clarity of the expectations associated with the role of a ‘graduate student’ can have demonstrable effects on the lives of students. In addition, the behavior of graduate students is related to how they define or interpret their roles as students. During their first semester, students saw themselves strictly as ‘students’ and not at the same level as their faculty. As previous research suggests (Robinson, 2007), students tend to hold unrealistic or uninformed expectations about their program. This, coupled with the need to fulfill one of their duties as a ‘student,’ namely attending classes, resulted in most students overloading themselves academically. Given that the vast majority of students also held some type of assistantship (also part if the role of ‘student’), the result was that many students were often frustrated, anxious, overwhelmed, and in crisis mode. This supports Baird’s (1990, 1992) notion that entering students are not clear about what changes or shifts in attitude, perceptions or behaviors will need to occur for students to be successful in graduate school. This was particularly true for students entering their program from either the workforce or from an undergraduate program.
During the second semester, students began to experience the duality of roles that Altbach (1970) described. Students vacillated between relating to faculty as peers and showing deference as a student. It is during this time that students were also beginning to reconceptualize their roles as ‘student’ and ‘scientist/expert.’ At one end of a continuum lies the role of ‘student’; at the other end one can find the roles of expert, scientist, scholar, and faculty. Throughout their first year, students appeared to move along this continuum as they struggled to internalize the norms, values, attitudes, behaviors, and expectations associated with adopting the roles of expert, scientist, scholar, and faculty.

Students experienced numerous challenges and disappointments, along with some startling revelations as they negotiated their way through the year. Many students found the day-to-day activities of research mundane, trivial, boring, or unfulfilling. Some students felt the anguish of experiments not working, or of not having enough time to complete experiments. Every student felt the struggle to stay on top of tasks, assignments, projects, reading, grading assignments, holding office hours—in short, many of the unglamorous activities faculty members must do. Students were also surprised at the lack of involvement by faculty advisors, especially since many students anticipated and hoped for just the opposite.

Students also experienced a fair amount of success throughout their first year. While it was common for students to express self-doubt, fear, and anxiety, the build up of positive experiences helped dissipate some of these negative feelings. Most students experienced the rewards of hard work by receiving good grades in their classes. Several students were engaged in research projects that excited them and allowed them in some cases to help in authoring research papers. In terms of the socialization process, most students seem to be reorienting their expectations and behaviors toward the norms of success as defined by their faculty, departments, and disciplines. Such a reorientation, or adaptation, is necessary for the success of individuals who must adopt new roles as part of their professional journey. However, it should be noted that several students defined success in ways not espoused by others, such as making a difference in the lives of others and enjoying one’s work/occupation.

As the year progressed, many students began to develop what can be termed either a “possible self” (Markus & Nurius, 1986) or a “niche” (Brower, 1988). Over the year, through the process of observation, imitation, feedback, and internalization students gained clarity about future goals and roles for themselves. For some students, the niche they saw themselves ultimately
occupying was quite different from their initial career goal. For other students, their experiences solidified the role they initially imagined for themselves.

In examining the overall findings through the cognitive-ecological perspective, one notices several things. First, it seems that students rarely entered graduate school with a clearly defined niche, or possible self. More often than not, students expressed several possible future-oriented selves, each necessitating different courses of action by the students. Because of their lack of clarity regarding their niches, students availed themselves of the myriad of academic and social opportunities and activities. Over the course of their first year, students developed or refined their individual niches, which allowed them to develop routines, rules, procedures, and interactions centered on those future “selves.” As their niche became more clear, and as their schema (cognitive maps) also became more clear, students learned to shape their environment while simultaneously being shaped by their experiences. For instance, as a student became clearer about his niche as a faculty member within a small teaching college, he planned to seek out additional opportunities for teaching while in graduate school. This student will be shaped by the norms and cultures affiliated with being a faculty member at a major research institution, but will also ascribe meaning to various norms or behaviors that may be different from those held by current faculty, particularly as they relate to what it means to be a “teacher.”

It is clear that the first year of doctoral study is indeed a year of transition, as Tinto (1993) suggests. Students entered their respective programs with a multitude of prior experiences and a set of expectations concerning their programs. During their first year, students attempted to establish themselves in both social and academic communities within their departments and institution. The exploration, experimentation, and degree of assimilation of various norms, values, attitudes, and behaviors dictate the level of success each student experiences. The smaller the gap between initial expectations and the lived reality of students entering a doctoral program, the easier it is for students to assume their new roles, and the greater the chance of success within their programs.

From the socialization perspective, during their first year, it is clear that students are learning to adopt various roles in an effort to fit into a prescribed group or culture. Fulfilling various roles (student, scientist, research, TA, etc) allows students to try out different niches. While it might be assumed that those students with prior experience or exposure to various roles, or niches, within their graduate programs or held by their faculty would easily assume those roles, this is not always the case. Likewise, it can not be assumed that these students also integrate more easily into the social or academic milieus than others without such experience. One of the key factors affecting the successful navigation and
feelings of satisfaction revolve around the development of appropriate cognitive maps or schemas. Prior socialization activities do not ensure the development of these schemas. Ongoing exposure and experience with faculty and mentors throughout a student’s academic career are the crux to the development, and refinement of appropriate cognitive maps, role formation, and niches.

Conclusion

While this study focused on a small sample of students at a single university, it has provided important data surrounding the early experiences of new doctoral students with the natural sciences. Despite having research experience or exposure to graduate students as an undergraduate, many incoming doctoral students held inaccurate expectations about their own roles as graduate students. This analysis also showed that the first year of doctoral study is a transitional year for students. Many students have some common experiences as they negotiate their way through their academic and social communities. More senior graduate students proved to have a more mentoring and support role for the students than did faculty. It was often these more senior students who filled in the gaps about policies, procedures, and norms for the new doctoral students. However, this was not done in any systematic fashion, and not all students learned the same information. In essence, there was no uniform way that students “learned the ropes” about their programs.

The first year for the students in this study proved full of ups and downs, emotionally, psychologically, socially, and academically. For all of the students, it really was a year filled with transitions and multiple learning opportunities. Students experienced both success and disappointment not only in the classroom, but often in their research activities as well. Most of the students struggled to adapt to the role of “graduate student” early on in their program as they integrated into their social and academic communities. By the end of the year, students had developed the initial skills and knowledge required to navigate the various roles required of them during their program—student, teaching assistant, research assistant, technician, mentor, scientist, and scholar. In addition, various experiences and opportunities helped clarify potential career paths for many students. Some grew more certain that the academic or teaching route was the right path; others realized that research in the private sector held more appeal. In the end, however, most students felt more confident in their academic and research abilities, and were anxious to give up their title of “Low Man on the Totem Pole.”

By explicitly addressing both the expectations and experiences of new doctoral students, I have sought to provide additional insight into the manner in which graduate students are socialized into their academic communities and
disciplines. This study may be a stepping stone for further exploration regarding the complexities existing within the doctoral education process. Given the human resource, financial and time costs associated with doctoral study, this area continues to deserve great attention by faculty, scholars, researchers, administrators, and policy makers who can impact this segment of our educational system.

Implications for policy & practice

The primary contributions of my study are practical, not theoretical. Given the nature of naturalistic inquiry as a research design, the findings should be viewed as tentative. It is not possible to generalize based on a sample of twelve students attending one institution. Nonetheless, there are several important implications for policy and practice regarding the process of doctoral education.

Through my research, it is clear that students enter doctoral programs with a set of beliefs and expectations about almost every aspect of their lives as graduate students, from advising relationships to the level of difficulty of classes to the amount of free time they will have. Many of these expectations were vague, stereotypical, naïve, or unrealistic. It would make sense then that both the student’s undergraduate institution and graduate department should play a role in correcting misconceptions and preparing students for the realities of doctoral study.

At the undergraduate level, career counselors or advisors could begin the discussion about the differences between undergraduate and graduate programs. This would mean that advisors would need to be educated in some instances about the realities of graduate school. Advisors could have a list of topical areas with questions for students to investigate and inquire about during the graduate school application and interview process. In addition to career advisors, it is incumbent that undergraduate academic advisors also have frank conversations about what students can expect out of a doctoral program, and the types of challenges that might exist not just on their first year, but throughout the entire graduate program. A final suggestion for career advisors is to help students begin to explore and envision their niches, or possible selves, including the numerous roles they might assume in a doctoral program as well as after post-graduation.

The graduate department also has an extraordinary role in alleviating the misconceptions and correcting naïve expectations that incoming students may have about that particular doctoral program. Faculty members should be encouraged to have open and honest conversations with incoming students about advising style, academic expectations, research expectations, and other
quality of life issues. These discussions should include information about policies and procedures, and key milestones necessary for students to navigate through their program. One of the primary challenges for students was that of time management. It would serve students well to have a workshop or similar discussion about effective time and project management skills. Along with this, discussions should take place concerning the differences in reading and studying at the graduate level compared to undergraduate coursework. A final suggestion for departments concerns the needs of international students. Most of the international students in this study were also taking English as a Second Language classes, in addition to a full academic load. Departments should consider alternative ways to enhance international students’ experience without burdening them academically. Students should be encouraged and allowed to have a reduced course load their first semester while they acclimate not only to a new culture, but to a new educational system and a new language. Since most campuses have a special office that works with international students, departments could work closely with those staff to have workshops for students to help them adjust to the demands facing them in a doctoral program.

Finally, students themselves should be encouraged to take a more introspective look at their true reasons for pursuing a doctoral degree, along with their expectations and hopes for entering such an intense program. Students must evaluate how their academic experiences have or have not prepared them for graduate study. Students should ask difficult questions of prospective faculty and other students in potential graduate programs such as: What sacrifices will be required as part of a doctoral program? What support structures are available to students for facing personal or academic challenges? What are the real experiences of students in a particular program? What are current students’ successes, failures, challenges, or obstacles?

Through the lens of socialization theory, we can see the importance of anticipatory socialization in helping to ensure success (Merton, 1968). Anticipatory socialization requires that individuals begin to assume the values and orientations common to the group in which one does not yet belong, but in which one is likely to enter. In the case of incoming doctoral students, the sooner that they begin to understand the beliefs, values, attitudes, norms, and expectations associated with particular programs or fields of study, the more likely they are to experience success and satisfaction during their transitional first year. Furthermore, the more congruence between students’ expectations and the reality they encounter, the greater the goodness-of-fit experienced by the individuals within the department; this also serves to increase the opportunities for and feelings of success. Undergraduate career centers, academic advisors, graduate departments and faculty, and the students themselves can play very
active roles in developing well informed expectations about doctoral programs, as well as ensuring successful navigation of the first year.

Implications for future research

Several suggestions for future research exist. First, this study could be replicated within other departments and institutions to broaden the data. This could conceivably tease out departmental, discipline, and institutional effects that may exist. These questions may include: do students in the natural sciences at other universities also have the same type of initial expectations and experiences during their first year? Also, how do students from the social sciences or humanities at one institution compare to the students in natural sciences at that same university? Replicating this study across disciplines and institutions would help delineate common expectations, beliefs, norms, and experiences of doctoral students.

Second, it is important to conduct further research on the expectations and experiences of international students. Are there significant differences between students from different geographical regions? What are the origins of initial expectations by international students? How easily do international students internalize the norms and values of their department or discipline? What are the socialization experiences for international students like during the remainder of their academic programs? What are the outcomes for these students, compared to their American peers?

In addition to cross-discipline and cross-institution investigation, the research findings here warrant longitudinal research studies. Questions still remain as to what factors continue to shape students expectations and how behavior may or may not continue to change in response to expectations that are either met or unmet over the course of students’ academic tenure. Longitudinal research addressing these questions would continue to inform the socialization theory literature. Furthermore, such information and data would begin to validate or negate Tinto’s (1993) proposed stages of graduate persistence.

A final area of research relates to the role that faculty play in setting the stage for students to be successful. To this end, research should address faculty members’ expectations for students, the manner in which these expectations are communicated, the degree to which faculty expectations match student expectations, and how any such gap can be bridged.

Examining the expectations and experiences of all students and of departmental faculty members will provide a rich source of information from which to further establish policies and practices that ensure students make informed decisions.
regarding graduate school. This in turn would lead to successful experiences for students, which could then increase the completion and graduation rates for doctoral students.
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