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Of Special Interest

Factors that Influence Chemistry Students' Decisions to "Drop Out" of Graduate School

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In this study, we were concerned with the essence of the experience the students had while making the decision to drop out...

Focus group interviews were used to study the decision-making process by which chemistry graduate students decided to "drop out" of graduate school with an M.S. degree. Several factors played a role in the participants' decisions to change their career goals, including balancing family and career, preconceptions (or misconceptions) about the nature of graduate school, role conflict versus role congruence, and self-esteem. Significant differences were found between the factors that influenced the career choices made by the male and female graduate students in the sample population. Significant differences were also found in the reactions to their decisions that the male and female graduate students received from their families, peers, and faculty mentors.

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Introduction

There is little doubt that women are not adequately represented in the sciences. Women account for only one-third of the bachelor's degrees in science, one-fourth of the advanced degrees, and one-sixth of employed scientists and engineers [1]. There is also evidence that women are lost from the scientific pipeline at a variety of times and places. Raymond and Brett [2] noted that a large number of girls stop taking mathematics and sciences courses during the middle-school years. Other studies have shown that women are lost to the sciences when they choose a major at the bachelor's level [3, 4]. Still other studies, done at the doctorate level, show that although women enter graduate school at the same rate as men, but their graduation rates are not comparable—at least not in the sciences [4–11].

A variety of factors have been identified that influence success in graduate school. The gender of the research advisor has been found to play an important role in determining students' success in graduate school across a variety of fields [12–17]. Female psychology graduate students with female advisors, for example, reported significantly higher self-esteem, work commitment, and career aspirations than did women with male advisors [18].

Faculty–student relations also have been shown to have an impact on student success. Hartnett [19] found that in history departments, the female graduate students reported less emotional support than did the male graduate students. In her study of 27 graduate departments, Hite [20] found that, regardless of their field, women perceived less support from the faculty than the men did.

The presence of a mentor has also been shown to be important to graduate student success. In their study of psychology graduate students, Cronan-Hillix et al. [21] found that the number of publications and conference presentations was significantly related to whether or not the student had a mentor.

Role conflict (e.g., conflict between the roles of the individual as student, spouse, teaching assistant, and so on) has been invoked as an important factor determining success for female graduate students. Beutell and Greenhaus [22] found that married women who were graduate students experienced conflict between their multiple roles. Hite [20] found that men experienced more role congruence than women, regardless of

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the field of study, and suggested that this might be one reason why women leave doctoral programs.

Previous research on graduate school retention has been quantitative. By measuring retention rates on large samples, it has given us an indication of general trends. This research, however, cannot be used to explain *why* women leave graduate school because one cannot attribute causation to a specific variable in statistical studies of this nature. For our purposes, these studies all suffered from a fatal flaw—no one listened to the voices of the students talking about why they had dropped out of the Ph.D. program.[1] They tell us little, or nothing, about the people behind the data—about why they made the decisions that they did. This study therefore focused on a qualitative methodology, which gives us more depth and detail about a smaller segment of the sample population.

This study investigated whether too many people or the wrong people might be dropping out of the Ph.D. program in chemistry with an M.S. degree. Particular attention was paid to the differences and similarities in the process by which males and females made the decision to "drop out" with an M.S. degree in order to guide chemistry departments as they revise their graduate programs.

The theoretical perspective behind this study was *phenomenology*, which focuses research on answering the question: "What is the structure and essence of experience of this phenomenon for these people?" [23]. In this study, we were concerned with the essence of the experience the students had while making the decision to drop out of the Ph.D. program and get an M.S. degree instead.

Method

Focus Groups

The primary source of data in this study was a series of open-ended focus group interviews. Each focus group contained three individuals who had decided not to continue in the Ph.D. program in the Department of Chemistry at Purdue University. These individuals were all in the second or third year of the graduate program and had

[1]In this study, "dropping out" was defined as student-initiated decisions to make substantive changes in their career goals by leaving graduate school upon completion of an M.S. degree, instead of completing the Ph.D. degree that had been their goal when they entered graduate school.

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all decided to change their career goals and obtain an M.S. degree instead of the Ph.D. they had expected to pursue when they entered graduate school. The focus groups were deliberately assigned by gender. The first interview was done with a group of three women ("Judy," "Linda," and "Jennie"); the second was done with a group of three men ("Sam," "Aaron," and "Steve"). The names used for the participants in these focus group sessions are nicknames chosen to protect the individuals' privacy.

Patton [24] notes three advantages of focus group interviews. They are an efficient means of data collection, they provide a means of focusing the discussion on the major points, and they are enjoyable for the participants. The decision to use focus groups in this study was made on the basis of preliminary discussions with other students who had dropped out of the Ph.D. program, which had suggested that the focus group environment would facilitate discussions of a sensitive topic because the discussion would be held among a group of individuals who were in a similar situation. Focus group interviews were also chosen because comments made by one participant during the interview can elicit feelings, memories, or important details from other participants.

Open-ended questions were used during the focus group interviews in order to probe the decision-making process through the eyes of the participants. Once the discussion was initiated, all questions asked by the interviewer flowed from the discussion at hand. This enabled the interviewer to respond to the participants and to pursue the topics that were important to the participants.

Each focus group interview lasted for about an hour and a half. These interviews were both audiotaped and videotaped. The audiotapes were used to transcribe the interviews. The videotapes were used to record the body language of the participants, which turned out to be an important source of data, and to serve as a backup to the audiotape.

Although the interview data were collected with groups of individuals, the unit of analysis was the individual student in order to study what had happened to each individual in the graduate school setting that caused them to change their career plans.

Triangulation of Data

Data triangulation provides a check of the validity of each source of data in a study [25]. In this study, a survey instrument was used to check the validity of the focus group interview data. The survey instrument collected data on the students' gender, division of study, marital status, and year in graduate school. It included questions that probed the

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students' original plans upon enrolling in graduate school, any changes that were made in these plans once they arrived at graduate school, why they chose chemistry as a major, why they chose to go to graduate school, how they chose a research advisor, and their perception of how they ranked as a graduate student among their peers. It asked the students to reflect on what they would say to first-year graduate students who wanted to know what to expect if they were to enter their research group. It also examined what the students thought graduate school would be like before they came, in what ways their expectations were fulfilled, and in what ways their expectations were not fulfilled.

The survey instrument was distributed to 287 graduate students in the Department of Chemistry at Purdue University. The cover letter that accompanied this instrument informed the students that the results were anonymous and that thus there was no way for any comments they made to "get back to their advisor." Sixty-seven surveys were returned (23%). The responses to the survey were entered into a spreadsheet and then sorted to see if any gender-related patterns existed in educational background, research advisor information, and career path of the respondents.

The distribution of survey respondents by gender (60% male, 40% female) was representative of the graduate student population in the department (68% male, 32% female).

The distribution by division was similar to the graduate student population for students from the analytical, biochemistry, and physical chemistry divisions. Students in the organic chemistry division responded to the survey significantly less often (12%) than the total population (31%), whereas the response from the inorganic chemistry division (19%) was larger than the total population (13%). The distribution by year of study was remarkably similar to the total population.

Results

The results of the survey instrument were consistent with what one would expect from the prior literature on graduate-student retention. Women were more than twice as likely to "drop down" than men (18.5% vs. 7.5%, respectively). The women were also more likely overall to experience some sort of change—whether it be a change in the area of study, degree plan, or career plan—than were the men (52% vs. 32.5%, respectively).

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The focus group interviews identified both similarities and differences between the decision-making processes used by men and women who decided to stop with an M.S. degree rather than continue toward the Ph.D. The most striking difference between the men and women was the reaction they received from their families, friends, and advisors. The women had to defend their decision, almost as if they should feel ashamed of their decision. Consider Judy's discussion of the reactions to her decision to get an M.S. degree instead of a Ph.D.

> Judy: Um, and I fought with it for a while because, you know, my parents, at least my mother was really upset. Oh, you know, "It's because you're a woman and, uh, you're letting yourself down. You're smart enough to do it. Why do you want to leave?"…And when I started telling people, even my professors back at my undergrad, they are like, "What's wrong? What happened to you. You had so much promise." Um, you know, when I made my decision, that was it. But I still felt that these people were trying to pull me the other way. "You know, you're wasting yourself with a master's."

The men experienced very different reactions from their families, peers, and mentors. Consider Steve's reaction to having heard that Sam had decided to leave with an M.S. degree.

> Steve: And I thought…well actually in my mind I was thinking…**Wow!**…he knows exactly what he wants to do with his life instead of following like a flock of sheep…So, I was actually quite impressed that people knew exactly what they wanted to do…and did it.

Sam's professors also supported him.

> Sam: [My analytical major professor] was very supportive. Like when I talked to him…it was…that was…one of the hardest things I ever had to do. He said, "OK. I'm glad you've decided. You've thought about this and you know what you want to do." And that was kinda the reaction…that most people had. "Good, you've decided something. You're running with it." And they thought it was a good decision…I thought I'd get more flak…for the decision than I've gotten. I've almost been waiting for it…kinda, I'm not sure, masochistically, like, hoping that somebody would, like, give me problems. I don't know why. [Laughter]

After pressing the issue, Sam had this to say:

> Interviewer: So did anybody make you feel that there was some lost potential there…that, "Oh, what happened? You were doing so well. Why did you decide to settle for a master's?"

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> Sam: I've had nobody come up to me and…in an angry tone of voice say, "It's a waste of your talent." Nobody has ever said that to me. Ever.

Another major difference between the men and the women in the focus groups was the extent to which they seemed to have considered the effect of an M.S. versus a Ph.D. on their ability to combine a family and a career. The women talked at length about this issue and suggested that it was a large factor in their decision. Linda discussed how having a family would change her career goals. When she had a family, Linda, like Judy, wanted to start working part time.

> Linda: Um, in my case, I originally, when I came here, I thought I wanted to get the Ph.D. and I wanted to work in research, you know, in industry, for a while, you know, like five or six years or something. And then if I actually found somebody that I wanted to get married to and then have some kids with, then at that point I was thinking I wanted to go and do something like patent searching of chemical compounds on a consulting basis for, um, companies because I have a friend who does that and it works out really well because she can do it out of her own house and she can work, you know, part-time…however many hours she wants. And she's still in the house where the kids are.

Linda also felt that getting an M.S. would make it easier to move around and follow her spouse-to-be around the country.

> Linda: The thing is, it's a lot easier to get a master's job, also. [Laughter] You're much more relocatable. You can move around the country much more easily. Which, you know, um, I mean, if you think you ever want to get married, it's something to think about. Especially if you're gonna get married to someone who has a Ph.D.

None of the men considered family issues in their decisions. When the topic was brought up by the interviewer, they shook their shoulders and said that this question did not apply to them. When asked if marriage–career conflict entered into his decision at all, Aaron said that it hadn't.

> Interviewer: Um. OK, to switch topics a little bit, I guess. Do, any of you anticipate any, uh, marriage–career conflicts?…I mean, did that…did you think about…did that affect your decision at all? Thinking, oh, it will be easier to have a family if I get a master's?
>
> Aaron: Not really. That's…I think…in reality that may…that may happen…Um, but as far as thinking about that when I made my decision, no. That didn't enter into the picture at all.

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If any of the men had been likely to consider the possibility of marriage–career conflict, it should have been Aaron, who was interviewed shortly before his marriage. Aaron admitted that upon reflecting on the idea, it was probably true that he would have more time for his family, but that he had never thought about it before then.

The significant difference in the importance of family–career conflicts as a factor in the decision-making process of the men and women in this study does not reflect differences in the marital status of the participants in this study. Two of the three participants in each group were neither married nor engaged at the time of the interviews. However, the women seemed to be thinking into the future and expected that getting an M.S. degree would minimize the role conflict they would experience in the future.

Role conflict had already begun to be a problem for the women in this study. Jennie best described this when she explained how she was tired of being in school. She became burned out very quickly, which she attributes to the fact that she had too many roles to fill.

> Jennie: Um, we might have all said it at one point. About now we're just tired of being here. I...I have always looked at this…comparing myself to…almost all of my very close friends are male…Um, but I burned out way before they did. And I kept trying to figure out why. And I know why at this point. At least I'm convinced I know why. Um, I worry about so many things. I mean, I'm here being a graduate student and I feel a responsibility towards teaching. Um, I have a responsibility to myself, towards my course work. I have a responsibility to [my professor] to do, you know, whatever for him. Um, I'm worrying about relationships. I'm worrying about money. It's like I try to juggle all these things and I get so involved that I burned out right away.

Role conflict did not seem to be a problem for the men, who did not bring up this issue in the discussion. When the interviewer raised this issue, Sam responded as follows.

> Interviewer: Do you feel like you had too many things to worry about? Like your classes, your research, uh, your social life. All of these things.
>
> Sam: All of those were fine. It was just the fact that I didn't enjoy it. They were all going well. I just didn't want to do it.

Another significant difference between the men and women in the focus group interviews was the extent to which the women were disconcerted by the fact that they were no longer "the best and the brightest." This affected the women's decision to stop

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with an M.S. degree because they felt like "failures" for the first time. Jennie discussed how she felt a loss of confidence when she came to graduate school and was no longer the "number one" student.

> Jennie: I experienced for a while there a real loss of confidence when I came here because I had gone from being number one to, holy cow, the biggest brains in the world are all around me all of a sudden. And that didn't help the whole situation either.

For the men, it either did not bother them that they were no longer number one or they felt they were still among the best and the brightest. The general survey results would support the latter conclusion. The survey respondents were asked to rank themselves in relationship to their peers. The males (50%) were far more likely than females (35%) to rank themselves as above average;

the females (54%) were more likely than males (39%) to rank themselves as average, and there was no difference in the extent to which either group described itself as below average (11%). Whereas several of the males ranked themselves as "number one" in their class, none of the females did. These results are consistent with prior research, which suggests that females rank themselves lower than males [26].

Although we have focused on the differences between the results obtained with male and female graduate students, there was an important area in which these groups were very similar: None of the graduate students had a good conception of what graduate school would be like when they arrived at Purdue. Nor had they made a conscious choice to come to graduate school. They either "followed the crowd" to graduate school, or they "did what was expected of them" and went to graduate school.

When discussing her ideas about what graduate school would be like, Judy admits that she came to graduate school because it was what her parents and her undergraduate professors assumed she would do.

> Judy: It was assumed from the day I was born that whatever I went into I was gonna get the highest degree I could because my parents were smart, I was smart and that's what you do. My professors in undergrad…were like, "Grad school would be great for you. It's just what you want. You know, you just sit there and do research and that kind of thing and go on and do that. And of course that's what you're going to do."

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Similar stories were told by all of the other participants in the focus group interviews. Steve says he did not have a good idea of what graduate school was like; he was just following the crowd to graduate school.

> Steve: You know, that's…I feel like, you know, a lot of people are just following the crowd. You get to the point where, oh, OK, I have to do this next. I'm probably still following the crowd slightly.

The general survey results supported the results of the focus group interviews. A significant number of respondents indicated that they had no idea what to expect from graduate school. Perhaps the best quote on this topic was provided by Jennie: "I thought graduate school would be just like undergraduate, with one big paper at the end!"

Conclusions

Several factors seem to have played a role in the focus group participants' decisions to change their career goals, to finish graduate school with an M.S. instead of a Ph.D. degree. These factors include balancing family and career, preconceptions (or misconceptions) about the nature of graduate school, role conflict versus role congruence, and self-esteem. Our results are consistent with previous research, but they emphasize the importance of recognizing differences in the factors that influence the career choices made by men and women at all stages in the phenomenon known as the "scientific pipeline"—even the final stages of graduate school.

Institutions that wish to search for possible solutions to the problem of differential rates of dropping out of graduate programs by men and women might wish to attend to the factors described in this paper. They might consider implementing programs that enable their students, both graduate and undergraduate, to understand the differences between the types of jobs held by M.S. and Ph.D. graduates. At the undergraduate level, they might strive to help their students develop a more realistic understanding of what to expect if and when they go to graduate school, and the reasons for choosing to go to graduate school. They might also want to rethink their attitude toward students who decide to stop with an M.S. degree, and to recognize that it is not necessarily a consolation prize given to those who were not good enough to get a Ph.D. It is often the result of a rational decision.

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