

**Why Atmospheric Science?
Career Choice and Perceived Challenges
of Female and Male
Atmospheric Science Graduate Students**

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- This study focused on female and male Atmospheric Science (ATS) graduate students **choice to pursue ATS studies as well challenges to their career plans.**
- The background diversity question pertains to the different participation of women and men in ATS, with the goal being to understand and support interest and persistence in ATS of a diversity of students.

- In the 1960s and 1970s the field of Atmospheric Science (ATS) in the United States was male dominated, especially at the doctoral level.
- There were very few (median = 5.5%) women earning ATS undergraduate degrees, and even fewer (median = 3.5%) women among ATS doctorate earners (National Science Foundation (NSF), 2008).

- Since then, there has been significant growth in women's participation in ATS education.
- The percentage of women earning ATS undergraduate degrees has been at least 23% since 1998 with a peak of 36% in 2005 (NSF, 2008).
- Women started earning at least 25% of ATS doctorates in 2002, with a peak representation of 37% in 2004 and a decline to 31% in 2006 (NSF, 2008).

- At the same time women's participation in ATS remains limited in many important ways.
- To start with, ATS has the widest gap in the geosciences with regard to undergraduate (Charlevoix, 2010) and doctoral degree (NSF, 2010) completion by women, relative to men.

- In addition, the percentage of women in ATS occupations lags behind the percentage of women completing degrees in the discipline (American Geological Institute (AGI), 2010).
- Data from the NSF Scientists and Engineers Statistical Data System (SESTAT) indicate that in 2006 women represented only 15% of ATS/space scientists, with oceanographers recording the highest percentage (28%) of women in geosciences occupations.

- These data raise questions about what may motivate women, as compared to men, to choose ATS as a field of studies, and also what women's career concerns may be, relative to men's.
- It may be that women enter ATS studies for different reasons, and that they may experience different challenges to being an ATS scientist than men, with possible consequences for retention in the field.

- There has been substantial research on what motivates women and men to choose and/or to stay in a variety of STEM disciplines (e.g., AAUW, 2010; Bernstein, 2011; Sax, 1994).
- Few studies have explored women's and men's choice of, and retention in ATS, and in the geosciences in general.

- Three of these studies (e.g., Charlevoix, 2010; Hartten & Lemone, 2010; NSF, 2008) only described the demographic characteristics of ATS students.
- One of these studies (Charlevoix) also asked whether ATS students intended to stay in the major, and found that women were slightly more likely than men to consider changing majors.

- We found only one study asking respondents what motivated them to go into the geosciences (Levine, Gonzáles, Cole, Furman, & Le Floch, 2007).
- The limitation of this qualitative study is that its sample (N = 14, 8 men and 6 women) was made almost exclusively (n = 12) of ATS senior scientists, with only two being (graduate) students.

- Levin and colleagues study's main finding was that entry into the career was facilitated not only by general positive educational experiences (such as having a mentor) and resources (such as fiscal abilities), as is the case for other STEM disciplines, but also by factors unique to the geosciences, such as an appreciation for the outdoor and field trips.
- It is unknown whether female and male geoscientists offered different explanations for their choice of a geoscience career because the responses of women and men were not examined separately.

- In conclusion, there still a gap in the participation of women and men in ATS education, relative to many other geosciences.
- In addition, the percentage of women in ATS occupations lags behind the percentage of women completing degrees in the discipline.
- It is unclear what may be the factors involved in the persisting gender gap in choice and retention in ATS.

- Particularly striking is the lack of studies on ATS graduate students. A focus on ATS graduate students is critical to understand ATS choice and retention because a graduate degree is “the passport” for a career as a scientist and leader in the field (Bernstein, 2011, p. 30).

- This study was designed to explore how female and male ATS graduate students explain their choice to pursue ATS studies.
- This study also sought to explore ATS graduate students' perceptions of the challenges they may encounter in accomplishing their career plans.
- Given the limited research in this area, and consistent with the method choice of the only other study of geosciences career choice (Levine et al., 2007), in this study we focused on a carefully selected, small sample, used interviews as data collection method, and qualitative methods for data analyses.

Method

- PARTICIPANTS: Eleven (6 female, 5 male) ATS graduate students were selected for inclusion in this study based on their career plans (4 expressed an interest in an academic career, 4 in a research career, and 3 in a consulting career) across two levels of graduate studies, about half ($n = 6$) being masters level and the other half ($n = 5$) doctoral level students.

Method

- PROCEDURE: Potential respondents were recruited from a large ATS graduate program via email invitation and via peer and faculty referrals.
- Participants first completed a written survey about their personal and educational background and their career plans. Semi-structured interviews were then conducted to explore educational and career experiences and plans.

Method

- INSTRUMENTS:
- *Written questionnaire:* The written survey asked questions about range of topics, including the respondent's age, ethnicity, nationality, relationship status, and number of children. It also inquired about the respondents' stage of progress in the graduate program and career plans.
- *Interview protocol:* The two main questions serving as the focus of the current study were: (a) "What led you to where you are now in your education and career path?" and (b) "What are your education and career plans and goals, and what are the biggest challenges to achieving these goals?" Follow-up questions were used to clarify and explore the respondents' answers.

Findings:

Factors Influencing Career Plans

Practical experiences

- Both women and men explained their choice of ATS as the outcome of rich and rewarding, hands-on field experiences. These opportunities enabled students to experience what it would be like to do research as a career and to test their abilities in this area

Findings:

Factors Influencing Career Plans

Practical experiences

- *I did an ... internship for three summers...I guess I really found what I was interested in. –Female Student*
- *I spent ten weeks out there, and I really enjoyed the research and I came back and I said, “Alright, I’m going to graduate school, not going to do TV anymore.” –Male Student*

Findings:

Factors Influencing Career Plans

Role models and mentors

Both women and men discussed the importance of role models and mentors.

However, more women than men mentioned that role models, mentors, and/or the support of others influenced their educational and career choices.

Findings:

Factors Influencing Career Plans

Role models and mentors

- *My advisor was really great and, so, I decided to come here [to study atmospheric science]. – Female Student*
- *I was in an astronomy class and had a really good professor...he said, “If you want to do astronomy or atmospheric sciences you should do a physics major because it’s kind of a broad major that will...teach you a lot about the mathematics that are used in [those fields]. – Male Student*

Findings:

Factors Influencing Career Plans

Math and science interest and aptitude

Women were more likely than men to articulate their math and science interest and aptitude as a factor in their educational and career choice.

Findings:

Factors Influencing Career Plans

Math and science interest and aptitude

- *I like this, you know, and I'm pretty good at it. –Female Student*
- *I think the thing that I excel at the most in school was always math...so I know I wanted to study math. – Female Student*
- *...there was something about math classes and excelling there when most people failed that I really enjoyed. –Female Student*

Findings:

Factors Influencing Career Plans

Societal Impact

- For women more than for men, it was important that their career include opportunities to make a societal impact. Some discussed hopes for how their career could influence the world in a positive way.

Findings:

Factors Influencing Career Plans

Societal Impact

- *One of the things about science is I feel like it's something you can have a real impact in. –Female Student*
- *...it was a way for me to help the world in some way, but still be involved in academia and mathematics and things like that. –Female Student*

Findings:

Challenges to Career Plans

Challenges

- Women and men differed with regard to perceived challenges

Findings: Career Plans

Challenges

- Women and men differed with regard to perceived challenges

Findings:

Challenges to Career Plans

Challenges from the Point of View of Women

- When thinking about challenges, women expressed a concern about fitting career goals with partner and family commitments. Some women talked about how their career choices would be impacted by their relationships and future plans for a family.

Findings:

Challenges to Career Plans

Challenges from the Point of View of Women

- *I can't be selfish anymore and I need to, to focus on what's best as a couple. –Female Student*
- *...The biggest challenge I think I'm going to face in the future is finding a job that has stable money [and] can support me in...the lifestyle that I want, and also gives me the freedom to, like, have a kid. –Female Student*

Findings:

Challenges to Career Plans

Challenges from the Point of View of Men

Men did not really mention challenges. They focused on the financial rewards of a career path. Some mentioned the ability to provide financially for a partner or family as important and possibly a concern.

Findings:

Challenges to Career Plans

Challenges from the Point of View of Men

- *I'm gonna do what pays a little bit more, but who knows. –Male Student*
- *Especially if I get married and have a family or even just get married, money does start becoming more important. –Male Student*

Discussion

This study documented differences and similarities in female and male ATS graduate students choice of ATS as well as in perceived challenges to these career plans.

With regard to what supported ATS career choice, practical experiences were mentioned as important by both women and men, but math aptitude and role models/mentors were emphasized by women. This final finding falls in line with previous research, indicating that mentoring is an especially important tool for women students in pursuit of scientific careers.

Discussion

Women perceived a focus on their career as challenging or even selfish in light of current or expected family needs.

In our larger ATS sample, we found that while both women and men planned for academic and research careers, only women mentioned consulting careers.

It is possible that careers in academia, compared with consulting careers, are perceived as less flexible and, due to family obligations, less appealing

Discussion

For men, financial considerations were emphasized as an important component of the career planning process, primarily as a way to be successful in their profession and for their family.

Women's family orientation and men's financial focus may represent the different ways in which women and men are socialized and how they view their life options.

Implications

The implications to increase and support a diversity of individuals to choose a career in ATS suggest a focus on

Mentoring

The social value/potential social impact of work in ATS

Family supportive policies and practices in work settings

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