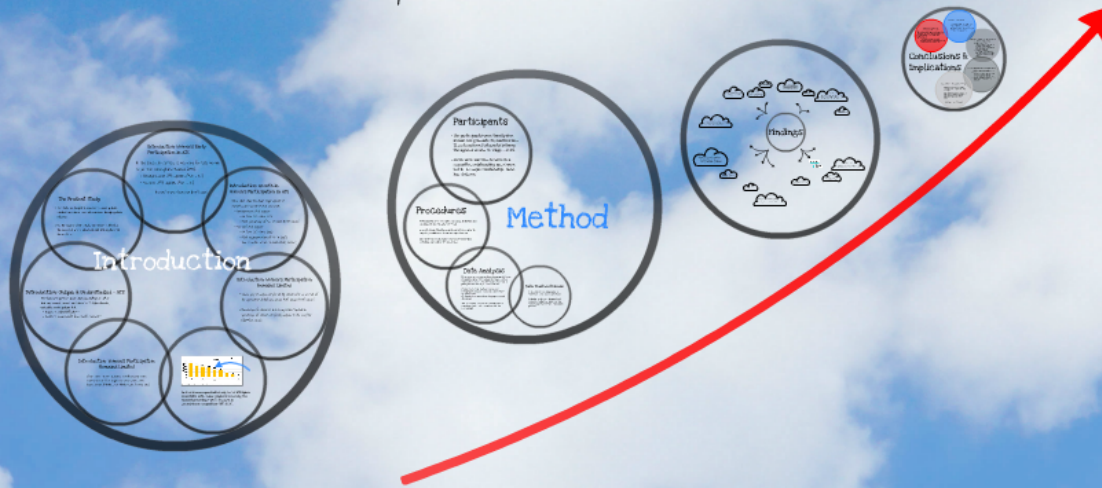


# Why Get a Doctorate?

## Views and Experiences of Atmospheric Science Female Graduate Students

Carlie D. Trott, B.A., Tabitha Bhatti, B.S., Carissa Mayer, B.S., and Silvia Sara Canetto, Ph.D.

Presented at CMMAP Summer Education & Diversity Retreat, 2012

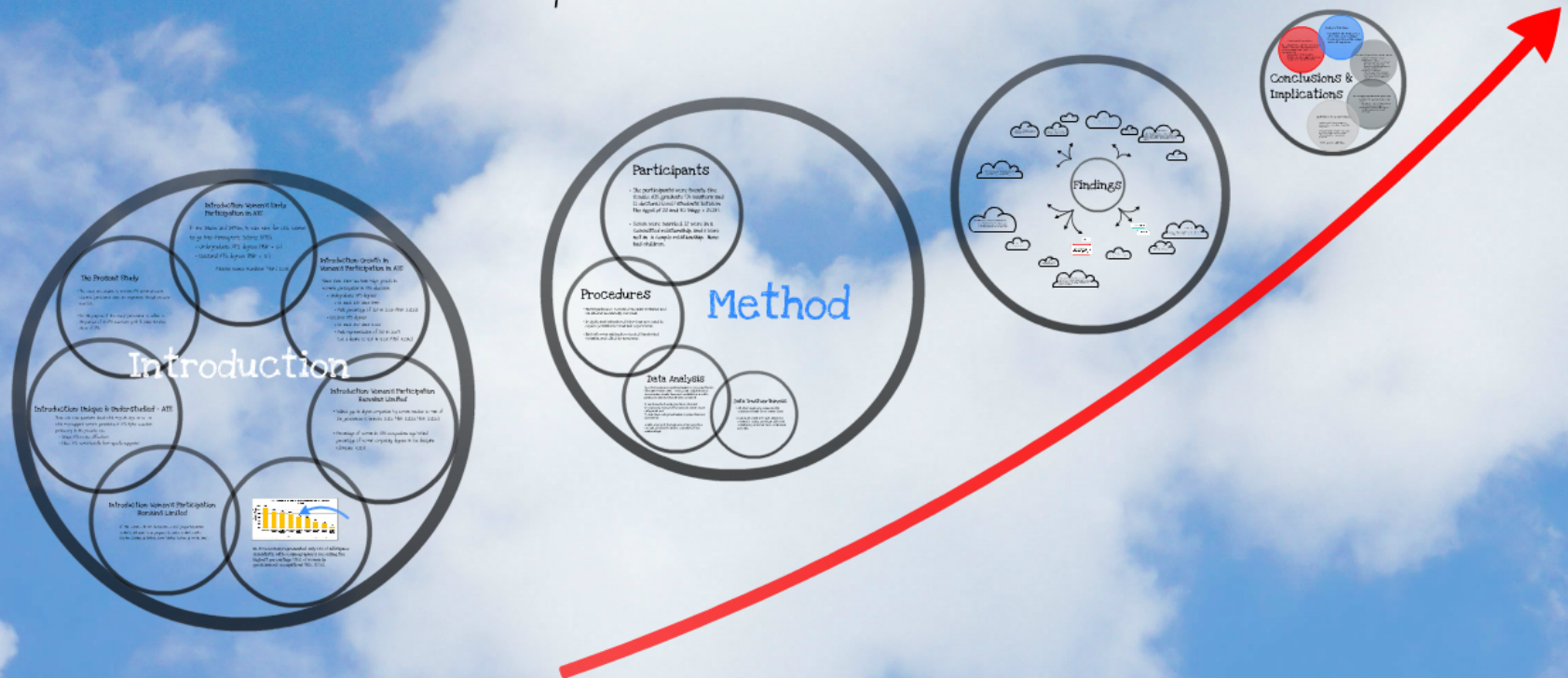


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# Introduction

## Introduction: Women's Early Participation in ATS

In the 1960s and 1970s, it was rare for U.S. women to go into Atmospheric Science (ATS).

- Undergraduate ATS degrees (Mdn = 5%)
- Doctoral ATS degrees (Mdn = 3%)

(National Science Foundation [NSF], 2008)

## The Present Study

- This study was designed to examine ATS women graduate students' persistence views and experiences through graduate education.
- For the purpose of this study, "persistence" is defined as the pursuit of an ATS educational path following the initial choice of ATS.

## Introduction: Growth in Women's Participation in ATS

Since then, there has been major growth in women's participation in ATS education.

- Undergraduate ATS degrees:
  - At least 23% since 1998
  - Peak percentage of 36% in 2008 (NSF, 2012a)
- Doctoral ATS degrees:
  - At least 25% since 2002
  - Peak representation of 38% in 2007, but a decline to 20% in 2008 (NSF, 2012c)

## Introduction: Unique & Understudied - ATS

These data raise questions about what may challenge as well as what may support women's persistence in ATS higher education, particularly at the graduate level.

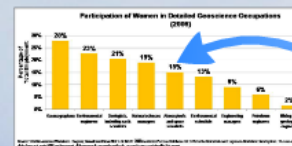
- Unique ATS-related difficulties?
- Would ATS women benefit from specific supports?

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- Widest gap in degree completion by women relative to men of the geosciences (Charlevoix, 2010; NSF, 2012a; NSF, 2012c)
- Percentage of women in ATS occupations lags behind percentage of women completing degrees in the discipline (Gonzales, 2010)

## Introduction: Women's Participation Remains Limited

Of the women with ATS doctorates, a small proportion enters academia, and even fewer progress to senior academic ranks (Tucker, Ginther, & Winkler, 2009; Winkler, Tucker, & Smith, 1996).



In 2006 women represented only 15% of ATS/Space scientists, with oceanographers recording the highest percentage (26%) of women in geosciences occupations (NSF, 2006).

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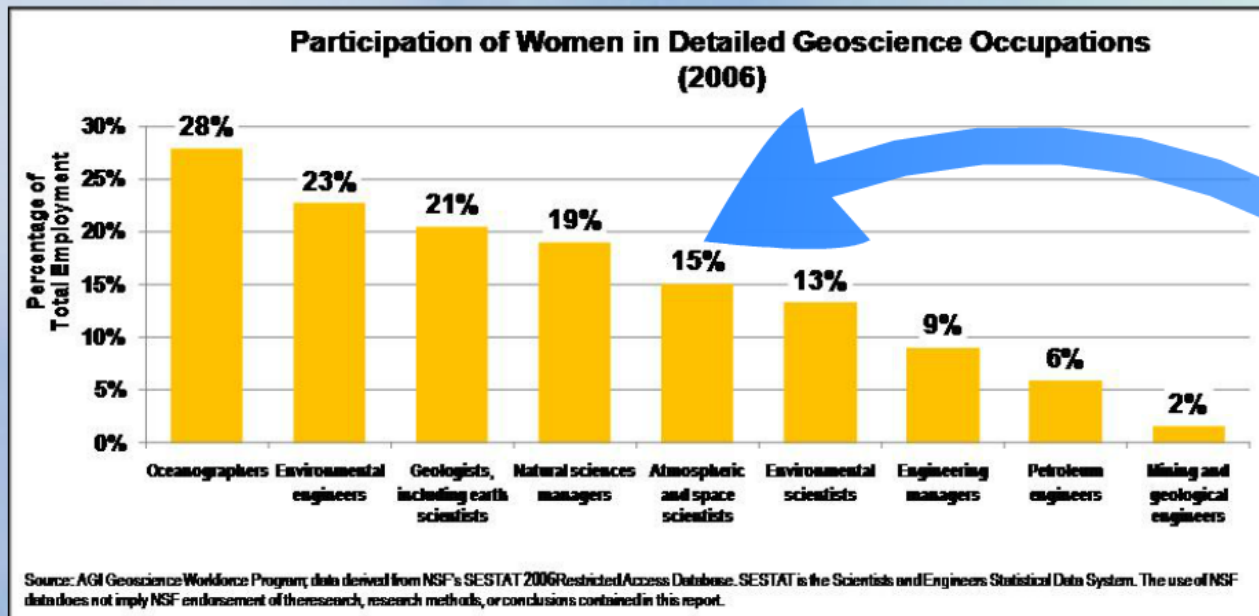
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- For the purpose of this study, "persistence" is defined as the pursuit of an ATS educational path following the initial choice of ATS.



# Method

## Participants

- The participants were twenty-five female AIS graduate (14 masters and 11 doctoral-level) students between the ages of 22 and 30 (Mage = 25.13).
- Seven were married, 12 were in a committed relationship, and 6 were not in a couple relationship. None had children.

## Procedures

- Participants were recruited via email invitation and via student and faculty referrals.
- In-depth, semi-structured interviews were used to explore persistence views and experiences.
- Each interview was audio-recorded, transcribed verbatim, and edited for accuracy.

## Data Analysis

The interviews were analyzed based on grounded theory (Strauss & Corbin, 1990). Coding was completed by a four-member female team and consisted of a multi-phase process whereby all team members:

- (1) identified textual segments of interest;
- (2) organized emergent themes into hierarchical categories; and
- (3) described categories based on properties and dimensions.

Finally, emergent themes were arranged into a conceptual model to better understand their relationships.

## Data Trustworthiness

- All interviews were independently coded by at least three researchers.
- Individual codes were discussed and revised in coding meetings, with final codes being achieved via a consensus process.

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# Findings



- Motivation
  - Optimism
  - Self-Confidence
- Personal Attributes

Interest in Science:  
"If I'd gotten into a different area of research... I might have stopped after the master's degree, but... it's something I think is important."

- Self-Doubt
- Time Management Stress (Academic vs. Social)
- Uncertainty about the Future

Common Setbacks

- Desired Career Qualities:
  - Social Impact
  - Stability
  - Flexibility (for family)
  - High Regard

Career-Related Plans & Concerns

- Anticipated Challenges:
  - Employment
  - Geographic Location
  - Time to Ph.D.
  - Dual-Career Matters
  - Plans for Children

- Role Models & Mentors:
  - Women in STEM
  - Work-Life Integration Models

- Academic:
  - Advisors
  - Peers
  - Professors
  - Teachers
- Personal:
  - Family
  - Partner
  - Friends

Supportive & Influential Relationships

Advice:  
"Nobody in my family had ever gotten a [graduate] degree... So I didn't know what to expect... just having a mentor who could show me what research was like and guide me but give me a little bit of freedom to do what I was interested in... just encouraged me to go on and study more."

Advice & Guidance:  
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- Practical Support:
  - Advice & Guidance
  - Financial

- Emotional Support:
  - Encouragement
  - Motivation
  - Inspiration

Supportive Experiences

Encouragement:  
"My parents being proud of me has always encouraged me to keep going."

Influential Experiences

- Hands-on:
  - Research Involvement
  - Internships & Fieldwork
  - Camps & Programs
- In the Classroom:
  - Coursework
  - Teaching & Offering Mentorship

Graduate Program Fit

- Departmental Culture:
  - Collaborative Research Atmosphere
  - Supportive Peer Group
  - Gender Dynamics (e.g. Lack of Women)

- Advising Style:
  - Flexibility
  - Availability
  - Ability to Relate

Career-Related Opportunities

- Networking
- Professional Development
- Recognition (e.g. Publishing)

Challenges

- Overt Gender Discrimination
- Discouraging Interactions

Policies & Initiatives

- Diversity-Focused Programs (e.g. Scholarships, Internships)
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Gendered Expectations

- Gendered Career Norms
- Pressure to Prioritize Family

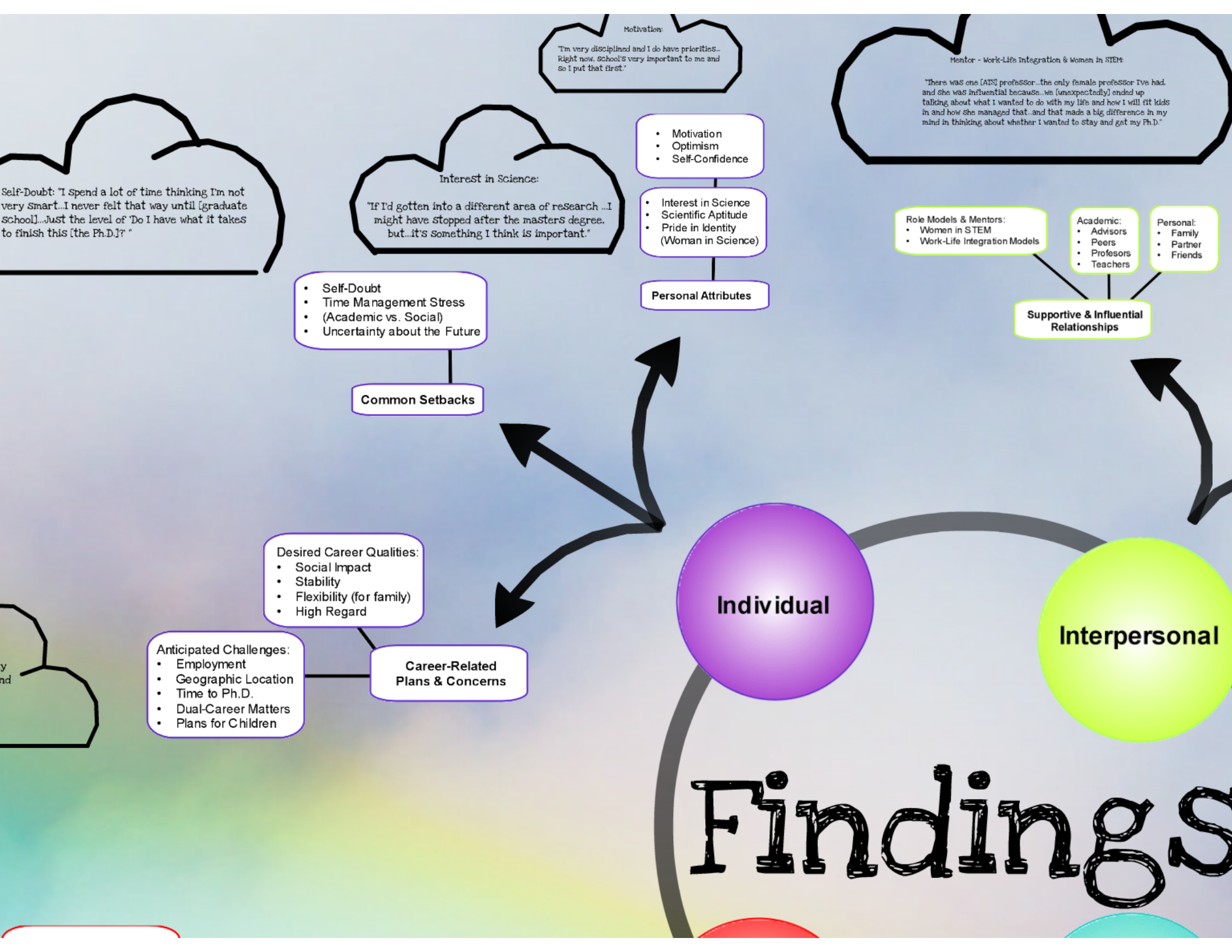
Societal Values

- Education
- Science

Pressure:  
"I feel like honestly if I don't put family in, but I also feel like if I get a Ph.D. in opportunities presented to me... that's not so good."

Gendered Expectations





"I'm very disciplined and I do have priorities... Right now, School's very important to me and so I put that first."

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Interest in Science:

"a different area of research ...I moved after the masters degree, something I think is important."

- Motivation
- Optimism
- Self-Confidence

- Interest in Science
- Scientific Aptitude
- Pride in Identity (Woman in Science)

- Role Model
- Work
  - Work

**Personal Attributes**

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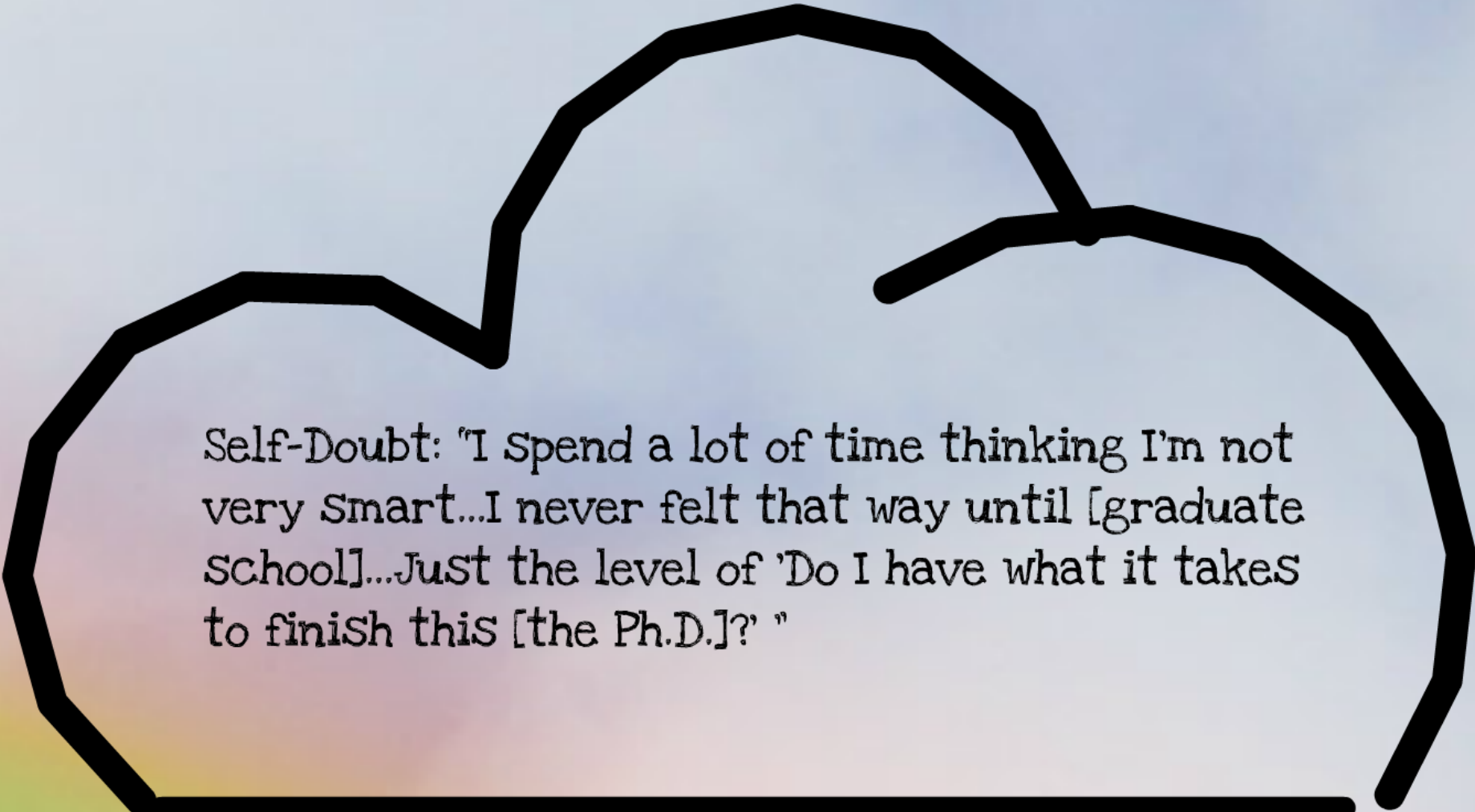
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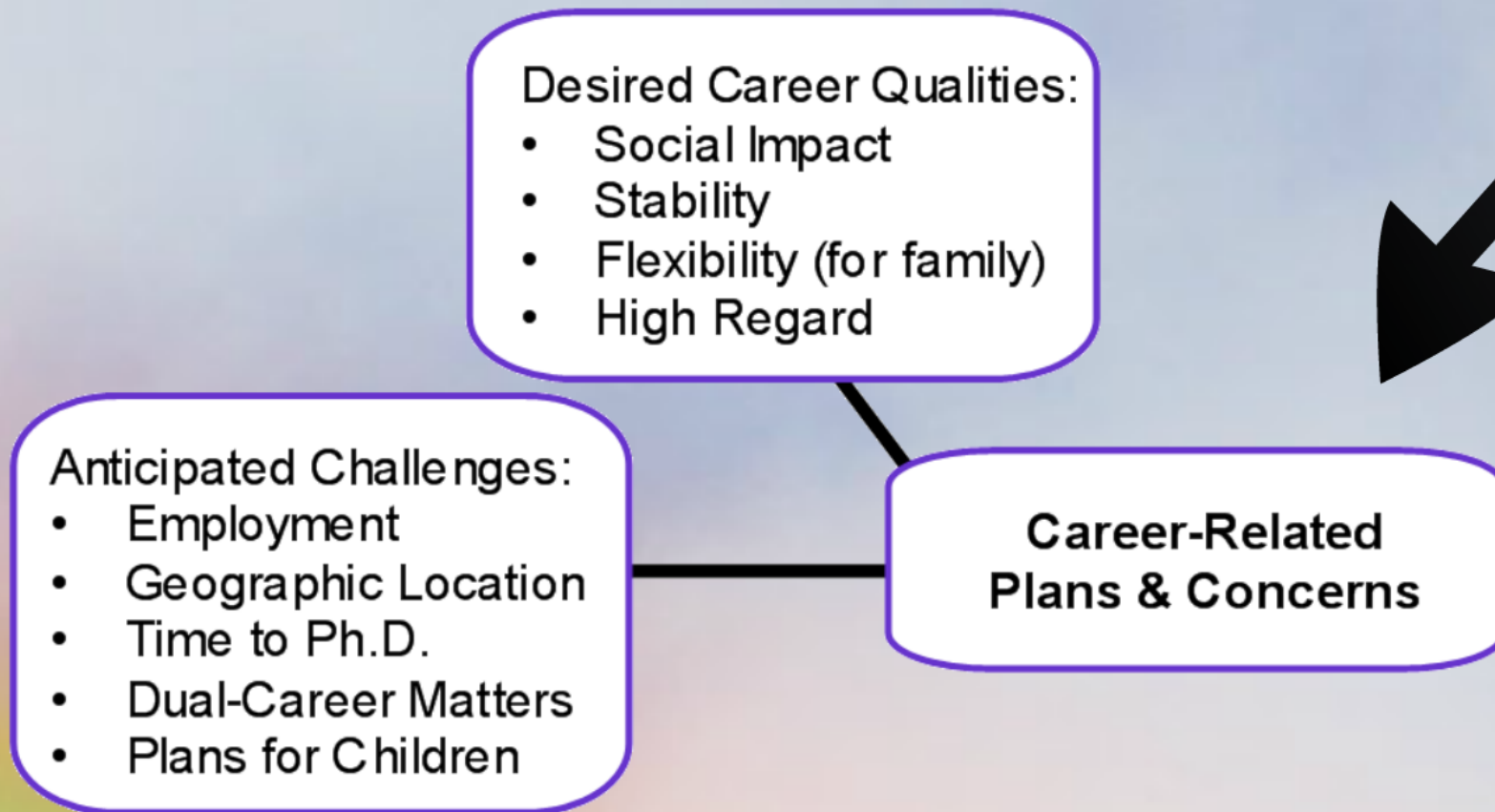
**Common Setbacks**

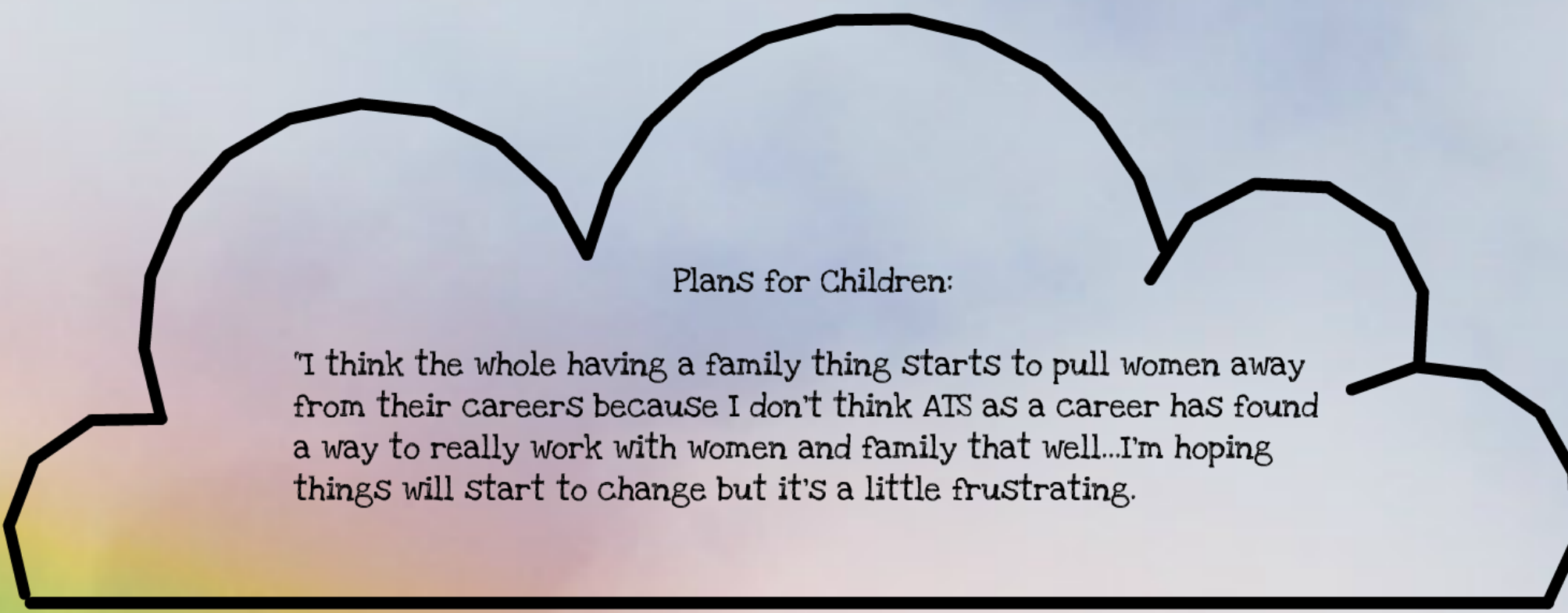




Self-Doubt: "I Spend a lot of time thinking I'm not very smart...I never felt that way until [graduate school]...Just the level of 'Do I have what it takes to finish this [the Ph.D.]?' "







Plans for Children:

"I think the whole having a family thing starts to pull women away from their careers because I don't think ATS as a career has found a way to really work with women and family that well...I'm hoping things will start to change but it's a little frustrating."





**Role Models & Mentors:**

- Women in STEM
- Work-Life Integration Models

**Academic:**

- Advisors
- Peers
- Profesors
- Teachers

**Personal:**

- Family
- Partner
- Friends

**Supportive & Influential Relationships**



Mentor - Work-Life Integration & Women in STEM:

"There was one [ATS] professor...the only female professor I've had, and she was influential because...we [unexpectedly] ended up talking about what I wanted to do with my life and how I will fit kids in and how she managed that...and that made a big difference in my mind in thinking about whether I wanted to stay and get my Ph.D."

Role Models & Mentors:  
• Women in STEM

Academic:  
• Advisors

Personal:  
• Family



AdviSor:

AdviSor: "[My adviSor] has been an incredible adviSor. He's really [helped me to get] to...where I am now. I'm having a paper published pretty Soon and then I'm finishing my theSiS and having a bright career ahead of me."



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graph LR; A[Supportive Experiences] --- B[Practical Support: Advice & Guidance, Financial]; A --- C[Emotional Support: Encouragement, Motivation, Inspiration];
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## **Supportive Experiences**

### **Practical Support:**

- Advice & Guidance
- Financial

### **Emotional Support:**

- Encouragement
- Motivation
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### Practical Support:

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Encouragement:

"[My parents] being proud of me has always encouraged me to keep going."



# Findings

## Individual

## Interpersonal

## Environmental

## Societal

Common Setbacks

Desired Career Qualities:

- Social Impact
- Stability
- Flexibility (for family)
- High Regard

Career-Related Plans & Concerns

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Influential Experiences

Hands-on:

- Research Involvement
- Internships & Fieldwork
- Camps & Programs

In the Classroom:

- Coursework
- Teaching & Offering Mentorship

Collaborative Research Atmosphere:

"I don't think that I would be sticking around for the Ph.D. if [my advisor] didn't construct a research group that has the dynamics it has"

Graduate Program Fit

Departmental Culture:

- Collaborative Research Atmosphere
- Supportive Peer Group
- Gender Dynamics (e.g. Lack of Women)

Advising Style:

- Flexibility
- Availability
- Ability to Relate

Gendered Expectations

- Gender
- Press

Societal Values

- Education
- Science

Policies & Initiatives

- Diversity-Focused Programs (e.g. Scholarships, Internships)
- Government Research Funding

Career-Related Opportunities

Networking & Professional Development

- Networking
- Professional Development
- Recognition (e.g. Publishing)
- Rewarding Experiences (e.g. Community Outreach)

Challenges

- Overt Gender Discrimination
- Discouraging Interactions
- Observations of Work-Family Conflict Among ATIS Professionals (Mostly Women)

Supportive Peer Group

"My peer group at the institution (in ATIS) is phenomenal... it's about getting things done by department and just not in their own little department. I would like to be here."

Recognition & Networking

"I feel that recognition and networking are really important. It's not enough to just do the work and then have it go by unnoticed. It's about getting your work out there and being recognized for it."

Diversity-Focused Programs

"The four-year summer internship... for students from underrepresented groups... probably not as where I am today."

Observations of Work-Family Conflict:

"I see a lot of women in our field, especially faculty, and they were married and divorced, or never married, and it's like their personal life is not part of who they are as a scientist, and I find that to be a barrier for me in this field."

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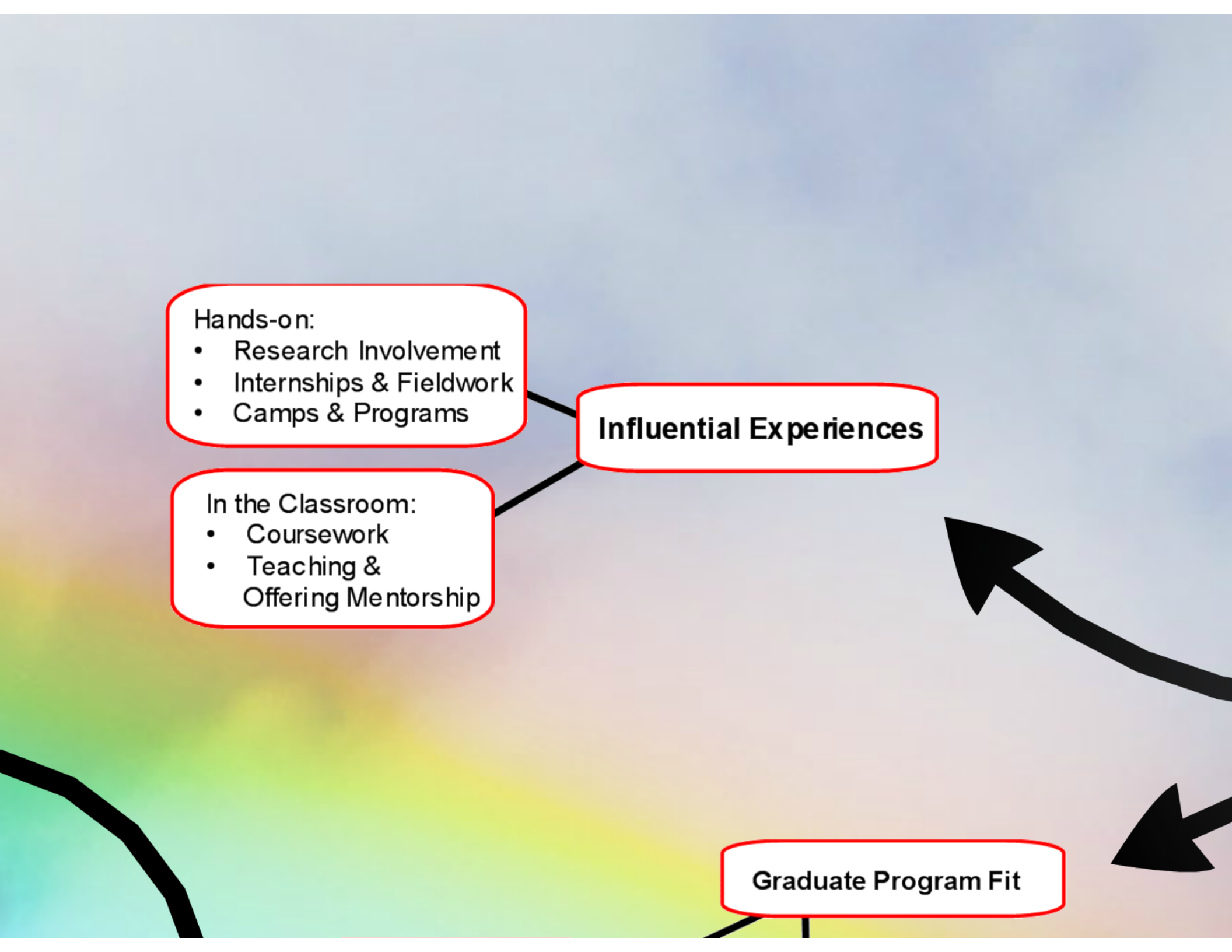
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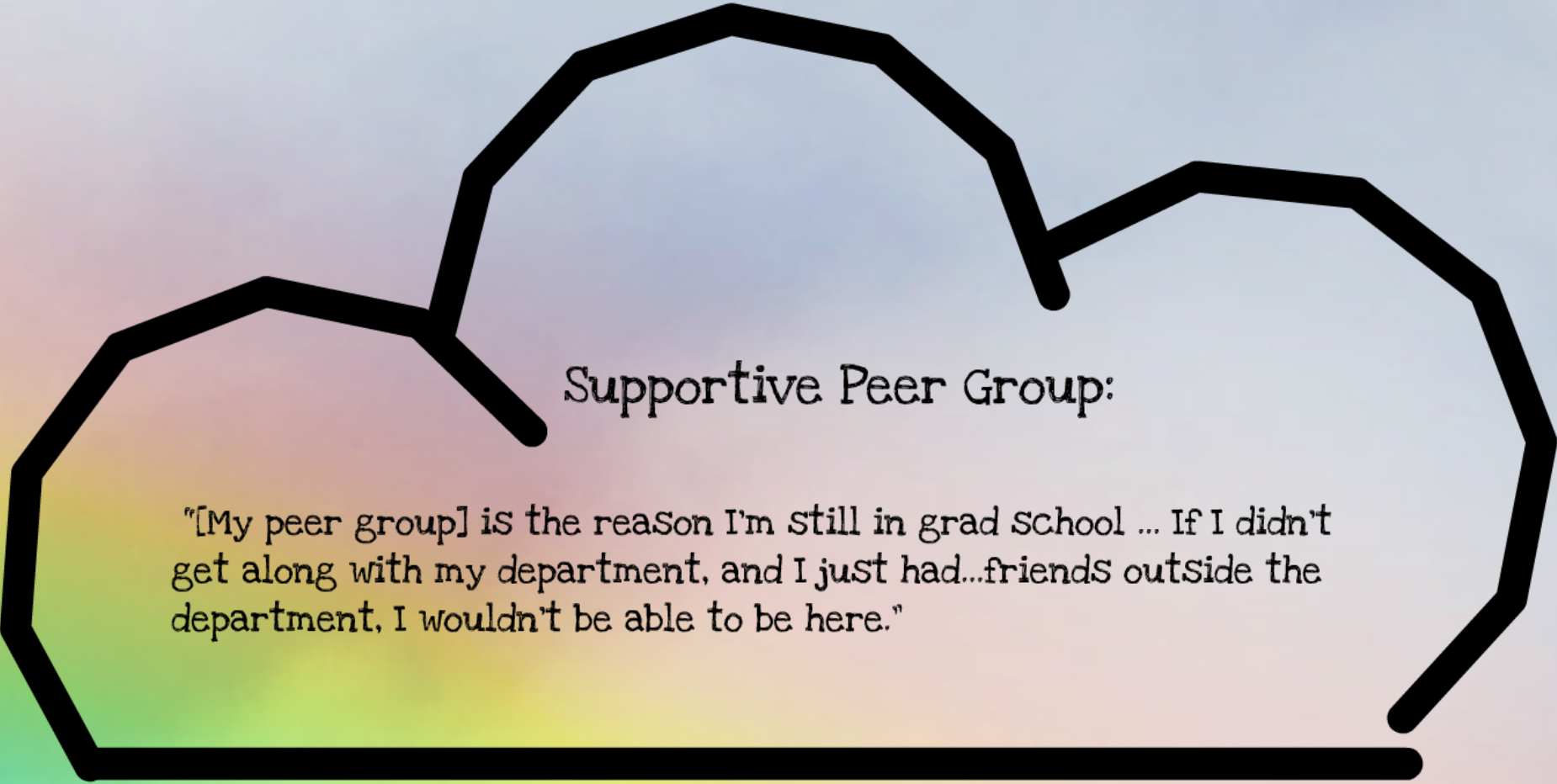


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Supportive Peer Group:

"[My peer group] is the reason I'm still in grad school ... If I didn't get along with my department, and I just had...friends outside the department, I wouldn't be able to be here."

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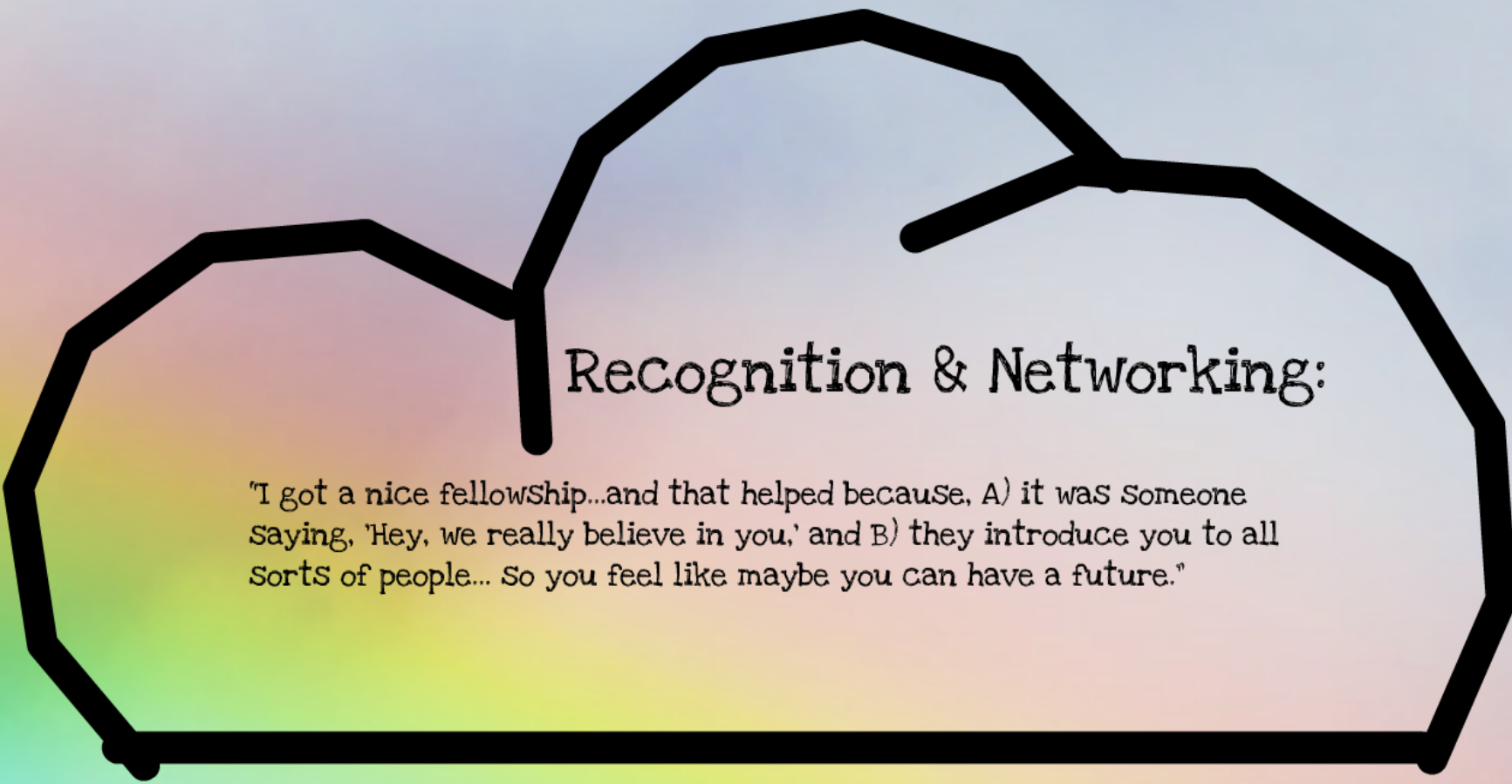
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**Career-Related Opportunities**

- Networking
- Professional Development
- Recognition (e.g. Publishing)
- Rewarding Experiences  
(e.g. Community Outreach)

- Overt Gender
- Discouraging
- Observation  
Conflict Among  
Professionals





## Recognition & Networking:

"I got a nice fellowship...and that helped because, A) it was someone saying, 'Hey, we really believe in you,' and B) they introduce you to all sorts of people... So you feel like maybe you can have a future."



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## Challenges

- Overt Gender Discrimination
- Discouraging Interactions
- Observations of Work-Family Conflict Among ATS Professionals (Mostly Women)

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# Findings

Individual

Interpersonal

Environmental

Societal

Supportive Experiences

- Practical Support:
  - Advice & Guidance
  - Financial
- Emotional Support:
  - Encouragement
  - Motivation
  - Inspiration

Encouragement  
"My principal being part of the AAT always encouraged me to keep going."

Gendered Expectations

- Gendered Career Norms
- Pressure to Prioritize Family

Pressure to Prioritize Family  
"I feel like honestly if I don't put family first, I'm going to feel guilty about it. But I also feel like if I get a Ph.D. in ATS and I have all these great opportunities presented to me...that turning away from them is going to make me feel guilty."

Societal Values

- Education
- Science

Gendered Expectations  
"Why am I still a student? Why am I not starting a family...and going where my husband wants to be? ...there's kinda that pressure."

Policies & Initiatives

- Diversity-Focused Programs (e.g. Scholarships, Internships)
- Government Research Funding

Diversity-Focused Programs  
"That four-year summer internship...for students from underrepresented groups...probably got me where I am today."

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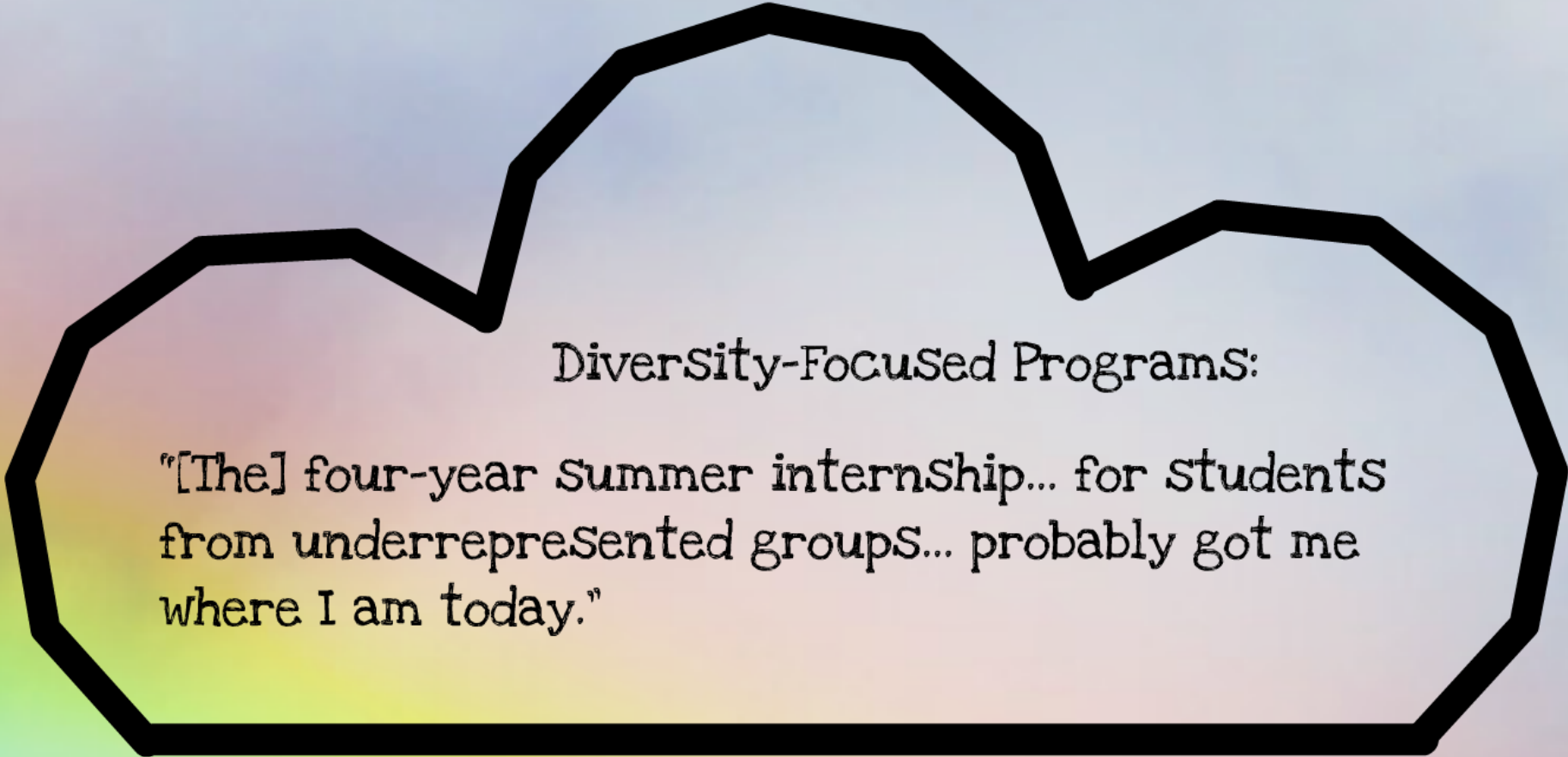
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# Conclusions & Implications

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This study provides important information on the persistence views and experiences of women in graduate ATS studies, with implications for:

- The design of future research
- Programs aimed at supporting women's completion of the ATS doctorate

## Findings of this study:

- Consistent with findings from other SIEM women's studies
- Present new information unique to the ATS experience

## Challenges to persistence for ATS women:

- Gendered: The result of social pressures on women to:
  - Minimize educational commitment
  - Prioritize family (including partners' careers & assuming the primary caregiver role.)
- ATS-specific, considering:
  - ATS employment opportunities & limited geographic job availability
  - Dual career conflict, especially critical

## Factors supporting educational persistence:

- Consistent with previous studies of SIEM women
  - Importance of role models & mentors
  - Emotional & practical support
- ATS-unique, including the significance of:
  - Hands-on research involvement
  - Field trips

## Limitation of the present study:

- Findings may be department-specific; Sample drawn from a single, top-ranking ATS program
- Future studies should seek to verify and enrich the present study's findings within a diversity of ATS graduate programs.

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