

Intrinsic and Extrinsic Motivators of Why Women Enter STEM



THE COLLEGE OF
WOOSTER

Marian Overfield
Advisor: Dr. Meredith Hope

Abstract

This study examines the relationship between types of Science, Technology, Engineering, and Mathematics (STEM) majors and motivation levels. Demographically, this study looked at female identifying individuals at the undergraduate level, who had already declared their major. Women from the College of Wooster completed surveys on reasons why they had decided to major in STEM. Surveys also asked whether they felt a sense of belonging or not within their specific department, based on peer and faculty interaction and appreciation. Data was analyzed using bivariate correlations, ANOVAs, and linear regressions. No significant results were found for the first two hypotheses, however trending positive data was found against hypothesis three, where women of Southeast Asian decent had highest levels of sense of belonging out of any ethnicity.

Background

Women in STEM

- On average women in STEM earn 85% less than their male counterparts (Sterling et al., 2020).
 - Black and Hispanic women in STEM are subjected to the largest pay gap, making almost \$50,000 less than Asian men- who make the most- all for doing the same job (Kennedy et al., 2021)
- Men are pushed into societal roles that better suit the pursuit of STEM, while women are pushed into social roles (Buck et al., 2002; Dasgupta & Stout, 2014, Konrad et al., 2000)
- Women make up 21% of individuals who hold a job that can be categorized as STEM (US Census Bureau, 2021)
- Women are four times more likely to have a male professor in STEM while in college than a female professor (National Science Foundation, 2015)
 - Women have been found to perform better in calculus when taught by a female professor than a male (Stout et al., 2011)
- Women of all races rank in the minority of STEM professionals

Motivation

- Self determination theory is a need-based theory of motivation comprising of three parts, that if met, result in higher levels of intrinsic motivation
 - Intrinsic motivation: the feeling of autonomy and effort directed towards a task due to genuine interest or enjoyment Extrinsic motivation: requiring some external force to drive the completion of a task rather than being intrinsically self-driven
- On average women in STEM field with low female representation tend to have high levels of intrinsic motivation, compared to women in STEM field with high female representation, who have high levels of extrinsic motivation

Sense of Belonging

- When women are able to relate to a role model, sharing gender and/or race, their sense of belonging within a STEM field increases (Asgari et al., 2011).
 - a high sense of belonging has been proven to have better outcomes within academics

Current Study

What are the intrinsic and extrinsic motivators of why women enter STEM

- Within specific STEM disciplines, such as physics, computer science, and computer science affiliated fields, as the sense of belonging increases, so will intrinsic motivation.
 - Previous research shows there is a connection between sense of belonging and intrinsic motivation (Ryan et al. 2016)
- Women in STEM at The College of Wooster who have a declared major in Computer Science, Data Science, Economics, Environmental sciences, mathematics, or physics, will report higher levels of intrinsic motivation than their peers who have declared STEM majors not listed.
 - Female populations within a STEM department has been shown to impact if a woman presents intrinsic of extrinsic levels of motivation
- Low level of female professors of color in the College of Wooster STEM departments, and the positive correlation between sense of belonging and relatedness, hypothesizes that female students of color will report lower rates of sense of belonging, than white female students at the College of Wooster.

Methods

- 67 Participants completed a survey consisting of a total of 22 questions all ranked on a Likert Scale
 - 4 were taken from the Academic Motivation Scale-College Version, to measure intrinsic motivation- specifically the Intrinsic Motivation-Towards Accomplishment subscale (Vallerand et al., 1993)
 - “For the pleasure, I experience while surpassing myself in my studies.”
 - “For the satisfaction I feel when I am in the process of accomplishing difficult academic activities.”
 - 4 were taken from the Academic Motivation Scale-College Version, to measure extrinsic motivation, specifically the Extrinsic Motivation- Introjected subscale. (Vallerand et al., 1993)
 - “To prove to myself that I am capable of completing my college degree”
 - “Because I want to show myself that I can succeed in my studies.”
 - 14 were taken from the adapted version of The Psychological Sense of School Membership to measure sense of belonging level (Knehta et al., 2020)
 - 8 about within a specific STEM department
 - “Other students in the _____ department take my opinions seriously”
 - “Students in the _____ department help each other to succeed”.
 - 6 look at involvement in department related events and activates
 - “Attend the office hours of a department faculty member”
 - “Join a department-related student group or club at Wooster.”

Results

- Inconsistent with previous studies, results did not yield support for hypothesis one. Stating that specific majors will show a positive relationship between sense of belonging levels and intrinsic motivation.
- Results did not yield support for the second hypothesis, which built off Lutenberger’s (2019) argument that women in low-female populated STEM majors are more likely to have higher levels of intrinsic motivation
- While not entirely consistent with previous findings, there were positive trends seen in support of hypothesis three. This hypothesis claimed that due to low level of sense of belonging, as found by Dasgupta & Stout (2014), women of color would report lower levels of sense of belonging compared to white women.
 - South Asian women reported the highest levels of sense of belonging out of any ethnic group of participants
- **Significant Association**
- Higher rates of intrinsic motivation related to being a Math major (minority women in this department- fits with the literature)
- Higher rates of extrinsic motivation related to being an Environmental Studies major (majority women in this department- fits with the literature)

Conclusion

While women are still widely underrepresented within the field of STEM, it is clear from the participation in this study, and gender breakdown of STEM majors on the College of Wooster’s campus, that this trend seems to be shifting. Some researchers note that gender does not exist in the binary, but on a spectrum (Connell, 2010; Harrison et al., 2012) This can be silencing towards female-presenting but not identifying people in STEM who still face the stereotypes associated with their outward presentation (Mattheis et al., 2020).

This study focused on the connection between STEM majors and levels of intrinsic and extrinsic motivation, which have previously been shown to have a relationship (Ryan et al., 2016). Using a survey with undergraduate women in STEM, I sought to find what motivated these women to pursue STEM fields beyond high school. It is my hope that, in the future, young children will be encouraged to explore any field of study that they want, regardless of gender and ethnic identity. Being able to understand what drives people into feeling accepted is the first step in this process.

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