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Considering the Role of Gender in Developing a Science Identity: Undergraduate Students in STEM Fields at Large, Public, Research Universities

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Project STEP UP

- Science, Technology, Engineering, and Mathematics (STEM) Trends In Enrollment & Persistence for Underrepresented Populations (STEP-UP).
- Investigates trends such as factors that impact students' entrance into, persistence in, or movement out of STEM fields.
 - Gender
 - Race/Ethnicity
 - Socioeconomic status
 - STEM fields



Purpose of the Study

- Investigate the extent to which students in STEM fields at large, public, research universities identify as a scientist.
 - Focus on gender differences
- Increasing calls to improve success for underrepresented groups in STEM major fields.
- Increasing calls to improve diversity in the STEM workforce.



Research Questions

1. Do science identities differ by gender? If so, how do they differ?
2. How do students' perceived self-efficacy differ by gender?
3. How do students' perceived self-efficacy impact their science identity? Do differences exist by gender?



Data

- Online survey of undergraduate students
- 9 large, public research universities
- Participant Profile
 - N=1,881 students completed the survey
 - 61.2% Women
 - 38.1% Men
 - 0.7% Prefer Not to Answer



Methodology

- Descriptive statistics, cross-tabulations, factor analysis, and regression analysis were used to answer the research questions.
- Comparisons were made by:
 - Gender
 - Current major in the following STEM fields:
 1. Physical Sciences, Computer Sciences, Math and Engineering (PSCSME)
 2. Agricultural Sciences, Biological Sciences (ABS)
 3. Health Sciences and Psychology (HSP)



Major Categories By Gender

	Male	Female	Prefer not to Answer
PSCSME	104	215	2
	14.5%	18.7%	14.3%
ABS	447	622	12
	62.4%	54%	85.7%
HSP	31	182	0
	4.3%	15.8%	0%
Non-STEM	134	132	0
	18.7%	11.5%	0%
Total	716	1151	14
	100%	100%	100%



Principal Axis Factor (PAF) Analysis

- PAF resulted in two distinct factors that utilized 12 of the 14 variables, which collectively explain 66% of the variance within the overall set of science identity questions.
- Two Distinct Factors Include:
 - 1) *Identifying as a scientist (composite score created)*
 - *This composite variable served as the dependent variable in regression analysis which investigated the relationship between students' science identity and their self-efficacy.*
 - 2) *Using and Doing Science*



Science Identity Survey Items

Identifying As a Scientist (Cronbach's Alpha=0.940)

I identify as a scientist

I am comfortable identifying myself as a scientist

Field of study helps me identify as a scientist

My peers recognize me as a scientist

My family and friends recognize me as a scientist

It is important to me that others see me as a scientist

Seeing other people who look like me within my field reinforces my science identity.



Science Identity Survey Items Cont'd

Using and Doing Science (Cronbach's Alpha=0.831)

Doing Science is important to who I am

My knowledge and skills will allow me to help others

My knowledge and skills will allow me to contribute to social issues that are important to me

I enjoy conducting research



Self Efficacy Survey Items

Self-Efficacy (Cronbach's Alpha=0.924)

I feel good about myself

I don't have enough control over the direction my life is taking

I feel I am a person of worth, the equal of other people

I am able to do things as well as most other people

Every time I try to get ahead, something or somebody stops me

My plans hardly ever work out, so planning only makes me
unhappy

Students like me do not usually do well at this college/university

I expect to be an honors student at this college/university

I could get higher grades in a major that suited me better



Self-Efficacy Survey Items Cont'd

Self-Efficacy (Cronbach's Alpha=0.924)

I am afraid I may not make it in college or in a university

On the whole, I am satisfied with myself

I feel useless at times

At times, I think I am no good at all

When I make certain plans, I am almost certain I can make them work

I feel I do not have much to be proud of

In my life, good luck is more important than hard work for success

Chance and luck are very important for what happens in my life



Science Identity Results

- In ABS, more women reported that they did not need to see other people who look like them in their field to reinforce their science identity. ($p < .05$)
- In HSP, more men reported that they needed someone who looks like them within their field to reinforce their science identity. ($p < .05$)
- More women report having to work harder than their peers to be recognized as a scientist due to gender. (ABS $p < .05$ /PSCSME $p < .05$)



Self-Efficacy Results

- More women reported having a low level of self-efficacy. ($p < .05$)
- More men reported being very confident in their math and science skills. ($p < .05$)
- More men reported feeling good about themselves (PSCSME $p < .01$ /ABS $p < .01$)



Regression Results: Self-Efficacy Impact on Science Identity

- 9 Models tested; Final $R^2 = 0.28$
- There is an overall weak association between students' self-efficacy and science identity
- Positive Impact on science identity
 - Using and doing science
 - Majoring in PSCSME and ABS
- Negative Impact on science identity
 - Students who reported having to work harder than peers to be recognized as a scientist due to their gender



Limitations

- Despite having 9 participating campuses, some universities had more students participate than others.
- The survey was long, resulting in some respondents not completing the survey.
- There was low number of observations of respondents in non-STEM fields.
- Students were only asked about identifying as a scientist.



Future Research

- Gain a more in-depth understanding of how a student's sense of identity and self-efficacy changes over time.
- Student definition and/or explanation of what it means to be a scientist.
- Conceptualization of scientist and how it affects their science identity.
- Gaining an understanding of science identity of men in women dominated STEM fields.



Implications and Conclusion

- The findings from this study provide information that can assist program directors and administrators in establishing programs that aim to foster science identity development.
 - Gender differences in science identity
 - Gender differences in self-efficacy
 - Holistically viewing science identity in STEM major fields that are dominated by either gender
 - Using and Doing science had an impact on science identity



Questions and Comments

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