What attitudinal factors correlate with persistence of women in physics?

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Abstract. Retention of women remains a persistent problem in physics. Using survey results obtained at the American Physical Society (APS) Conference for Undergraduate Women in Physics (CUWiP), we tested several affective factors to find how they correlate with retention at several stages of physics. These factors are motivation, sense of community, sense of belonging, perceived recognition, identity, interest, and performance competence. We find that identity, interest, perceived recognition, and certain factors of motivation are all highest in women that stay in physics post-university, while sense of belonging is highest in women that leave the field after graduating with a physics degree.

Introduction

As a hostile climate and negative stereotypes push women out of physics [1], educators must support women in their classes in order to boost retention. To do this, it is helpful to identify women who are at risk of leaving the field, and therefore need the most support. This study examines surveys taken by undergraduate women studying physics in American universities, as well as a follow-up survey taken years later, in order to quantify which attitudes and beliefs are most often found in women who stay in or leave physics. The goal of this project is to predict which women would benefit most from interventions to remain in physics.

Theoretical framework

The factors we examine tie together a variety of theoretical frameworks. The most complex factor is motivation, for which we create a coding scheme combining two frameworks. The first is expectancy-value theory [2], which states that people undertake a task if they believe the expected value outweighs the associated cost. The second is self-efficacy theory [3], which states that people are more likely to do a task if they believe they will succeed.

Our other factors are united under the umbrella of identity [4], though each examines different aspects. These factors have all been linked with persistence in physics in some way, but the only factor that has been found to correlate with long term persistence of women in physics is perceived recognition, specifically from mothers [5]. Our work expands this body of research by studying what other factors correlate with long term retention of women in physics.

Methods

Our data come from two different surveys. The first was the pre/post conference survey given annually to attendees at the APS CUWiP between 2014 and 2019, and it is composed of one short answer question, studying motivation, and 40 Likert-scale questions for the other factors. The second was the follow-up survey given in 2018, 2-4 years after the participants had attended the CUWiP. Our motivation coding scheme was developed by two researchers working in tandem, while the other codes were validated by factor analysis of the survey questions.

Results

We find that identity, interest, and perceived recognition are all highest among women who remain in physics after graduating. Curiously, we also find that sense of belonging tends to be highest in women who get a degree in a different STEM field.

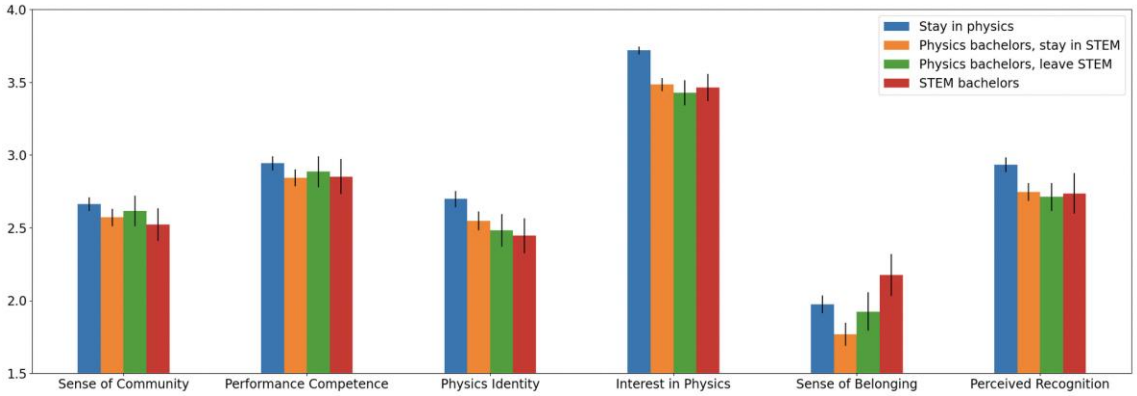

Figure 1: Differences in affective variables between retention groups

While our results are not as clear for the motivational codes, we do find that some codes tend to be more closely associated with remaining in physics, especially the social persuasion sub-category of self-efficacy.

Conclusions

We find that identity, interest, perceived recognition, and having initially joined physics because of the persuasion of others all correlate with long-term retention of women in physics. While we cannot draw causal claims from our results, the correlations do allow us to predict which women would be in most need of support to remain in physics. We are currently in the process of developing a machine learning tool to predict whether a woman will need support from the initial conference survey.

References

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