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Expanding STEP UP - Encouraging Girls in Physics Globally

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Abstract. The number of women in physics trails the number of men, despite efforts to change this representation. The STEP UP project aims to mobilize teachers to encourage girls to study physics, by changing classroom dynamics and having deliberate conversations about representation in physics. This workshop will explain the STEP UP lessons and highlights efforts to expand the program internationally. Educators will gain insight in how to have these challenging conversations, and how to get involved.

1 Gender Representation in Physics

Previously collected data shows that the percentage of women completing bachelor's degrees in physics has historically trailed behind other STEM fields in the United States [1], and in other parts of the world [2]. Several gender-dependent factors have been identified as alienating girls from physics: socialization patterns; self-efficacy towards physics; classroom culture; curriculum and assessment strategies; and teachers' beliefs and awareness regarding girls' engagement [3].

2 STEP UP

The STEP UP (Supporting Teachers to Encourage the Pursuit of Undergraduate Physics) project represents a powerful movement for high school physics teachers who are motivated to support and inspire girls in future studies in physics [4]. The project has developed guidelines for teachers along with two lessons that directly deal with the issue of representation in physics.

Figure 1. The percentage of bachelor's degrees earned by women in Science, Technology, engineering and mathematics (STEM) fields (left) [1] and specifically undergraduate physics degrees across different countries (right) [2].

The Everyday Actions Guide is designed to develop equitable classroom culture, providing teachers with a self-reflection questionnaire to help them consider how they interact with students, and if their work promotes inclusivity in their classroom. The Careers in Physics Lesson has students explore profiles of individuals with a degree in physics and identify goals that can be accomplished with skills learned in a physics degree. Students are encouraged to assess their personal values and see how they match with the values of people already working in various careers, learning that physicists are in jobs that help others and the world around them. The Women in Physics Lesson examines the conditions for women in physics, drawing on current statistics and research (Fig. 1). The goal of the lesson is to help students reflect and think critically about the issues of underrepresentation in order to counteract bias. The lesson has students examine the conditions for women in physics, discuss gender issues with respect to famous physicists, and share personal experiences.

3 International Efforts

Over the past three years, the STEP UP Project has worked to get teachers using the lessons in their classrooms, with international teachers increasing in number. In the 2019-2020 school year, forty-five teachers from across the United States were selected as STEP UP Ambassadors, to receive training on the lessons and then train other teachers, empowering them to inspire young women to pursue physics. In the 2020-2021 school year, the number of teacher ambassadors increased to eighty teachers, including two international teachers - one from Canada and one from Brazil. These two international ambassadors were tasked with sharing the lessons to teachers in their home countries as well as generating translations and adaptations for their local contexts. For the 2021-2022 school year, the model of teacher recruitment changed, with a group of twenty-one ambassadors staying on as teacher leaders and one hundred and eighty-six teachers (referred to as teacher advocates) who will receive direct training on the STEP UP lessons. The group of advocates includes ten international teachers from eight countries (Fig. 2). Efforts are underway to develop an international set of career profiles, and translate the lessons into more languages.

Figure 2. The location of STEP UP's International Ambassador Lead and Advocates.

4 Conclusion

The STEP UP Lessons represent a way for teachers to encourage their female students to study physics, and help change the representation in the field. Research has shown that the STEP UP lessons have benefits for all students' belief in a future physics career, and had increase benefits for young women. This workshop will give educators an overview of the STEP UP lessons and guiding principles. In addition, opportunities for educators to get involved with the program will focus on international efforts.

References

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