

## Physics education research: A research subfield of physics with gender parity

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Women currently outnumber men in obtaining undergraduate degrees but are underrepresented within STEM fields. However, women's representation varies by STEM field, and even further by STEM subfield. One field that has held a persistent low representation of women is physics. This paper seeks to uncover the truth behind an anecdotal claim that the subfield of physics education research (PER) has a higher representation of women than physics as a whole. Graduate students in PER completed an online survey to assess their demographics, trajectory in PER, climate experiences, and goals for their research. The response rate for the survey was 68%, yielding 125 total respondents. This paper will focus on the 91 respondents enrolled in U.S. graduate programs. It was found that women make up 51% of the U.S. PER graduate students in this sample, as compared to only 19% of physics graduate students overall. Survey findings also revealed that both women and men in PER graduate programs experience similarly positive working relationships with faculty and fellow students. Last, both men and women reported building a stronger scientific workforce and becoming better teachers as goals for their PER research.

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### I. INTRODUCTION

This study investigates the representation of women in the physics subfield of physics education research (PER). Although the field of physics is known for having very low female representation [1–3], anecdotal evidence suggests that PER has near gender parity in both departments of physics and schools of education [4,5]. This possible gender parity represents a difference between both schools of education and departments of physics. In schools of education, women comprise about 68% of PhD students and in physics they comprise about 19% of students [6,7]. In this article we will discuss the PER community in comparison to departments of physics.

A web survey was developed and distributed to graduate students in PER to document their gender composition as well as to identify whether there are any differences in the ways that men and women experience PER. The experiences assessed included work relationships and comfort within their work environment (climate), when they chose to pursue PER, career expectations (trajectory), and desired outcomes of their research (goals). These experiences were

targeted because they emerged as important in an earlier qualitative study of PER graduate students and post docs [4].

### II. BACKGROUND

PER is a rapidly growing subfield of physics research. There is some dispute as to when the subfield actually emerged. Some claim that PER began with the formation of the American Association of Physics Teachers in the 1930s [8], while others argue that the field began in the 1970s with formal publication in PER [9]. Annual PER Conferences (PERC) began in 1997. The field primarily focuses on the teaching and learning of physics alongside analyses of the social contexts in which students learn physics. Consequently, the field is unique in physics due to its focus on learning as opposed to laws of nature, which are the focus of traditional physics research. The field is also inherently interdisciplinary because it draws on knowledge from other fields such as education, psychology, and sociology. PER faculty and graduate students exist in physics departments as well as departments outside of physics. For example, some PER programs are housed in schools of education.

Little research has been done to investigate the field of PER itself. A recent call by the National Research Council suggested that in order to sustain Discipline Based

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Education Research (which includes PER), new research needs to focus on the educational pathways by which new researchers enter the field [10]. Our efforts to understand these pathways into PER began with a qualitative study interviewing 13 graduate students and post-doctoral scholars in the field [4].

The results of this qualitative study [4] described how the participants came to PER, why they chose the field, and gave an overall look at their experiences within the field. Of importance to our analyses were the composition of the participants and their description of their experience within PER. Over half of the participants were women ( $N = 8$  women,  $N = 5$  men) that came from a nearly gender equal sampling pool ( $N = 10$  women,  $N = 9$  men). This representation of women is much higher than the national average of women in graduate physics, which is 19% [7].

The majority of the participants wanted to pursue PER to help people or make an impact ( $N = 6$ ), with other participants pursuing the field because they enjoyed teaching ( $N = 5$ ), or enjoyed educational research ( $N = 2$ ). Last, the participants overwhelmingly described a positive community where they had support from peers and their advisors alike. The results of this qualitative study were central to the design of our survey. Combined they suggested four areas of interest related to student pathways into and trajectories through PER: demographics, trajectory, climate, and goals in physics. These four areas were targeted in the web survey used in this study.

### III. RESEARCH QUESTIONS

This study seeks to investigate the demographics and experiences of graduate students in PER and to compare the representation and experiences of men vs women. The following research questions guide our investigation:

*How do men and women who are PER graduate students compare in the following four areas:*

- (I) *Demographics.*
- (II) *Trajectories into PER.*
- (III) *Climate they experience within PER.*
- (IV) *Goals in pursuing PER.*

### IV. METHODOLOGY

The data analyzed in this research were collected through an online survey administered to all known graduate students in PER. This section will describe the development and implementation of the survey.

#### A. Sampling

To survey the PER graduate student community, we were granted access to the graduate student Email list from the Physics Education Research Consortium of Graduate Students (PERCoGS), a PER graduate student representative body. This list was created to facilitate the first election

of PERCoGS and was populated through two methods: (i) A convenience sampling was performed through the collection of Emails at the American Association of Physics Teachers Summer 2012 Graduate Student Crackerbarrel, (ii) A snowball sampling was performed through emailing researchers from the Crackerbarrel and the Physics Education Research Topical Group listserv and asking them to further populate the list which was posted online. This final list consisted of 182 PER graduate students from around the world. While students were primarily based in physics departments and schools of education, student selection was not limited to particular academic programs.

Before the survey was distributed, three leaders in the PER community sent a joint introductory Email endorsing the survey and urging graduate students to participate. One day after this Email, the survey was launched. Reminders were sent to nonrespondents every five days until the graduate student either completed the survey or they received three reminders. The survey was open for a total of twenty days and was closed when responses stagnated after the last reminder. In all, there were 125 respondents from the 182 students sampled, giving a response rate of 68%.

#### B. Survey Instrument

The survey instrument was developed by us from results of the previously discussed qualitative study of graduate students and post-doctoral research associates in PER [4]. A member check was performed by presenting a draft of the survey to the PER research group at the University of Colorado Boulder. In the meeting with CU Boulder's PER researchers, each survey question was discussed to ascertain its relevance and purpose with respect to the goals of the study. Rewording and ordering of a number of questions occurred with the advice of the group. Finally, the survey was piloted in two think alouds where PER graduate students took the survey and spoke aloud how they interpreted each question while one of us took notes.

The survey instrument had a total of 51 questions (see the Appendix). Not all participants answered all questions, as some had built in logic to only be displayed if relevant to the participant. For example, if a participant answered yes to "*Have you taught a physics course?*" then they would be directed to a question asking more about the course they taught.

Included in the survey was a reliability question to test for the participant's close reading and attention to the survey. Halfway through the survey, within a table that contained multiple questions, one question asked "*Please check disagree for this question.*" Students who checked anything other than disagree were removed from the analysis. This removal only resulted in discarding one participant from the analysis.

### C. Analysis

Our analysis was limited to graduate students in the U.S. so that the data could be compared to U.S. surveys on the demographics of the physics community [11]. This delimitation also allowed more consistency in the data. Graduate programs can vary substantially from country to country and thus are deeply contextualized. Gender is the main demographic reported and used in the analysis. To assess a participant's gender the survey asked the following question: "What is your gender identity?" with the choices "Man," "Woman," "Transgender (please specify)," and "Other." All participants identified as either "Man" or "Woman." The trajectory of participants was assessed by asking respondents what their undergraduate degree was, their teaching experience, their time of choice of PER, and their career goals amongst others.

To assess climate, participants were asked to rate their levels of comfort and how positive their working relationships were with students and faculty. Students were also asked if they were considering leaving their research group or department. These questions were all on a five point Likert scale from "Strongly Disagree" to "Strongly Agree." Last, graduate students' goals were assessed by asking respondents about what effects they would like their research to have (e.g., building a strong scientific workforce) and if they enjoyed research and teaching.

Because of the nature of working within a smaller physics subdiscipline, our sample size is limited. After vetting our survey results to only include PER graduate students enrolled in U.S. institutions, we were left with a sample of 90 students. The majority of the data is categorical in nature and was statistically examined using chi-squared analysis. For the continuous variables (e.g., funding rates),  $t$ -test analyses were performed. The smaller nature of the subfield of PER makes finding statistically significant differences difficult.

## V. RESULTS

The results will be presented below in their respective constructs. These are the demographics of participants, their trajectories in PER, their climate experiences in PER, and their goals in doing PER. All bracketed results will be labeled at the end with an "NS" if the differences are nonstatistically significant and "S" if they are statistically significant. Unlike other physics subdisciplines, a significant percentage of PER graduate students are not enrolled in physics departments. This study found that PER doctoral students are spread fairly evenly between physics departments (55%) and schools of education (43%) with just 2% enrolled in other programs.

Gender representation within the physics departments (52% men and 48% women, NS) and schools of education (46% men and 54% women, NS) are nearly even both within and between departments. No statistically

significant differences were found between graduate students in physics departments and schools of education with respect to climate questions, trajectory, and goals. Because these differences are not statistically significant, for the remainder of the data analysis section we will not differentiate between graduate students in physics departments, schools of education, and other departments. Similarly, except where specifically noted, the differences between men and women were not found to be statistically significant.

### A. Demographics

National data show a clear disparity between the genders within physics departments, with men making up over 80% of the population. However, this trend is not reflected in the subdiscipline of PER where the genders were evenly distributed, with women making up 51% of the population. Examining the portion of PER graduate students enrolled in physics departments, there is a nearly even distribution between men (52%) and women (48%) (Fig. 1). It should be noted that the overall physics department data comes from an American Institute of Physics survey that was administered to physics department graduate students in 2010 and 2011, while the PER-only data comes from the survey designed and administered by us in 2013. To see if the difference was statistically significant we conducted a chi-square analysis to look at the distribution of men and women across physics and PER by combining the AIP data with our own. The test showed that the difference was significant,  $\chi^2(3) = 51$ ,  $p < 0.000$ . Please see Field [12] for details on chi-square analyses.

An examination of PER graduate students' races shows that a majority of the respondents indicated a Caucasian/White ethnicity (76%), with Asian (13%) and Hispanic/Latino (6%) being the next two most common ethnicities (Table I). All other categories combined only totaled to 5%. In 2007 and 2008 the AIP reported that PhD classes were comprised of white (45%), Asian American (2%), Hispanic (2%), African American (1%), and other (1%) students [7]. The remaining 49% of students were non-U.S. citizens and

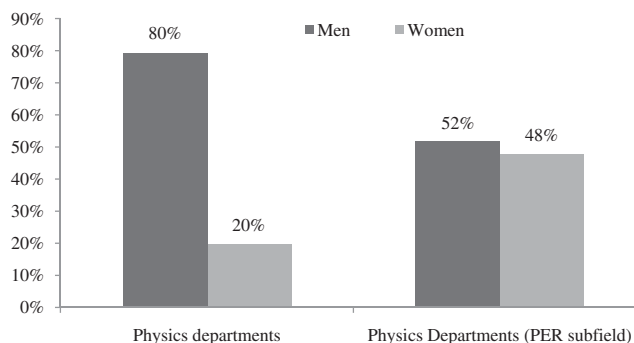


FIG. 1. Gender representations of graduate students in physics departments as a whole [3] and the physics department subdiscipline of PER.

TABLE I. PER graduate student ethnicity by gender.

	Caucasian/White	Asian	Hispanic/Latino	African American/Black	Alaskan Native	Middle Eastern
Men ( $N = 45$ )	77%	9%	9%	2%	0%	2%
Women ( $N = 45$ )	74%	17%	2%	2%	4%	0%

TABLE II. PER graduate student background by gender.

	Undergrad degree			Previous teaching		
	Physics	Math	Astronomy	Physics	Nonphysics	Non-PER physics publication
Men ( $N = 45$ )	67%	22%	7%	87%	56%	33%
Women ( $N = 45$ )	80%	20%	7%	87%	65%	30%

their race and ethnicity were not reported. The differing data collection methods between this data and the AIP make it difficult to make conclusive comparisons.

### B. Trajectory

The sample's educational and work backgrounds are shown in Table II. The examined background variables of men and women are fairly similar with no significant differences on any items. The majority of the graduate students hold a physics degree and have taught physics classes before. Over half of the students (56% of men and 65% of women, NS) have taught nonphysics classes before. Approximately one-third (33% of men and 30% of women, NS) of the doctoral students have published a non-PER physics publication.

Teaching experience was prevalent within the survey respondents (Fig. 2). The majority of the sample (67% of men and 61% of women, NS) have been teaching assistants as graduate students. Approximately one-third (31% of men and 39% of women, NS) of the students reported teaching physics as a teaching assistant during their undergraduate career and another third (22% of men and 39% of women, NS) reported having taught physics in the K–12 setting. Finally, slightly under one-third of the sample (31% of men and 17% of women, NS) reported having been a college physics instructor.

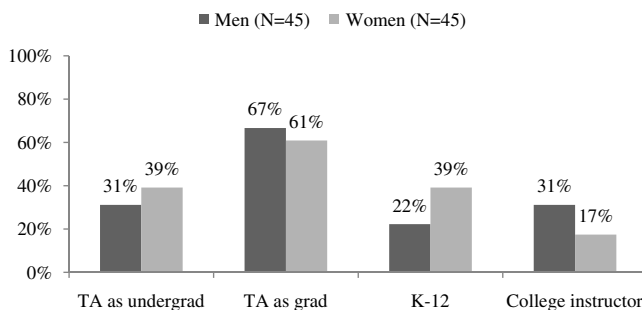


FIG. 2. Setting of physics classes graduate students have taught.

The data show a fairly even divide between choosing to pursue PER when applying to graduate school (38% of men and 52% of women, NS) and during graduate school (53% of men and 33% of women, NS) (Fig. 3). While the data suggest that men may be more likely to have chosen to study PER during graduate school, a chi-square test reveals a nonstatistically significant  $p$  value of 0.105.

Both the men and women in the study were enrolled in institutions of similar size, as measured by the total number of students, with the largest grouping (44% of men and 38% of women, NS) in the 20 000–40 000 student range (Table III). Both men (62%) and women (73%) were primarily in research groups that have more than seven members (NS). Graduate students in the sample were primarily funded through teaching assistantships (51% of men and 37% of women, NS) and research assistantships (23% of men and 33% of women, NS) (Fig. 4).

When asked about their desired employment, the most common response was working in a tenure track position in ten years (48% of men and 59% of women, NS) (Fig. 5). Within the tenure track positions, students showed no statistically significant preference for working at teaching-intensive universities (24% of men and 37% of women, NS) versus research-intensive universities (24% of men and 22% of women, NS). The other positions explicitly listed in the survey, community college, nontenure track university

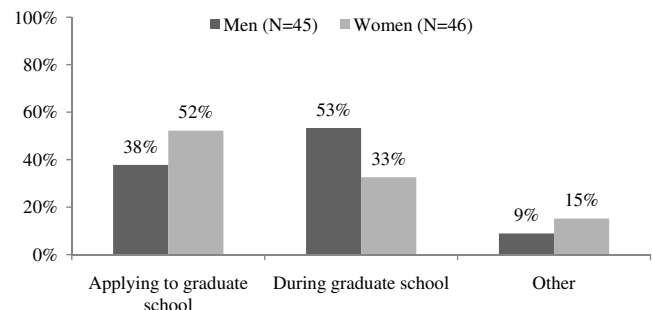


FIG. 3. When graduate students chose to pursue physics education research.

TABLE III. PER research settings.

	Institution sizes					PER community sizes		
	<5000	5–10 000	10–20 000	20–40 000	>40 000	1–3	3–7	>7
Men ( <i>N</i> = 45)	9%	11%	13%	44%	22%	11%	27%	62%
Women ( <i>N</i> = 45)	9%	13%	18%	38%	22%	11%	16%	73%

position, informal science education, science policy, teaching HS, and education industry, all failed to receive more than 10% of the responses. A number of participants reported that they were unsure where they wanted to be working in ten years (29% of men and 13% of women, NS).

The respondents were primarily positive in their reported interests to stay at their institutions and in their research

groups. Only 10% of the respondents (13% of men and 7% of women, NS) indicated that they are actively thinking about leaving their departments and 3% (4% of men and 2% of women, NS) were actively thinking about leaving their research groups.

### C. Climate and goals

Over half of all respondents reported having a positive working relationship with fellow graduate students, faculty in their department, their advisor, and the PER community (Fig. 6). The advisors were noted as having the highest positive rating (91% of men and 89% of women, NS) and the PER community had the lowest (58% of men and 51% of women, NS). Women overall reported better

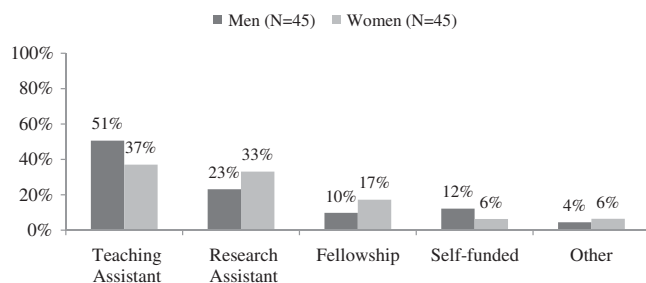


FIG. 4. Doctoral student funding types by gender.

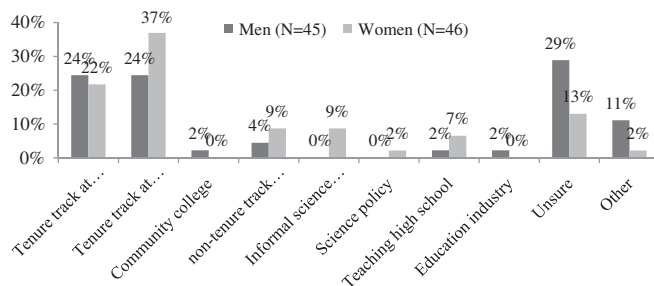


FIG. 5. Where students want to be working in ten years.

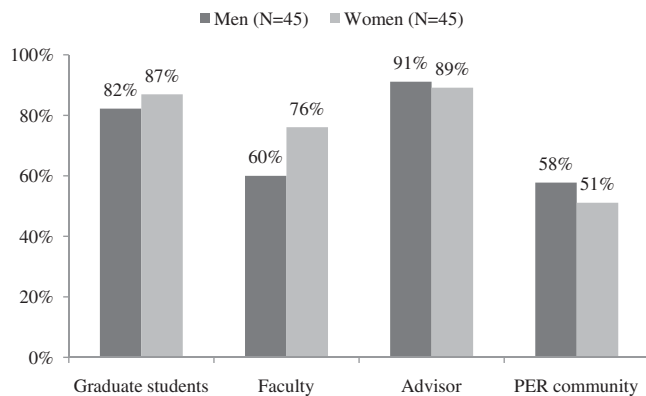


FIG. 6. Students who agreed to having a positive relationship with given groups.

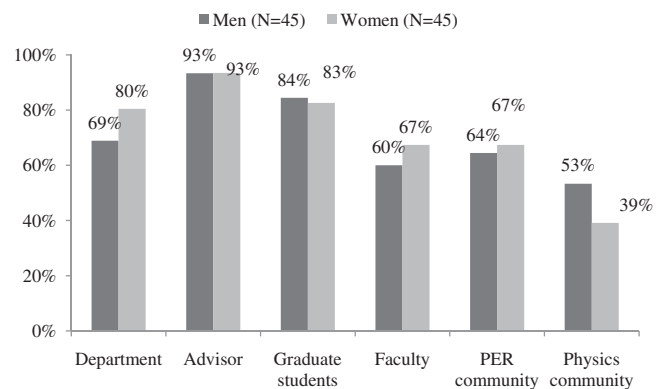


FIG. 7. Students who agreed to being comfortable with given groups. (Note: the neutral and disagree responses are not shown for the sake of simplicity).

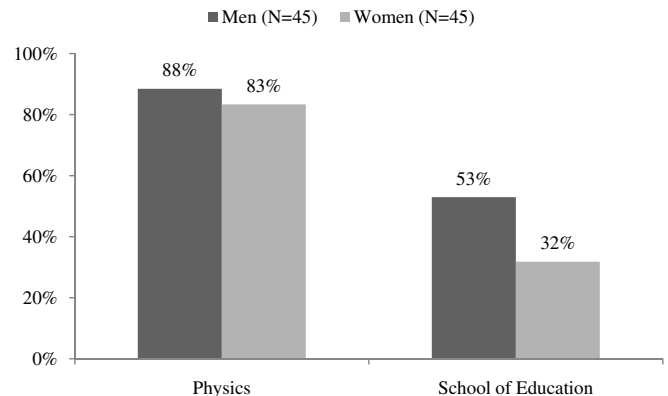


FIG. 8. Students who self-identified as a physicist by department ( $p < 0.01$ ).

TABLE IV. Student motivation to do PER research and enjoyable activities.

	PER research motivation			Enjoyment	
	Stronger science and technology workforce	Improve science literacy	Becoming a better teacher	Research	Teaching
Men ( $N = 45$ )	96%	76%	84%	89%	93%
Women ( $N = 46$ )	96%	91%	83%	85%	93%

relationships with faculty in their departments (60% men and 76% of women reporting positive relationships,  $S$ ,  $p = 0.035$ ).

The responses to the comfort questions were largely positive and mirrored those from the working relationships (Fig. 7). Again, the advisors had the highest positive response rate reporting feeling comfortable (93% of men and 93% women, NS). Departments were also found to be comfortable (69% men and 80% women, NS). The physics community, however, was ranked as the lower area of comfort for students (53% of men and 39% of women, NS).

While we recognize that identity is dynamically constructed and contextually dependent, within this survey the majority of students (73% of men and 59% of women, NS) indicated that they self-identified as a physicist. While examining the difference between genders does not reveal a statistically significant difference, when examining differences in student self-identification by department, a statistically significant difference ( $p < 0.01$ ) appears (Fig. 8). In physics, 88% of men and 83% of women (NS) identified as physicists whereas in schools of education it was only 53% of men and 32% of women (NS).

The majority participants agreed that one of their goals for engaging in PER research was to create a stronger science and technology workforce (96% men and 96% women, NS), improve society's scientific literacy (76% men and 91% women, NS), and to become a better teacher (84% men and 83% women, NS). The majority of the sample also responded that they enjoyed doing research (89% men and 85% women, NS) and teaching (93% men and 93% women, NS) (Table IV).

## VI. CONCLUSION

Our study highlights a subfield of physics, PER, that has more balanced gender representation than the broader field of physics. It also demonstrates a field of DBER that is doing a good job supporting graduate students. This is the first empirical evidence of a physics subfield with equal participation of men and women. Less than half of all the participants also reported feeling comfortable with the physics community. This may be partially due to students participating in communities outside of physics.

Something unique may exist in PER that facilitates and promotes the parity of men and women in graduate programs. One factor that may attract students to PER is the positive community reported in the survey. This may be

why many participants switched to PER during graduate school. Another explanation could be the content of PER. Students may choose PER because it is a way to help people, which is an aspect of PER that is not readily apparent in other fields of physics. It is important to note again that about half of these participants were in schools of education and not departments of physics. Consequently, their programs of study may have been very different, even though they reported similar experiences. This may impact the overall makeup of PER graduate students, even though in this study the groups reported similarly on all questions.

Further research should explore the climate experiences of men and women in physics at large. Such data would allow a direct comparison between students in PER and physics and may illuminate if PER provides a different educational experience than physics as a whole. Last, investigations into the conditions of graduate students in PER should occur every decade or so to ensure the community is still producing interested and supported scholars.

## APPENDIX: SURVEY INSTRUMENT

**Q1** What is the highest level degree you are seeking?

- PhD
- EdD
- SciD
- MA
- MS
- Other \_\_\_\_\_

**Q2** What is your year in graduate school?

**Q3** What department will confer the degree you are seeking?

- Physics
- Education (or a department in a school of education)
- Other \_\_\_\_\_

**Q4** Estimate how have you cumulatively been funded in your doctoral program by percentage.

- \_\_\_\_\_ Teaching Assistantship
- \_\_\_\_\_ Research Assistantship
- \_\_\_\_\_ Fellowship
- \_\_\_\_\_ Self-Funded
- \_\_\_\_\_ Other

**Q5** What is the instructional area of your primary research?

- K-12
- Undergraduate

- Graduate  
 Informal Education  
 Other \_\_\_\_\_

**Q6** What field was your undergraduate degree in?

- Physics  
 Astrophysics  
 Math  
 Other \_\_\_\_\_

**Q7** Have you taught a physics class (e.g., K–12, as a teaching assistant, college level)?

- Yes  
 No

If No is selected, then skip to Have you ever taught a nonphysics class?

Answer If have you taught a physics class? Yes is selected.

**Q8** Where did you teach a physics class?

- Teaching Assistant as an Undergraduate student  
 Teaching Assistant as a Graduate Student  
 K-12  
 College Instructor

**Q9** Have you ever taught a nonphysics class?

- Yes  
 No

Answer If have you ever taught a nonphysics class? Yes is selected

**Q10** What kind of class?

- Education  
 Astronomy  
 Math  
 Chemistry  
 Earth Science  
 Biology  
 Sociology  
 History  
 Other \_\_\_\_\_

**Q11** How many students, overall, attend your institution?

- <5 000  
 5 000–10 000  
 10 000–20 000  
 20 000–40 000  
 40 000

**Q12** Estimate the size of the PER community at your school (e.g., combined number of students, post docs, and professors).

- 1–3  
 4–6  
 7 or more

**Q13** Does your advisor conduct PER?

- Only PER  
 PER and a traditional field of physics

- PER Research and other education research  
 Only a traditional field of physics  
 Education research not involving physics

**Q14** Do you self identify as a physicist?

- Yes  
 No

**Q15** What country is your graduate institution in?

- United States  
 Israel  
 Mexico  
 Canada  
 Slovenia  
 Spain  
 Finland  
 Ireland  
 Puerto Rico  
 Scotland  
 South Africa  
 India  
 Bosnia  
 Serbia  
 Italy

**Q16** Are you a citizen or permanent resident of the U.S.A.?

- Yes  
 No

**Q17** What ethnicity do you identify with?

- African American/Black  
 Asian  
 Caucasian/White  
 Hispanic/Latino  
 Middle Eastern  
 Native American  
 Alaskan Native  
 Hawaiian Native  
 Other \_\_\_\_\_

**Q18** What is your age?

\_\_\_\_\_ Age in years

**Q19** What is your gender identity?

- Man  
 Woman  
 Transgendered (Please Specify) \_\_\_\_\_  
 Other \_\_\_\_\_

**Q20** What is your sexual orientation?

- Asexual  
 Bisexual  
 Heterosexual  
 Homosexual  
 Pansexual  
 Other \_\_\_\_\_

**Q21** What is the highest degree earned by your

	Doctorate or Professional Degree (e.g., Law)	Middle School or Less	High School	Some College	Bachelor's	Master's
Mother	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Father	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q22** When in your academic career did you discover the field of PER?

- Pre-College
- As a college freshmen or sophomore
- As a college junior or senior
- Graduate School
- Other \_\_\_\_\_

**Q23** How in your academic career did you discover PER?

- Advisor
- Research Talk
- Conference
- Online
- Other \_\_\_\_\_

**Q24** When did you choose to study PER at the graduate level?

- Applying to graduate school
- During graduate school
- Other \_\_\_\_\_

**Q25** Have you ever authored or co-authored a non-education physics or astronomy publication (e.g., a paper on condensed matter physics)?

- Yes
- No

**Q26** What best describes where you want to be working in 10 years?

- Tenure Track at a Research Intensive University
- Tenure Track at a Teaching Intensive University
- Community College
- Non-Tenure Track University Position
- Informal Science Education
- Science Policy
- Teaching High School
- Education Industry (e.g., Kaplan)
- Don't Know or Not Sure
- Other \_\_\_\_\_

**Q27** What best describes where you think you will be working in 10 year?

- Tenure Track at a Research Intensive University
- Tenure Track at a Teaching Intensive University
- Community College
- Non-Tenure Track University Position
- Informal Science Education
- Science Policy
- Teaching High School
- Education Industry (e.g., Kaplan)
- Don't Know or Not Sure
- Other \_\_\_\_\_

**Q28–30** I want my research to

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Help create a stronger science and technology workforce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help create a more scientifically literate population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make me a better teacher	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q31** I believe my research will gain me respect within the field of physics

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree
- Not Applicable



**Q32–33** I enjoy

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Doing research in physics education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teaching	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q34** If I could redo my career path I would still choose to do PER

- Strongly Disagree  
 Disagree  
 Neither Agree nor Disagree  
 Agree  
 Strongly Agree

**Q35–41** I feel comfortable

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
In my department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With my research advisor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With other graduate students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With faculty in my department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please select Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With the PER community at large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With the physics community at large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q42–45** I have a positive working relationship with

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Other graduate students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty in my department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My research advisor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The PER community at large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q46–47** PER is valued by

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The physics community at large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The faculty in my department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q48** My research is respected by the PER community at large

- Strongly Disagree  
 Disagree  
 Neither Agree nor Disagree  
 Agree  
 Strongly Agree

**Q49** My school uses PER reforms in their physics classrooms

- Strongly Disagree  
 Disagree  
 Neither Agree nor Disagree  
 Agree  
 Strongly Agree

**Q50–51** I am considering leaving my

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Department	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Research group	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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