

# Pluralistic ignorance and occupational choice: The impact of communicating norms on graduate students' career aspirations

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## Abstract

Occupational choices at the early stage of one's career path are influenced by the real and imagined input of mentors. This research focuses on PhD advisors and the graduate students that they mentor. Each participant in that dyadic mentoring relationship holds assumptions about the beliefs of the other regarding the students' career preferences. We propose that, in the absence of discussions surrounding career goals in such relationships, pluralistic ignorance surrounding career norms may develop. PhD students may assume that their advisors prefer that students seek academic research positions; while advisors may assume students prefer academic research positions and may not bring up alternative careers. Three studies adopt a mixed-method approach to investigate divergent experiences surrounding career discussions. Study 1A ( $N = 301$  faculty members in STEM fields) features qualitative and quantitative data and found that PhD advisors have experience working with students whose career preferences did not align with their expectations, and report changing their mentorship approaches while maintaining rigorous training. Study 1B ( $N = 195$  PhD students in STEM fields) features qualitative data and found that students, although generally comfortable discussing different career options with their advisors, report several concerns that deterred them from discussing nonacademic research positions. Study 2, an experiment designed to compare perceived with actual norms ( $N = 200$  PhD students in STEM fields) revealed that such discomfort could be alleviated by making explicit advisors' support for diverse career options and actual career preferences. The present research provides insights about pluralistic ignorance with implications for having more holistic career discussions in dyadic mentor relationships.

## 1 | INTRODUCTION

"(My advisor) may still see (nonacademic positions) as less prestigious than a tenure-track academic job. As such, he may not think of me as equally as ambitious if I pursue a nonacademic position as he would if

I pursued the tenure-track. Furthermore, I worry if this would translate to him feeling like I may not need as much support to finish my degree or to be competitive on the job market."—PhD student

"When I started as a professor, I sort of imagined that all of my students would become professors. Very early on, it became clear

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that many students don't want to follow that path. This was a little disappointing at first, but I quickly realized that the most important thing is for students to find the best career fit for themselves. I try to be completely supportive of whatever path students choose to take.”—PhD advisor

When PhD students and advisors approach the topic of career development, scenarios such as the ones depicted in the opening quotes may occur. PhD students may perceive that their advisor, likely nearly all advisors, values only academic jobs for the graduate students they mentor and would view non-tenure track academic research positions less positively. Students may be concerned that expressing interest in careers other than tenure-track research-focused positions would negatively affect their doctoral experience and relationship with their advisors. As a result, many PhD students who are interested in nonacademic research positions may not explicitly convey their career preferences with their advisors. On the other hand, PhD advisors generally assume that most PhD students are interested in pursuing an academic-research position. Unless students explicitly discuss their career preferences, advisors would likely provide mentorship and training under that general assumption even though they would actually be supportive of their students' preferences in other career options. In short, the occupational choices at the early stage of one's career path are influenced by the real and imagined input of mentors, and this input is shaped by the expectations that mentors have of those they are mentoring.

The mismatch in perceptions surrounding career preferences among PhD students and advisors exemplifies pluralistic ignorance, a psychological state characterized by the divergence of individuals' private attitudes and their perceptions of social norms (see Sargent & Newman, 2021 for review). Pluralistic ignorance can occur when individuals misrepresent or lack information about the targeted social norm (Sargent & Newman, 2021). When an individual's private attitude towards a targeted behaviors is incongruent with their perception of the majority's attitudes (the socially normative attitude), they may exhibit behaviors that align themselves with the social norm, possibly because they wish to avoid experiencing negative social judgment or rejection. Individuals may also perceive that others hold attitudes that are also congruent with their own perceptions of others' behaviors, which contributes to greater pressure to act in a way consistent with the norm.

In the context of PhD student–advisor dyads, pluralistic ignorance can manifest in the following ways. First, findings from multiple studies revealed that career discussions about alternative career options were largely absent, or occur very late in students' doctoral studies (Fuhrmann et al., 2011; Sauermann & Roach, 2012; Thiry et al., 2015). Furthermore, the traditional norm within academia is to train the next generation of faculty members (Austin, 2002). Given the lack of information and explicit conversations about career development, PhD students rely on the traditional norms when making inferences about their advisors' career preferences for them and may not feel as comfortable having career discussions about alternatives to academia with their advisors. Indeed, in one survey of 4109 PhD students, respondents who pursued the academic research

route, by and large, felt supported by their advisors, whereas those who pursued alternative career paths (e.g., teaching-focused, industry positions) felt that they were on their own and had to rely on external sources for to inform their career decision (Sauermann & Roach, 2012; Woolston, 2019). When considering career discussions with their advisors, STEM (Science, Technology, Engineering, Math) PhD students reported feeling much more comfortable discussing academic-research careers compared to industry or teaching-focused positions (Sherman et al., 2021).

Pluralistic ignorance can also shape PhD advisors' perceptions of their students' career preferences. A study that examined PhD students' changes in career preferences in different stages of their doctoral programs revealed that more than half of the respondents rated a research-focused faculty position as most attractive when they first enter a PhD program; yet over time, their ratings for research-focused faculty position declined, and perceived attractiveness of other positions (e.g., government, industry positions) increased (Sauermann & Roach, 2012). Research-focused faculty positions are becoming less attractive not only within the United States, but in other countries as well. A 2022 *Nature* survey with 3252 participants across 84 countries revealed similar findings, where less than half (48%) of STEM graduate students ranked research-focused faculty positions as their top career preferences, down from 56% in 2019 (Woolston, 2022). Without having explicit discussions about career preferences and development, PhD advisors may not be aware of the trend and changes in their students' career preferences and assume that their students' career aspirations remain as research-focused faculty positions, thus not offering support for diverse career options.

To summarize, pluralistic ignorance among student–faculty dyads could manifest in two ways that may, we argue, be indicative of issues arising in mentor–mentee relationships more generally. Students may be uncomfortable discussing nonacademic research positions as they make inferences about their advisors' private attitudes (e.g., greater preferences for academic-research positions) based on traditional norms within academia; while advisors may not bring up topics about alternative career paths because they may not be aware of students' interest in nonacademic research careers and assume that most of their students aspire to be a professor in a research university. And although we focus on the specific relationship between PhD students and their advisors, the concept of pluralistic ignorance has been applied in other organizational contexts (Halbesleben et al., 2007). The unique features of this particularly dyad within education can help shed light on other situations where communication gaps can impede mentoring relationships and occupational outcomes.

The present research explores whether and how pluralistic ignorance shapes PhD students' and advisors' views of career discussions. Specifically, we examine the nature of that differential levels of comfort and ask whether potential support that students might receive from their advisors could be masked by misunderstandings between students and faculty advisors surrounding norms and preferences about career opportunities. We adopt a

mixed-method approach to examine qualitative responses from PhD advisors (Study 1A) about their experience, attitudes and mentorship approaches when students preferred a career that did not align with their expectations. We then assessed qualitative responses from PhD students (Study 1B) about their comfort and concerns when having career discussions with advisors. Then, we conducted an experimental study to assess the impact of social norms (e.g., advisors' actual views about students' career preferences vs. students' perceptions of advisors' views) on PhD students' levels of comfort in discussing different career options (Study 2).

## 2 | (MIS)PERCEPTIONS OF CAREER NORMS

Prior findings from both the students' and advisors' perspectives suggest that the asymmetry in the experiences surrounding PhD students' career development can be a consequence of pluralistic ignorance, giving rise to potential misunderstanding in this important dyadic relationship. A recent study (Sherman et al., 2021) examined the norms about career preferences from the perspectives of PhD students and advisors. PhD students were asked to rank their career preferences (research focused, teaching focused, industry) from multiple perspectives including their personal preferences and their advisors' perceived preference for them. PhD students in STEM fields were interested in varied career options (46% ranked industry highest; 21% ranked teaching-focused positions highest; 34% ranked academic-research positions highest), yet they perceived that their advisors overwhelmingly (81%) would rank pursuing academic-research positions highest (with 6% thinking their advisors would rank teaching-focused positions highest, and 13% industry focused ranked highest; Sherman et al., 2021). PhD students were also less comfortable having career discussions about industry or teaching positions with their advisors, compared to academic research positions (Sherman et al., 2021; Study 1). Moreover, students who were interested in industry or teaching positions felt that they belonged less and reported being less supported by their advisors than students who were interested in academic research positions.

A second study posed similar questions to faculty advisors, and findings suggest that students may not have an accurate or complete view of advisors' career preferences for them (Sherman et al., 2021, Study 2). Advisors ranked the same three career options from three different perspectives. They first indicated their general career preference for an ideal student (i.e., "general preference"). Then, they were asked to think of a current senior student they were mentoring (i.e., Student A), and indicated what they thought Student A's preference was (i.e., "perceived Student A's preference"), and what they want for Student A (i.e., "advisor's preference for Student A"). Although faculty advisors' general preference was for their students to pursue academic-research positions (84%, closely resembling students' perception of advisors' career preferences),

their preference for Student A (39% industry; 18% teaching-focused; 44% academic-research positions) closely mirrored what they perceived to be Student A's preference (36% industry; 17% teaching-focused; 47% academic-research positions). Regression analyses confirmed that faculty advisor's preferences for their students were predicted much more strongly by what they perceived to be the students' interests than by their general preference. Taken together, Sherman et al. (2021) revealed that the misperception of career norms between PhD students and advisors was potentially shaped by pluralistic ignorance—PhD students may be unaware of their advisors' actual preferences for them (which may be more concordant with their own preferences) while they may also be largely accurate in perceiving advisors' *general career preferences*. PhD advisors were receptive towards, and supportive of students' career preferences, yet these preferences and support may not have been explicitly communicated to students.

## 3 | NORM-BASED INTERVENTIONS TO FACILITATE CAREER DISCUSSIONS

The reduction of pluralistic ignorance is often accomplished by informing people about the correct norms, what have been termed norm-based interventions. Norm-based interventions assume that people are unaware of, or have an inaccurate representation of, social norms (Miller & Prentice, 2016). By informing individuals about the actual behavioral and attitudinal norms, norm-based interventions are effective in encouraging or discouraging a targeted behavior or attitude. For example, informing college students that their own alcohol consumption was higher than their peers (i.e., behavioral norms, Prentice & Miller, 1993), or informing students about their peers' discomfort in heavy drinking (i.e., attitudinal norms; Prince & Carey, 2010) reduced students' subsequent levels of alcohol consumptions. In a dyadic negotiation context, informing people of the actual political views of a fellow negotiator on the other side of the affirmative action issue (which were more moderate) led people to be more optimistic about the dyadic negotiation and see more common ground than when they were informed of the perceived political views (which were more extreme; Sherman et al., 2003). In traditionally male-dominant fields or organizations, presenting actual data about men's concerns with workplace sexism has been shown to correct misperceptions that other men did not care about addressing issues surrounding gender bias, and introduced opportunities to promote allyship (De Souza & Schmader, 2022).

Thus, in the present research (Study 2), we created a norm-based intervention to inform STEM PhD students of the actual and perceived views of faculty advisors in terms of their preferences for career options for PhD students. We examine whether presentation of the actual norms would facilitate career discussions and alleviate some levels of discomfort relative to the perceived norms.

## 4 | OVERVIEW AND OBJECTIVES

There are several research objectives for this series of studies. First, we aim to identify antecedents that could shape the subsequent misperceptions of social norms with regard to career preferences within a particular organizational context, that of higher education. To achieve this goal, we utilize qualitative and quantitative data from a larger data set (Sherman et al., 2021) to gain deeper insights about *how* advisors react and mentor students when students wish to pursue a career path that is aligned or not aligned with their expectations for the student (Study 1A), and *why* career preferences are associated with different levels of comfort in engaging in career discussions from the PhD students' perspectives (Study 1B). Building on prior evidence demonstrating the efficacy of norm-based interventions (Miller & Prentice, 2016), the second objective is to investigate whether making explicit advisors' actual career preferences for their students (in the aggregate) can alleviate students' discomfort in career discussions relative to presentation of advisors' perceived career preferences for their students (Study 2). We utilize the actual data collected in Sherman and colleagues (2021) to create novel manipulations of perceived (vs. actual) norms about advisors' career preferences. We examine whether students who learned about the actual aggregate norms (i.e., advisors' preferences for students were concordant with students' preference), will report greater comfort in having discussions about their own career development, compared to students who learn about the norms that other PhD students perceived (i.e., advisors predominantly prefer students to go into academic research positions).

### 4.1 | Transparency and openness

Ethics approval was granted by the Human Subjects Committee. All studies were conducted online, and data was analyzed using SPSS Version 28 (IBM Corp, 2021). Details about data exclusion criteria, qualitative and quantitative data analysis procedure, measures and materials were described in their corresponding sections within each study. All questionnaires, including measures not included in the present report, and data, as well as SPSS Version 28 (IBM Corp, 2021) syntax and qualitative coding schemes, are available at OSF (<https://osf.io/b7hkn/>). These studies were not pre-registered.

## 5 | STUDY 1A

In Study 1A, PhD advisors reported their general reactions, experience, and mentorship approaches if or when students wished to pursue a career path that did not align with their career expectations. Faculty mentors in STEM fields were explicitly asked to reflect on their experiences when PhD students that they advised had opted for a position besides the primary

research-focused academic track—either an industry or a career at a university that prioritizes teaching undergraduate students (i.e., teaching position). This enabled an examination of both the prevalence of these occurrences (i.e., how normative it is) as well as a qualitative assessment of advisors' perspectives on it. Faculty advisors responded with both their emotions regarding the students' career choices, and how they felt it impacted their mentorship.

## 5.1 | Method

### 5.1.1 | Participants

Three hundred and one STEM faculty members from two public universities were recruited via email. 27 participants completed the survey but did not report their demographic information. Thus, responses from the full sample were analyzed, but the demographic information reflected the 274 participants who reported. More than half of the participants (52.6%) were full professors, 18.6% were associate professors, 27.4% were assistant professors, and 1.5% were others/unspecified. In terms of the fields of study, only participants from STEM fields were recruited; for the final sample, 31% of the faculty participants were in social sciences, 24% in life sciences, 12% in physical sciences, 18% in engineering, 7% in math, and 8% others/unspecified. The mean age of the sample was 49.1 (SD = 11.6), and the mean years in the professoriate was 16.2 (SD = 12.1). Refer to Table 1 for specific demographic information.

### 5.1.2 | Measures

#### *Experience with students' changes in career preference*

Based on the findings that most early-career STEM PhD students viewed faculty-research positions as attractive or extremely attractive (Sauermann & Roach, 2012), we were interested in advisors' experience and reaction when their students' career preferences have changed. Therefore, advisors were presented a prompt “please recall a time when a PhD student told you that he/she wanted to pursue a **teaching career**<sup>1</sup> when you hoped he/she would pursue an **academic research career**. Has this happened to you?” Participants indicated whether they have experienced this scenario (0 = No, 1 = Yes). Then, for those who responded “yes”, they were asked to rate their emotions regarding their student's career choice on a scale from 1 (not at all) to 5 (completely). The same questions were asked for situations where students wished to pursue industry positions. Positive (e.g., proud, pleased, supportive) emotions were grouped and formed a mean composite score for teaching-focused positions ( $\alpha = .75$ ,  $M = 3.44$ ,  $SD = 0.93$ ) and industry positions ( $\alpha = .78$ ,  $M = 3.47$ ,  $SD = 0.98$ ), and negative (e.g., unhappy, sad, disappointed) were grouped and form a mean composite score for teaching-focused ( $\alpha = .79$ ,

**TABLE 1** Study 1A faculty demographic characteristics.

Characteristics	N (%)
Age M (SD)	49.1 (11.6)
Years in professoriate	16.2 (12.1)
School/field of study	
Social sciences	85 (31)
Life sciences	66 (24)
Physical sciences	34 (12)
Engineering	49 (18)
Math	18 (7)
Other/unspecified	22 (8)
Gender	
Female	104 (38.6)
Male	165 (60.7)
Other/unspecified	2 (0.7)
Race	
Asian/Asian American	31 (11.7)
Black/African American	3 (1.1)
Hispanic/Latino-American	21 (7.9)
Multiracial	10 (3.2)
Native American	1 (0.4)
Other	12 (3.8)
White/Caucasian American	188 (70.7)
Professor status	
Assistant professor	75 (27.4)
Associate professor	51 (18.6)
Full professor	144 (52.6)
Other/unspecified	4 (1.5)
US Born	
U.S. Born	176 (64.9)
Non-U.S. Born	95 (35.1)
College generation status	
First-generation college student	61 (22.6)
Continuing-generation college student	209 (77.4)

$M = 1.61$ ,  $SD = 0.66$ ), and industry ( $\alpha = .86$ ,  $M = 1.63$ ,  $SD = 0.70$ ) positions.

#### *Impact on mentorship*

Advisors were asked to respond to the open-ended question “when a student tells you they want to pursue a nonacademic career (e.g., industry, government, non-profit), how does that impact your mentorship of that student?” The same question was asked for

situations where students wished to pursue a teaching career (e.g., teaching in a non-R1 college or academic setting).

### 5.1.3 | Qualitative data analysis procedure

We utilized a stepwise approach to analyze the open-ended responses (O'Connor & Joffe, 2020; Corbin & Strauss, 2008). Qualitative data was split into multiple subsets of 50 responses, with each response as a unit of analysis. Three coders (2 primary, 1 secondary) were trained to independently identify underlying themes and patterns. After coding the first 50 responses, the coders discussed common themes that emerged, and generated a coding scheme that consisted of 8 main categories, listed in Table 2a, for changes in mentorship approaches for industry positions, and 4 main categories, listed in Table 2b for changes in mentorship approaches for teaching-focused positions. The primary coders indicated whether a faculty member mentioned any changes in their mentorship approaches, and categorized their responses and indicated whether the theme was reflected in a given response in a binary manner (0 = no part of the response fell under a given category, 1 = one or more aspects of the response fell under the category). A given faculty member's response could be coded in multiple categories to indicate the one or more changes in mentorship approaches they made. For example, if a faculty member encouraged their students to find an internship and cater their research projects to be more relevant to industry jobs, their responses would be coded as “1” in each corresponding category. Discrepancies in responses were resolved by the secondary coder who was masked from the primary coders' previous responses. Table 2a,b listed the percent agreement<sup>2</sup> between both coders (Hallgren, 2012), frequencies of each category after discrepancies were resolved, as well as example quotes from respondents.

We analyzed and presented the qualitative findings in two ways. First, we calculated the proportion in which a given theme was reflected out of the total number of faculty members who mentioned that they would make changes in mentorship approaches (e.g., 52%, or 72 out of 145, faculty members who would make changes in their mentorship approaches mentioned that they would encourage students to develop skillset relevant to industry positions). We also calculated the proportion in which a given theme was reflected out of the total number of respondents as a reference to assess the prevalence of the theme among all faculty (e.g., 29%, or 72 out of 260, faculty members mentioned that they would encourage students to develop skillset relevant to industry).

## 5.2 | Results

### 5.2.1 | Experience with students' changes in career preference

Advisors reported extensive experience working with students whose career preference changed throughout their doctoral studies.

**TABLE 2A** Changes in career development mentorship approaches for industry positions.

Number of faculty who mentioned one or more types of changes in mentorship approaches (145 out of 260; 55%)					
Themes	Example quotes	Agreement	N	% (out of 145)	% (out of 260)
Use personal resources to facilitate job search	"I hold the same high standards for their research performance regardless of career path. The only thing different is that I keep an eye out for industry internships through my contacts and try to facilitate the job searching process for them." (#26)	0.85	50	34%	19%
Develop skillset relevant to industry	"I ask them to focus on building a skills portfolio (e.g. more stats classes, RA as project manager, etc)" (#76)	0.85	76	52%	29%
Encourage networking	"I start to think about what additional training they may need and pay more attention to specific conferences and networking opportunities they may need." (#39)	0.88	51	35%	20%
Encourage internship	"I encourage them to pursue industry internships" (#70)	0.94	27	19%	10%
Focus less on theory-building and publications	"I would still focus on strong research skills, but I'd be less concerned about finding publishing opportunities for that student." (#25)	0.94	28	19%	11%
Focus more on completing PhD	"I focus on helping them complete their dissertation rather than on publication of the dissertation" (#52)	0.97	18	12%	7%
Cater research or thesis to industry-relevance	"It affects the type of research projects that I give them. I will look for research projects that are less academic and more applied." (#12)	0.97	19	13%	7%
Unable/incapable to help	"I am supportive of students pursuing the career that is a best fit for them. However, I know very little about nonacademic careers, so I struggle to provide adequate mentorship for a student who wants to pursue that path." (#38)	0.97	20	14%	8%

**TABLE 2B** Changes in career development mentorship approaches for teaching-focused positions.

Number of faculty who mentioned one or more types of changes in mentorship approaches (153 out of 255; 60%)					
Themes	Example quotes	Agreement	N	% (out of 153)	% (out of 255)
Use personal resources to facilitate job search	"I strongly believe in the value of non-R1 schools and have worked at one myself. I would share my experiences of working at both R1 and non-R1 schools. I would describe to them the importance of setting realistic expectations for the time they would have available for research. In my experience, much of their time will be spent in course development, teaching, and advising undergraduate students. I would share this experience with them. The should know this going into such a position." (#41)	0.78	60	39%	24%
Encourage students to build teaching portfolio	"I also tailor their PhD and give them more teaching opportunities such as co-teaching my class, mentoring undergraduate students and thinking about postdoc opportunities that will help them build their teaching CV." (#17)	0.84	124	81%	49%
Introduce students to teaching workshops	"I will try to encourage more TAs and teaching workshops" (#5)	0.98	35	23%	14%
Place less emphasis on publication	"I would still want that student to develop strong research skills, but I would be less focused on finding publishing opportunities and more likely to encourage more teaching opportunities." (#25)	0.93	24	16%	9%



Specifically, among the 276 advisors who responded to these questions, 106 (38.4%) reported that they have had students whose career preferences changed to teaching-focused positions, and 123 (55.3%) advisors reported that they have had students whose career preferences changed to industry positions, even though they had initially hoped that these students would pursue academic-research positions. Paired-sample *t*-tests were conducted to examine how advisors felt when students approached them with a different career aspiration than their expectations. Among advisors who have had such experience, they reported much stronger positive emotions for teaching positions ( $M = 3.44$ ,  $SD = 0.93$ ) than negative ( $M = 1.61$ ,  $SD = 0.66$ ),  $t(105) = 14.30$ ,  $p < .001$ ,  $d = 1.31$ ). Similarly, when students' career preferences changed to industry positions, advisors reported much stronger positive ( $M = 3.47$ ,  $SD = 0.98$ ) than negative ( $M = 1.31$ ,  $SD = 0.70$ ) emotions,  $t(151) = 16.64$ ,  $p < .001$ ,  $d = 1.36$ . Among faculty who reported having some students who had chosen either of these paths, there was no difference in their positive or negative emotions between teaching and industry positions. Faculty advisors reported similar levels of positive,  $t(85) = -1.80$ ,  $p = .08$ ,  $d = 0.66$ , and negative,  $t(85) = -0.49$ ,  $p = .62$ ,  $d = 0.62$  emotions for teaching ( $M_{pos} = 3.44$ ,  $SD_{pos} = 0.95$ ;  $M_{neg} = 1.64$ ,  $SD_{neg} = 0.65$ ) and industry positions ( $M_{pos} = 3.57$ ,  $SD_{pos} = 0.91$ ;  $M_{neg} = 1.67$ ,  $SD_{neg} = 0.77$ ). In short, by their self-reports, faculty were generally positive in their emotional responses to the students that had chosen paths other than the R-1 path.

## 5.2.2 | Qualitative findings

The analysis of the open-ended responses revealed whether and how advisors change their mentorship approaches if students were interested in industry- or teaching-focused positions. Generally, advisors reported that they would likely change parts of their mentorship approaches to better support students' career aspirations while maintaining similar standards for their training in scientific research. Before analyzing qualitative responses, we removed participants who did not provide adequate responses to the questions, resulting in a total of 260 (86%) participants who responded to the open-ended prompts for industry positions, 255 (85%) for teaching-focused positions.

### *Changes in mentorship approaches for students interested in industry positions*

Out of 260 faculty members who responded to the question, 145 faculty members (56%) reported that they would change one or more aspects of their mentorship approaches if students were interested in industry positions. Among the 145 respondents, 52% of them encouraged students to develop skills that were transferable to industry, network with people in the positions or companies that students were interested in (35%), and to look out for internships and opportunities (19%). 34% of the advisors also mentioned that they would use their own resources (e.g., past work experience, personal network, etc.) to help students in their nonacademic research

pursuits. For example, one advisor response was reflective of the general sentiment, as they reported that they would “hold the same high standards for (students) research performance regardless of career paths... while keeping an eye out for industry internships through my contacts and try to facilitate the job searching process for them (#26).”

In terms of academic advising, several advisors reported that they would focus less on publication and theory-building (19%) and encourage/direct students' thesis or research projects to be more applied and relevant to industry (13%). Unlike several students' concern that their advisors would pay less attention to their academic progress (see Study 1B for more in-depth discussion), 12% advisors mentioned that they would pay *more* attention to the student to ensure completion of their PhD, because they feared that students may lose motivation after they made up their mind to pursue the nonacademic route. On the other hand, given the differences in hiring practices between industry and academia, 14% of the advisors reported the sentiment that they “know very little about non-academic careers, so (they) struggle to provide adequate mentorship for a student who wants to pursue that path (#38),” acknowledging that they were less equipped to help students land nonacademic jobs given their lack of experience in industry settings.

### *Changes in mentorship approaches for students interested in Teaching-Focused positions*

Out of 255 faculty members who responded to the question, 153 faculty members (60%) reported that they would change one or more aspects of their mentorship approaches if students were interested in teaching-focused positions. Out of the 153 respondents, when students were interested in teaching-focused positions, 81% of the faculty advisors encouraged their students to serve as a teaching assistant (TA) more and build their teaching portfolio and would introduce programs and encourage students to attend more teaching workshops (23%). 39% of them would also use their personal resources, such as encouraging students to TA for their own class or speaking with a colleague at a teaching-focused university, to help students gain insights and experience for such positions. An advisor who previously worked in non-R1 schools emphasized the importance of setting realistic expectations of working at a teaching-focused positions, informing their advisee that “the time they would have available for research, and that much of their time will be spent in course development, teaching, and advising undergraduate students (#41).” Several advisors (16%) also mentioned that they would focus less on theory-building and would not push for publication as hard as they would for those who wished to land research-focused positions, while maintaining the same standards for scientific research skills.

## 5.3 | Study 1A discussion

The majority of advisors in this sample of STEM faculty had prior experience working with students whose career preferences changed

in some way along their graduate trajectory. More than half of the advisors reported having students who switched their career preferences from academic-research to industry, and a smaller subset who switched to teaching-focused positions, suggested that changes in career preferences were common in students' doctoral studies. Moreover, when advisors learned that students preferred a career that did not align with their expectations, they reacted positively and were largely supportive of students' career decisions. It is not clear whether this information (that faculty have experience placing students in non-R1 positions), nor their sentiments (generally positive) was clearly expressed to students (see Thiry et al., 2015). To better prepare students for their desired career paths, advisors reported that they would likely tailor specific aspects of their mentorship approaches while maintaining the rigor and high expectations towards scientific research training, but some also acknowledged that they lacked the capability to support students who were interested in industry positions. Again, we do not know whether these advisors have explicitly conveyed their experiences, emotional support, and acknowledged limitations in the process of providing mentorship to students. We turn next to a qualitative analysis of students' perceptions of their conversations with faculty advisors about the potential for various careers options.

## 6 | STUDY 1B

Study 1B addresses the question of how PhD students feel when having career discussions with their advisors, and especially when these conversations are about industry or teaching-focused positions. Prior research suggests that PhD students do not generally have such conversations with faculty (Fuhrmann et al., 2011), and relied on external resources to inform their career development (Thiry et al., 2015; Woolston, 2019, 2022). The present studies contribute to the body of literature by drawing a large sample of PhD students and advisors from the same university. While it is important to acknowledge that participants across both studies are not advisor-advisee dyads, findings from these studies still suggest the extent to which PhD advisors' general support (as evidenced in Study 1A) is effectively communicated and perceived in a similar manner from students' perspective in a broad manner. We also examined students' concerns about the topic of career development irrespective of their levels of comfort. The goal of identifying students' concerns in Study 1B is to identify specific areas where pluralistic ignorance may manifest in the perceived impact of career conversations on student-advisor relationships.

### 6.1 | Method

#### 6.1.1 | Participants

One hundred and ninety-five STEM PhD students completed an online survey after being recruited via email. Students in our sample

were studying in social sciences (34.4%), life and environmental sciences (23.1%), engineering (20%), physical sciences (16.9%), and others/unspecified (5.6%). 53.3% participants were in their first 3 years of the PhD, while 46.6% were in their fourth year and beyond. The majority of the participants (57.4%) were in the pre-advancement stage, while (41.5%) participants had advanced as PhD candidates, the remaining 1% did not specify their advancement status. Refer to Table 3 for full demographic information.

#### 6.1.2 | Measures

##### *Comfort in career discussions*

Participants were asked to respond to the open-ended question "Please think about having discussion with your advisor about nonacademic positions (e.g., industry, government, non-profit organization). To what extent would you feel comfortable in these discussions and why?", followed by the question "to what extent would you feel uncomfortable in these discussions and why?" The questions were repeated for teaching-focused academic positions (i.e., professors at college without PhD programs), and for research-focused academic positions (i.e., professor at university with PhD programs). Participants responded to six open-ended prompts in total.

#### 6.1.3 | Comfort and discomfort in discussing career options

To get a clearer understanding of participants' level of comfort in having discussions about each of the three career options (industry, teaching-focused, academic-research positions), PhD students' responses from the prompts about comfort and discomfort were combined. We then analyzed the open-ended responses based on each career option. In other words, participants' responses to both prompts (i.e., to what extent would you feel comfortable and uncomfortable) in relation to a specific career option (i.e., industry, teaching-focused or research-focused academic positions) were coded simultaneously and together. After cleaning and organizing the open-ended responses, three main sets of responses that correspond to each career option were coded.

Three coders were trained and worked in pairs. Each coder was assigned two sets of responses and did two rounds of coding. In the first round, coders made an overall dichotomous judgment about whether participants were comfortable or uncomfortable in having career discussions with their advisors about each career path. In the second round, coders worked with subsets of 50 responses and identified potential concerns that students had that could evoke discomfort in having career conversations. Coders categorized participants' responses, indicating whether the theme was reflected in a given response (0 = no part of the response fell under a given category, 1 = one or more aspects of the response fell under the category). A student's response could be coded into multiple



**TABLE 3** Study 1B students' demographic characteristics.

Characteristics	N (%)
Age M (SD)	27.81 (3.51)
Gender	
Female	102 (52.3)
Male	90 (46.2)
Other/unspecified	3 (1.5)
Race	
Asian/Asian American	24 (12.3)
Black/African American	17 (8.7)
Hispanic/Latino-American	46 (23.6)
Native American	4 (2.1)
Native Pacific Islander	3 (1.5)
Other/unspecified	14 (7.2)
White/Caucasian American	87 (44.6)
Underrepresented Racial Minority (URM) Status	
URM	70 (35.9)
Non-URM	123 (63.1)
Other/unspecified	2 (1)
Year in PhD Program	
First-year	3 (1.5)
Second-year	57 (29.2)
Third-year	44 (22.6)
Fourth-year	34 (17.4)
Fifth-year	38 (19.5)
Sixth-year	16 (8.2)
Seventh-year or more	3 (1.5)
Advancement status	
Preadvancement	112 (57.4)
PhD candidates	81 (41.5)
Other/unspecified	2 (1)
International student status	
International student	45 (23.1)
Domestic student	149 (76.4)
College generation status	
First-generation college student	65 (33.3)
Continuing-generation college student	129 (66.2)
Other/unspecified	1 (0.5)
Field of study	
Engineering	39 (20)
Life and environmental sciences	45 (23.1)
Other/unspecified	11 (5.6)
Physical sciences	33 (16.9)
Social sciences	67 (34.4)

categories to reflect one or more concerns they may have when discussing each career option. Discrepancies in responses were resolved by a third coder who was masked from the previous coders' responses. The final coding scheme consisted of six main categories for industry and teaching-focused positions, and three main categories for research-focused positions. Table 4 listed the overall dichotomous judgment about participants' comfort in career discussions, and Tables 5A–5C list the percent agreement of pairs of coders, frequencies of each category after discrepancies were resolved, as well as example quotes that correspond to each category.

We present the qualitative findings in three ways. First, to gauge the general sentiment towards career discussions, we calculated the proportion of participants who were comfortable or uncomfortable in having career discussions with their advisors in each career path relative to all participants who responded to the prompts (Table 4). Then, to identify the different kinds of concerns that participants may have irrespective of their general level of comfort in career discussions, we calculated the proportion in which a given theme was reflected out of the total number of participants who mentioned any concern surrounding career discussion (e.g., 36%, or 22 out of 61, PhD students mentioned that they worried about going against advisors' expectations for them if they have discussions about industry positions). Lastly, we also calculated the proportion of responses in which a given theme was reflected out of the total number of respondents as a reference to assess the prevalence of the theme among all students (e.g., 13%, or 22 out of 176, PhD students mentioned that they worried about going against advisors' expectations for them if they have discussions about industry positions).

## 6.2 | Results

### 6.2.1 | Content analysis of qualitative responses

Before analyzing qualitative responses, we removed participants who did not provide adequate responses to one or both parts of the questions,<sup>3</sup> resulting in a total of 176 (90%) participants who responded to the open-ended prompts for nonacademic positions, 159 (82%) for teaching-focused positions, and 166 (85%) for research-focused positions. Overall, 83% of the participants reported that they were comfortable discussing academic research positions with their advisors, followed by 76% for discussions about teaching-focused positions, and 68% for discussions about industry positions. In other words, the majority of the participants perceived that their advisors were supportive of their career decisions and were generally open to discuss different career options (Table 4). While we acknowledge the general comfort in career discussions, 61 out of 176 respondents (35%) raised concerns about several aspects of career discussion in relation to industry positions; 60 out of 159 respondents (38%) for teaching-focused positions, and 30 out of 166 respondents (18%) for research-focused positions (Tables 5A–5C). Thus, in the following section, we identified the themes and concerns

**TABLE 4** Comfort in discussing different career options.

Themes	Industry (N = 176)			Teaching (N = 159)			Research (N = 166)		
	N	%	Agreement	N	%	Agreement	N	%	Agreement
Comfortable	120	68%	0.80	124	76%	0.78	138	83%	0.85
Uncomfortable	44	25%	0.81	35	34%	0.77	20	12%	0.91
Missing/unspecified	12	7%		0	0%		8	5%	

**TABLE 5A** Concerns about discussing industry positions.

Number of students who mentioned one or more types of concern (61 out of 176; 35%)						
Themes	Example quotes	N	% (out of 61)	% (out of 176)	Agreement	
<b>Impact on student-advisor relationship</b>						
Fear or worry of going against advisors' expectations	"I would feel uncomfortable and embarrassed discussing non-academic positions with my advisor because he has made comments about prior students indicating that he doesn't think that is a desirable career path for a doctoral student". (#167)	22	36%	13%	0.89	
Fear of negative repercussions	"I feel very uncomfortable and have been avoiding talking about this. I think they will focus their attention on those students that do want the academic positions and I will no longer be a priority to them. So I felt really uncomfortable bringing this up to one of my advisors." (#206)	7	11%	4%	0.93	
Advisors' lack of capability to mentor in preferred career option	"The discussion might be uncomfortable because I don't know that my advisor is well-versed in my options for nonacademic positions, or how to prepare me for such positions." (#43)	21	34%	12%	0.97	
<b>Influence of social norms</b>						
Advisors viewed nonresearch careers as inferior	"(My advisor) is very open in his dislike for the private sector, and his belief that academic positions are generally superior in every way." (#69)	16	26%	9%	0.93	
Departmental norm pushes for academic research positions	"I would feel more comfortable talking about it if the department did not frown on non academic jobs." (#51)	10	16%	6%	0.96	
Students' perception of themselves as not good enough for industry positions	"I wouldn't necessarily feel uncomfortable about the topic at hand, only that I know I'm not working as hard as I should, nor am I being as productive. That is the main cause of distress for interactions with my advisor." (#54)	2	3%	1%	0.99	

raised relative to each career options that students and advisors should consider to further enhance the discussions of various career options.

#### *Impact on student-advisor relationship*

Of the students who expressed concerns about discussing industry and teaching-focused positions, 36% of them were worried that talking about nonacademic careers would let their advisors down, possibly because of the perception that pursuing nonacademic research positions was going against advisors' expectations for them.

47% of the respondents for teaching-focused positions reflected similar concerns about how discussing teaching-focused positions would (negatively) impact the student-advisor relationships. Several participants considered the time and effort advisors put in their PhD training, and noted the following (regarding going into industry):

"The reason I would feel a little uncomfortable in this discussion is because my advisor has poured her time, energy, and resources into my work. I couldn't help but feel a little guilty to suggest to her that I might

**TABLE 5B** Concerns about discussing teaching-focused positions.

Number of students who mentioned one or more types of concern (60 out of 159; 38%)					
Themes	Example Quotes	N	% out of 60	% out of 159	Agreement
<b>Impact on student-advisor relationship</b>					
Fear or worry of going against advisors' expectations	"I would feel awkward because it would feel like a bit of a let down to work somewhere without a PhD program, and thus, I imagine, where minimal research was occurring." (#55)	28	47%	18%	0.81
Fear of negative repercussions	"Interest in anything other than pure academic track immediately disqualifies you for consideration on funding, publishing, and collaborations." (#179)	9	15%	6%	0.81
Advisors' lack of capability to mentor in teaching positions	"I feel moderately uncomfortable having these discussions with my advisor because they have made comments in the past that suggest that this think this is an acceptable option but they may not be as helpful because this was not the path they have experience with." (#56)	10	17%	6%	0.95
<b>Influence of social norms</b>					
Advisors viewed teaching-focused positions as inferior	"My advisor's main goal is placing students in R1 universities. Sending a student to a teaching institution is culturally seen as a bit of a failure." (#9)	25	42%	16%	0.82
Departmental norm pushes for academic research positions	"The expectation is, if you start in research, you should stay in research, so leaving for a teaching position feels like some kind of betrayal to the program." (#37)	17	28%	11%	0.81
Students' perception of themselves as not good enough	"I don't feel like I am a good enough teacher to do this." (#190)	6	10%	4%	0.97

**TABLE 5C** Concerns about discussing research-focused positions.

Number of students who mentioned one or more types of concern (30 out of 166; 18%)					
Themes	Example quotes	N	% out of 30	% out of 166	Agreement
<b>Doubt on capability</b>					
Doubt on self-capability	"I think I would feel uncomfortable because I personally do not think I have what it takes to get this sort of position." (#93)	27	90%	16%	0.87
Perceived advisors' doubt on capability	My only potential source of discomfort would be around discussing what he thinks my potential for attaining such a job would be. (#38)	14	4%	11%	0.91
Lack of interest in research positions	I have absolutely no desire to go to an R1 institution and try to avoid talking about it at all because of how strongly I feel about the subject. I already knew I wanted to go to a teaching college before I started grad school and my time here has only solidified my position. (#3)	21	70%	4%	0.90

consider a career path other than academia." (#196, industry positions).

Although less common, a smaller subset of respondents feared that having career conversations about industry (11%) and teaching-focused positions (15%) would lead to negative repercussion, such as the fear that their advisors would pay less attention to their academic progress or scientific training, or that their advisors would lack the motivation to mentor them in their preferred career paths. Participants worried that informing advisors about their interest in nonacademic research careers will "(shift advisors') attention to those

students who do want the academic positions (#206, industry-positions)," or "immediately disqualifies (students) for funding, publishing, and collaboration (#179, teaching-focused positions)".

#### *Influence of social norms*

Students' levels of comfort in having career discussions with their advisors was associated, for some students, with their perceptions of what is acceptable, approved, and normative. Among participants who had concerns about discussing industry positions, 26% reported they would be uncomfortable because of their perception that advisors viewed these positions as inferior. For instance, one

participant reported that their advisor “is very open in his dislike for the private sector, and his belief that academic positions are generally superior in every way (#69, industry positions).” Similar sentiments were reported for students who pursue teaching-focused positions (approximately 42% among all respondents who raised concerns). A participant noted that “My advisor’s main goal is placing students in R1 universities. Sending a student to a teaching institution is culturally seen as a bit of a failure.” (#9, teaching-focused positions.) While we acknowledge that there was only a small subset of participants who reported such experiences, the explicit disdain of some advisors for nonacademic research positions may contribute to the perception that this is normative and held more widely by other faculty.

In addition to participants’ perception of their advisors, social norms at the departmental levels also shaped participants’ comfort in career choice. Participants noted that the general departmental norm for students was to pursue academic research positions. Therefore, even though their advisors may be supportive of their career preferences, approximately 16% of respondents who had concerns mentioned that the departmental norms were a hindrance for discussing industry positions, and 28% mentioned such concerns for teaching-focused positions.

#### *Perceived advisors’ capability to mentor*

Approximately 34% of the respondents who had concerns mentioned that their advisor lacked the capability to mentor and provide them adequate guidance for industry positions. Students recognized the differences in hiring practices between academic-research and industry positions and perceived that their advisors were less capable of helping them land industry positions, especially if their projects or fields did not have any collaboration with industry partners. For instance, one participant reported that “The discussion might be uncomfortable because I don’t know that my advisor is well-versed in my options for nonacademic positions, or how to prepare me for such positions (#43, industry positions).”

Similarly, when discussing teaching-focused positions, a smaller subset of respondents (17%) mentioned that their department and advisors did not place enough emphasis on pedagogical training and were worried that they were not equipped for more teaching responsibilities. One participant noted that although their advisors find teaching-focused positions acceptable, “they may not be as helpful because this was not the path they have experience with (#56, teaching-focused positions)”. Therefore, the perceived advisors’ lack of ability may be a reason why students felt unsupported instrumentally, and this may contribute to the feeling that they were on their own in their job-hunting process (Sherman et al., 2021; Woolston, 2019).

#### *Self and perceived advisors’ doubt on ability*

When discussing academic-research positions, by contrast, the most prominent concern was doubt about capability. Among all participants who raised concerns, 52% of them cast doubt on their own capability to secure an academic-research positions. Although

obtaining an academic research position was perceived as the norm and most desirable positions from their advisors’ perspectives (Sherman et al., 2021), participants were aware of its competitiveness, and expressed concerns that “they were “unqualified’ or ‘not good enough’, especially for top R1 positions (#69, academic-research positions).” Furthermore, 27% of participants were also worried that their advisors would question them about their research ability and projects, which could result in the students delaying or avoiding having these career discussions.

### 6.3 | Study 1A and Study 1B discussion

The two qualitative studies, focusing on STEM advisors and PhD students in STEM departments suggest a psychological barrier may be preventing better communication concerning career options. Findings from Studies 1A and 1B suggest that pluralistic ignorance may be a factor in students’ experience of discomfort in having career discussions. Many students’ concerns stem from their uncertainty in advisors’ expectations for them and fear of disappointing their advisors if students’ own career preferences were incongruent with the perceived normative preference for academic-research positions. Students may also inaccurately perceive advisors’ intention and mentorship approaches if advisors’ support (as expressed in Study 1A) are not clearly communicated. For example, the lack of instrumental support (e.g., tangible career advice) could sometimes be perceived as a lack of emotional support from the students’ perspective, which in turn, could shape students’ feeling that their advisors do not support their career decisions. In Study 2, we sought to examine whether explicitly communicating actual norms about advisors’ career preferences and support to students could reduce the discomfort they experience as compared to the norms that students perceive.

## 7 | STUDY 2

In Study 2, we recruited a new sample of STEM PhD students, and presented them with different veridical information that reflected what STEM PhD students perceive that advisors prefer in terms of career preferences as well as what PhD advisors report actually preferring for their students. We based the perceived and actual data on the quantitative data reported by the 301 PhD advisors in Study 1A (for the actual norms) and the 195 PhD students in Study 1B (for perceived norms). Participants were shown a statistical report about advisors’ strong preference for academic-research positions (perceived norms) as well as advisors’ support for diverse career options (actual norms) in a mixed model design (with order counterbalanced) and reported their levels of comfort having career discussions with their advisors after learning each set of norms. We expected that participants would report greater comfort in having career discussions after learning about the actual norms (in aggregate) compared to the perceived norms. After learning about the first set of norms

(either perceived or actual norms), participants reported how desirable each of three career options were both from their own personal perspectives as well as what they perceived of as their advisors' perspectives. This enabled an examination of whether career preferences that were not perceived as normative (i.e., teaching, industry) were more desirable after PhD STEM students learned about the actual norms of faculty (relative to confirming their perceived norms).

## 7.1 | Method

### 7.1.1 | Participants

200 PhD students completed an online survey after being recruited via email. Participants were recruited from social sciences (25.4%), engineering (23.4%), physical sciences (22.9%), life sciences (20.9%), math (2.5%), humanities (2.5%), and other/unspecified disciplines (2.5%). 68.7% participants were in their first 3 years of the PhD, while 31.3% were in their fourth year and beyond. The majority of the participants (62.2%) were in the pre-advancement stage, while (35.3%) participants had advanced as PhD candidates, the remaining 2.5% did not specify their advancement status. All participants were compensated with a \$10 electronic gift card. The participants were from the same university system as the faculty and students in Studies 1a and 1b, respectively, but a new and independent sample. Table 6 lists the complete demographics, including discipline of study.

### 7.1.2 | Procedure

A sample of 240 graduate students initially responded to an email inviting them to complete the survey online using their university email address. Participants were contacted by the university graduate division. A total of 200 students responded and completed the study. The remaining 40 participants began the study but did not complete it and were excluded from data analysis, corresponding to an 83% completion rate. Informed consent was given digitally at the beginning of the survey before participants proceeded to the questions.

### 7.1.3 | Normative manipulation

The study employed a mixed-model factorial design with all participants being shown one set of aggregated information about STEM PhD advisors and their preferences for their PhD students, then completing dependent measures, before then being shown the second set of information. The two sets of information were based on Perceived Norms or Actual Norms and the order was counterbalanced.

All participants read a cover story about STEM PhD students and advisors' career preferences and expectations, developed based on the

**TABLE 6** Study 2 participants' demographic characteristics.

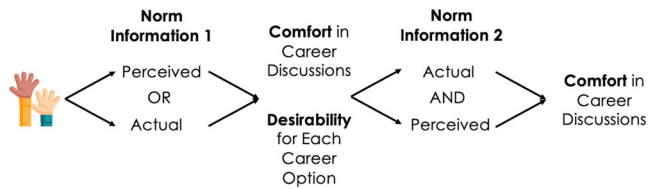
Characteristics	N	%
Age M(SD)	26.64 (3.29)	
Gender		
Female	109	54%
Male	87	43%
Other/missing	5	3%
Race		
Asian/Asian American	52	26%
Black/African American	7	4%
Hispanic/Latino-American	22	11%
Native American	1	1%
White/Caucasian American	112	56%
Other/missing	7	3%
Underrepresented Racial Minority (URM) Status		
URM	36	18%
Non-URM	164	82%
Other/missing	1	1%
Year in PhD program		
First-year	54	27%
Second-year	45	22%
Third-year	39	19%
Fourth-year	28	14%
Fifth-year	17	9%
Sixth-year	12	6%
Seventh-year or more	6	3%
Advancement status		
Preadvancement	125	62%
PhD candidates	71	35%
Other/missing	5	3%
National status		
International student	58	29%
Domestic student	143	71%
College generation status		
First-generation college student	36	18%
Continuing-generation college student	165	82%
Graduate school generation status		
First-generation graduate student	96	48%
Continuing-generation graduate student	105	52%
Field of study		
Engineering	47	24%

(Continues)



TABLE 6 (Continued)

Characteristics	N	%
Life sciences	42	21%
Physical sciences	46	23%
Social sciences	51	25%
Math	5	3%
Humanities	5	3%
Other/missing	5	3%



**FIGURE 1** The sequence in which participants received information about perceived (vs. actual) norms in Study 2, and the measures they respond to after the information was presented.

prior research described above (Sherman et al., 2021). In the first section, participants were randomly assigned to learn either that the majority of the PhD advisors preferred their PhD students to pursue academic research positions after they graduate (i.e., Perceived Norms condition: 84% academic research, 11% industry, 6% teaching); or that faculty members' expectations for their PhD students closely mirror students' preferences (i.e., Actual Norms condition: 44% academic research, 38% industry, 17% teaching). Then, participants reported their general comfort in having career discussions with their advisors, along with several measures listed below. In the second section, participants were presented with the information from the other condition that they had not received. In other words, those who previously learned about the actual norms were presented information about perceived norms (next to the information about actual norms that they had seen previously and information about students' career preferences), and those who previously learned about the perceived norms were now presented information about the actual norms; in sum, the second time participants saw three pie charts. Then, the participants answered the same set of questions about comfort in having career discussions with their advisors, followed by demographic information. Figure 1 illustrate the sequence in which participants received information about perceived (vs. actual) norms, and the measures they responded to after the information was presented. Figure 2 show a simplified version of the actual and perceived conditions that participants received.

### 7.1.4 | Within-subject measures

#### *General comfort in career discussions*

Participants thought about having career discussions with their advisors and reported their general comfort in having these career

discussions. There were three items in this measure: "on a scale from 1 to 10, how comfortable/interested/confident are you having discussions about your career with your advisor?" Participants completed this measure twice, once after they were presented the actual (or perceived) norm of faculty members' career preferences, and a second time after participants were reminded of the information they had previously received, and were presented both sets of norms—perceived and actual—about PhD students' and advisors' career preferences,  $\alpha_{perceived} = 0.83$ ,  $\alpha_{actual} = 0.80$ .

#### *Comfort with discussing each career option*

Participants reported how comfortable they felt discussing each of the three career options (industry, teaching-focused academic positions, and research-focused academic positions) with their advisors. Participants responded on a scale from 0 (very uncomfortable) to 10 (very comfortable) twice, once after they were presented the first set of information (representing actual vs. perceived norms), and once after they were presented both sets of norms.

### 7.1.5 | Between-Subject measures

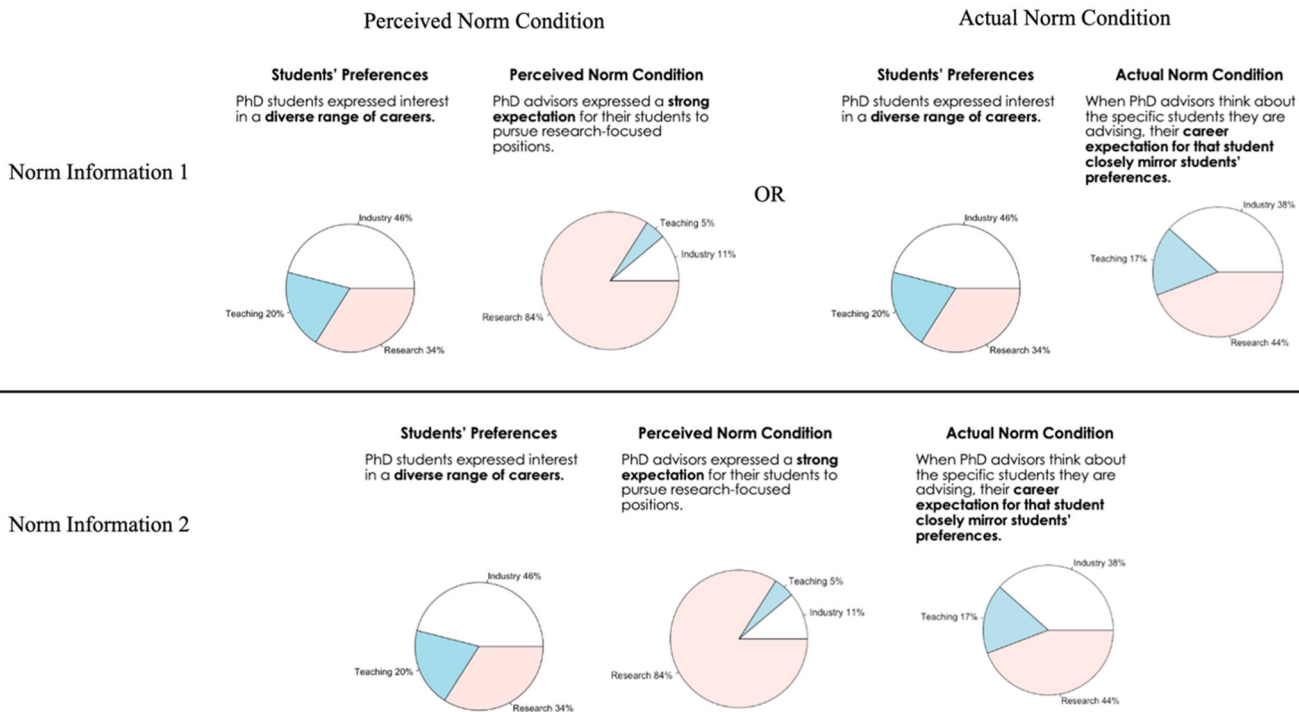
#### *Desirability for each career option*

Participants rated the desirability of each of the three career options from two perspectives - from their personal point of view, and from their advisor's perspective. Participants responded on a scale from 0 (not at all desirable) to 10 (extremely desirable). Participants responded to this scale after they were presented the first set of information (representing actual vs. perceived norms), so they only responded to this once.

## 7.2 | Results

### 7.2.1 | Comfort in career discussions

To examine the impact of perceived (vs. actual) aggregate norms on student's comfort in career discussions, we conducted a mixed-model ANOVA with the order in which the norms were presented as the between-subject variable, and the levels of comfort across norm conditions as the repeated measures. There was a marginal main effect of norm conditions on participants' general level of comfort in having career discussions,  $F(1, 198) = 3.89$ ,  $p = .05$ ,  $\eta_p^2 = 0.02$ . Participants reported higher levels of comfort having career discussions in general with their advisors after learning about the actual norms ( $M = 7.34$ ,  $SD = 2.04$ ) than after learning about the perceived norms ( $M = 7.17$ ,  $SD = 2.22$ ). There was no main effect of order,  $F(1, 198) = 0.03$ ,  $p = .86$ ,  $\eta_p^2 < 0.01$ , and no interaction between norm condition and order,  $F(1, 198) = 0.05$ ,  $p = .82$ ,  $\eta_p^2 < 0.01$ , ruling out the possibility of order effects on participants' responses. Revealing what a sample of STEM faculty advisors *actually* think was effective at



**FIGURE 2** Adapted version of the manipulation used in Study 2. The pie chart data were all based on the findings of Sherman and colleagues (2021). In the first part of the survey (Norm Information 1), participants were presented information about PhD students' career preferences and either perceived or actual norms. Participants in the "Perceived Norm" condition received information about PhD students' career preference as well as PhD students' perceived advisor's career preferences for them. Participants in the "Actual Norm" condition received information about PhD students' career preference as well as advisors' actual career preferences for one of their specific students. In the second part of the survey, participants were presented all three sets of information (Norm Information 2). See SOM for full cover story, and details about manipulation.

increasing the comfort that STEM PhD students reported in having discussions with their mentors about careers.

Similarly, in terms of the specific careers, there was a main effect of norm condition on participants' anticipated comfort in discussing industry careers with their advisors,  $F(1, 198) = 5.17, p = .02, \eta_p^2 = 0.03$ , with no main effect of order,  $F(1, 198) = 0.01, p = .93, \eta_p^2 < 0.01$ , and no interaction between norm condition and order,  $F(1, 198) = 0.63, p = .43, \eta_p^2 < 0.01$ . Participants reported greater levels of anticipated comfort when considering discussing careers in industry after learning about the actual norms ( $M = 6.99, SD = 2.63$ ) than after learning about the perceived norms ( $M = 6.73, SD = 2.78$ ).

There was no main effect of norm condition on participants' comfort in discussing teaching-focused positions,  $F(1, 198) = 0.001, p = .97, \eta_p^2 < 0.01$ , and no main effect of order,  $F(1, 198) = 0.39, p = .54, \eta_p^2 < 0.01$ . There was a significant interaction between norm condition and order,  $F(1, 198) = 20.15, p < .001, \eta_p^2 = 0.09$ . Participants reported similar levels of comfort discussing teaching-focused positions after learning about the actual norms ( $M = 6.93, SD = 2.69$ ) and in the perceived norms ( $M = 6.87, SD = 2.80$ ). A closer examination of pairwise comparisons of the interaction revealed that participants' comfort in discussing teaching-focused positions was lower after they learned about *both* the perceived and actual norms (i.e., after both of the norm information conditions was presented together;  $M = 6.51, SD = 2.99$ ), compared to when they learned about

*only* the perceived norms.  $M = 7.32, SD = 2.49, p = .04$ ), possibly because teaching-focused positions were still considered the least desirable option out of the three career paths across both sets of norms.

For discussing academic-research positions, there was no main effect of norm condition on participants' comfort,  $F(1, 198) < 0.001, p = .98, \eta_p^2 < 0.01$ , and no main effect of order,  $F(1, 198) = 0.34, p = .56, \eta_p^2 < 0.01$ . There was a significant interaction between norm condition and order,  $F(1, 198) = 6.09, p = .01, \eta_p^2 = 0.03$ . Participants were equally comfortable (and very comfortable) discussing academic-research positions after learning actual ( $M = 8.56, SD = 2.05$ ) and perceived ( $M = 8.53, SD = 2.20$ ) norms. Pairwise comparisons of the interaction revealed that participants' comfort in discussing research-focused positions was marginally lower after they learned about both the perceived and actual norms (i.e., after both of the norm information conditions were presented together;  $M = 8.34, SD = 2.37$ ), compared to when they learned about *only* the actual norms,  $M = 8.60, SD = 2.00, p = .07$ ). One possible explanation is that seeing both perceived and actual norms about what was thought to be the most favored occupational choice, research careers, revealed that there is some discrepancy between what mentors prefer in the abstract, and their preferences for particular students; although speculative, this may have led to somewhat more apprehension among students.

## 7.2.2 | Self-desirability ratings for each career option by norm condition

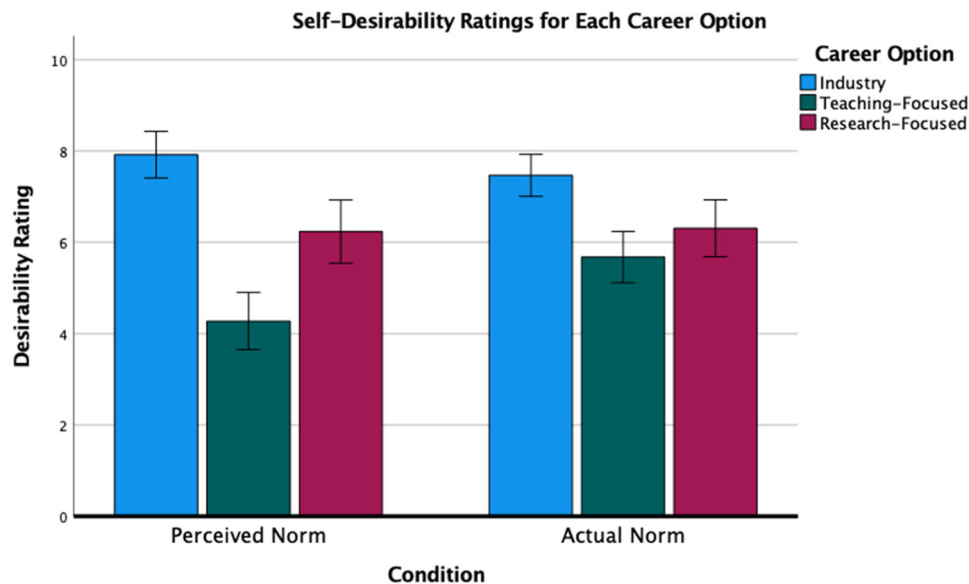
Next, we examined how perceived and actual norms influence the desirability of each of the three career options. We conducted a 3 (Career Option: industry, teaching, research)  $\times$  2 (Norm Condition: perceived, actual) mixed-model ANOVA with norm condition as the between-subject variable, and desirability of career option as the repeated-measure variable, depicted in Figure 3. Students' desirability ratings for the three career options differed significantly,  $F(2, 398) = 37.53, p < .001, \eta_p^2 = 0.16$ . Pairwise comparisons revealed that students rated industry positions as significantly more desirable than academic-research positions,  $p < .001$ ; and teaching-focused positions,  $p < .001$ . Students also rated academic-research positions as significantly more desirable than teaching-focused positions,  $p < .001$ . In other words, students viewed industry positions ( $M = 7.69, SD = 2.43$ ) the most desirable, followed by academic-research positions ( $M = 6.24, SD = 3.28$ ). They viewed teaching-focused positions as the least desirable ( $M = 5.08, SD = 3.04$ ).

There was also a significant interaction between career option and norm condition,  $F(2, 398) = 4.62, p = .01, \eta_p^2 = 0.02$ . The interaction

seems to have been driven by participants' desirability ratings for teaching positions. Participants in the actual norm condition ( $M = 5.68, SD = 3.03$ ), rated teaching positions as significantly more desirable than those in the perceived norm condition ( $M = 4.28, SD = 3.06$ ),  $p = .001$ . In other words, when participants learned that their advisors' preferences were driven by students' own preference, they viewed teaching-focused positions as more desirable and indicated greater consideration for pursuing a teaching-focused position after their PhD studies. Their views on industry or research-oriented academic positions were not affected by the norms communicated. See Table 7 for full descriptive statistics.

## 7.2.3 | Perceived advisors' desirability ratings for each career option by norm condition

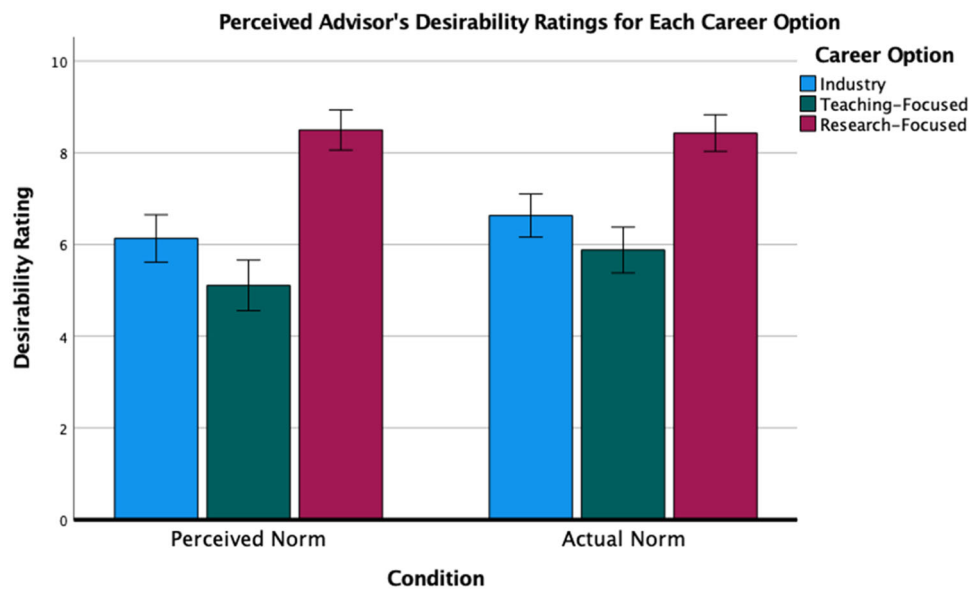
Similarly, to examine how perceived (vs. actual) norm affects students' perceptions of their advisors' desirability of each career option, we conducted a 3 (Career Option: industry, teaching, research)  $\times$  2 (Norm condition: perceived, actual) mixed-model ANOVA to explore whether and how norm condition would affect students' perceptions of advisors' desirability ratings for each of the



**FIGURE 3** Students' self-desirability ratings for industry, teaching-focused, and research-focused positions in Study 2.

**TABLE 7** Desirability ratings for each career option by norm condition and perspective.

	Industry		Teaching		Research							
	Self	Advisor	Self	Advisor	Self	Advisor						
	M	SD	M	SD	M	SD						
Perceived norm (N = 90)	7.92	2.28	6.13	2.44	4.28	3.06	5.11	2.57	6.23	3.08	8.5	1.98
Actual norm (N = 109)	7.5	2.55	6.63	2.47	5.73	2.87	5.88	2.65	6.25	3.46	8.43	2.17



**FIGURE 4** Perceived advisors' self-desirability ratings for industry, teaching-focused, and research-focused positions.

three career options depicted in Figure 4. We found a main effect of career option,  $F(2, 394) = 81.04$ ,  $p < .001$ ,  $\eta_p^2 = 0.29$ , such that students perceived that their advisors viewed research positions ( $M = 8.46$ ,  $SD = 2.08$ ) as most desirable, followed by industry positions ( $M = 6.41$ ,  $SD = 2.46$ ), and lastly, teaching-focused positions ( $M = 5.53$ ,  $SD = 2.63$ ). We did not find a significant two-way interaction between norm and career options,  $F(2, 394) = 1.60$ ,  $p = .20$ ,  $\eta_p^2 = 0.01$ . However, consistent with the findings from students' self-desirability, there was a significant contrast between perceived advisors' desirability ratings for teaching-focused positions,  $p = .04$ . Students perceived that their advisors would view teaching-focused position as *more* desirable after learning about the actual norm ( $M = 5.88$ ,  $SD = 2.65$ ) compared to the perceived norm ( $M = 5.11$ ,  $SD = 2.57$ ).

The increased desirability for teaching-focused positions after learning about the actual norms from students' personal and perceived advisors' perspectives suggested that making explicit the support for diverse career options could positively shape students' view towards teaching-focused positions and encourage them to consider pursuing this career path. See Table 7 for full descriptive statistics.<sup>4</sup>

### 7.3 | Study 2 discussion

Study 2 experimentally demonstrated the impact of social norms on addressing pluralistic ignorance in two ways. First, it demonstrated how PhD students' assumptions that their advisors were less supportive of nonacademic research positions than they actually were (Sherman et al., 2021), and their potential concerns about alternative career options (Study 1A), can negatively affect students' levels of comfort in having career discussions with their advisors.

Merely presenting information about a sample of advisors' actual career preferences and support for their students increased PhD students' comfort in having career discussions, especially for discussions about industry positions; suggesting that providing correct information is a simple but effective way to alleviate some discomfort or concerns that students may experience. Second, PhD students may view teaching-focused positions as less desirable, possibly because of the stigma and social pressure shaped by traditional academic norms (Sauermaun & Roach, 2012). Indeed, participants in this sample viewed teaching-focused positions as least desirable relative to industry and academic-research positions, from both their personal and perceived advisors' perspectives. However, their desirability ratings for teaching positions increased (for both themselves and their perceptions of advisors) after they knew that advisors were supportive of diverse career options, relative to after learning about the common (mis)perception about advisors' career preferences. Together, these findings suggest that making explicit advisors' actual norms about career preferences could be a simple and effective approach that could not only increase comfort and facilitate more discussions about career development, but could also encourage students to give greater consideration to teaching-focused positions, an equally important yet often overlooked career within academia.

## 8 | GENERAL DISCUSSION

Understanding what drives occupational choices among young people at the start of their careers requires a greater understanding of how mentors and mentees understand (or misunderstand) each other. Together, the three studies depict a holistic picture of PhD students' and advisors' experiences and concerns surrounding career

conversation, and illustrated ways in which pluralistic ignorance can shape the normative perceptions of career preferences from both perspectives. Findings from Studies 1A and 1B, using a mixed-method approach, revealed the following picture: most PhD advisors in our sample have had experience working with students whose career preferences changed over the course of their doctoral studies, and were generally supportive of their students' decisions. To better prepare students for their desired career paths, they reported willingness to modify aspects of their mentorship approaches while maintaining high standards in scientific training. Yet, it was unclear whether this support was explicitly communicated to students, possibly because advisors may not know of their students' (changed) career preferences. Thus advisors may provide mentorship under the assumption that students are interested solely or primarily in academic-research positions (Study 1A).

On the other hand, although students were generally comfortable discussing different career options with their advisors, their perceptions were still, to some degree, influenced by the traditional normative perceptions within academia. Several students who have experienced or observed negative attitudes towards nonacademic research positions recalled specific instances where their advisors expressed dislike towards industry positions and students perceived a strong preference for academic-research positions from other faculty members in their department. Such experience could deter students from having a full range of discussions with their advisors and be associated with the strong assumption that advisors strongly prefer academic research positions not just in general, but for "me as a student" in particular (Sherman et al., 2021). Furthermore, when students' targeted career options "deviated" from their perceived career norm (i.e., industry and teaching-focused positions vs. academic-research positions), students were more concerned about how expressing interest in these career options would influence the relationship with their advisors, such as the reluctance to go against their advisors' expectations for them. Yet, Study 1A suggested that students may not be aware of their advisors' support for, and experience in, mentoring students with diverse career preferences. Without explicit communication about career preferences and development, students and advisors were equally likely to be influenced by pluralistic ignorance and make inaccurate assumptions about one another.

Through informing students about faculty advisors' actual norms about career preferences for students, students' level of comfort increased, revealing a potentially powerful yet simple form of intervention to facilitate these career discussions on the interpersonal and even departmental level (Study 2). We presented both sets of information – based on the actual career norms of faculty advisors, as well as students' perceived norms about faculty advisors' career preferences—to PhD students. Compared to affirming students' perception that advisors had a strong preference for their students to pursue academic-research careers, informing students that advisors' career preferences were largely driven by students' own career goals both alleviated students' discomfort to engage in career discussions, and encouraged them to consider more teaching-

focused positions. Future research could adopt a similar strategy to present mentors with normative information about the choices and preferences of the students they mentor.

## 8.1 | Methodological contributions

Although prior studies have examined the broad impact of mentorship on PhD students' career outcomes (e.g., Austin, 2002), the present research is the first to delve deeply into the experiences, concerns, and messages about career goals from PhD students' and faculty advisors' perspectives using a mixed-method approach. In this program of research, we utilized both quantitative and qualitative methods in an attempt to capture a more holistic understanding of PhD students and advisors' experiences in relation to career discussions. While quantitative approaches were helpful in identifying trends and patterns among participants, qualitative approaches added depth and revealed nuances that could not be captured through close-ended measures (Yin, 2016). For example, we identified several main concerns that shaped students' discomfort in career discussions, as well as changes advisors made in their mentorship approaches, if or when they learned about students' career preferences through analyzing open-ended responses. The qualitative findings provided important context as to how pluralistic ignorance could affect PhD students' and advisors' views towards career conversations, especially when career preferences or expectations were not clearly conveyed. Additionally, using an experimental design provided more causal evidence that perceived norms inhibit, and actual norms facilitate, greater comfort in discussing career options. Together, both qualitative and quantitative approaches highlighted a need for clearer communication between advisors and their students and in organizational contexts more generally (Halbesleben et al., 2007).

## 8.2 | Practical implications

The present study focused on the experience of career development from the perspectives of PhD students and advisors in hope of understanding how perceptions and misperceptions may influence the trajectory of students through the challenging PhD experience. The landscape of graduate education is changing, with more PhDs being employed in sectors outside of 4-year educational institutions than in tenure-track academic research positions (National Science Foundation, 2023).

Understanding the barriers that inhibit constructive conversations can potentially lead to greater common ground among faculty advisors and their advisees. In our qualitative data, it is important to note that the sentiment surrounding career discussion was generally positive. Yet, several students reported having negative experiences and facing some stigma towards their preferred career choices when having career conversations with their advisors. For example, we found a more pronounced effect of presenting actual data on faculty norms (vs. perceived norms that students hold) for seeking teaching-focused positions compared to the other two career options.



Students viewed teaching-focused positions as more desirable from both their personal and perceived advisors' perspectives after learning about STEM PhD advisors' actual support for different career options. We posit that this is likely because the perceived norms surrounding teaching-focused positions were often viewed as a "back-up" if students were not able to successfully secure an academic-research position; learning that faculty PhD advisors are responsive to students' interests seemed to make teaching a more reasonable option for those who would like to pursue it.

Greater information about the actual norms in terms of advisors' reported responsiveness and openness to varied career options can help change the narrative and shift the norms within academic departments and student-advisor dyads (Sherman et al., 2021). By normalizing conversations about career development, whether it is through informal channels such as regular check-ins with students, or formal channels such as incorporating career goals in students' individual development plans (IDP, National Institute of General Medical Sciences, 2022), explicitly signaling advisors' support for different career paths can encourage students to feel more comfortable about reaching out to advisors and alumni to learn more about their career development. This research thus suggests a more general point: If mentors proactively and regularly incorporate topics about career development and goals, the perceived norms about career development among those whom they mentor could become much closer and aligned with the actual norms. This, in turn, could yield benefits for both the organization and the employees by facilitating greater occupational fit and satisfaction.

### 8.3 | Limitations and future directions

There are several limitations to this study. First, in Study 1A and Study 1B, we did not have a matched sample of PhD students and advisors. We were not able to examine the accuracy of career perceptions and concerns among student-advisor dyads, or specific ways in which pluralistic ignorance affects normative perceptions and, subsequently, comfort in career discussions. Future research that examines student-advisor dyads together would foster a greater understanding of this dynamic relationship and how information about careers is communicated and understood.

Additionally, it is important to note that the effect sizes observed in Study 2 were small. One possible explanation for the small effect size was that the intervention was relatively simple and brief as we only presented information about career preferences from both PhD students and advisors to the participants. Norm interventions are often much more prolonged and in greater prevalence (e.g., dorm and departmental campaigns, Turner et al., 2008). Nonetheless, participants' greater comfort after learning about actual norms provided some initial evidence that implementing a larger-scale norm intervention could further contextualize students' experience with career development and further examine the impact of the norm intervention.

Another issue is that the studies utilized a cross-sectional design and were unable to evaluate changes among students as they progress in the program. For example, 46.4% of the students in our Study 2 sample who

were early in their PhD career (Years 1-3) reported that their career preference remained the same, 33.3% were unsure, and 20.3% has changed; whereas 52.4% of the students who were late in their PhD career (Year 4 and beyond) reported that their career preferences have changed, compared to 30.2% were unsure, and 17.5% career preference remained the same (see supplementary materials for more discussions on impact of other demographic characteristics on career preferences). Future studies could take a longitudinal approach to evaluate students' experience with career discussions and inform students about advisor's attitudes and career preferences at the start of their program. That would enable a more complete examination of students' perceived career norms in different stages of the program, students' career goals and concerns, as well as their interactions with their advisors.

Finally, this research was conducted within one particular context—academic institutions, and one particular dyad—PhD students and their advisors. Future research would benefit by expanding this methodological approach to examine other occupational contexts where choices are influenced by the mutual understandings of mentors and mentees.

## 9 | CLOSING THOUGHTS

Individuals make inferences and behave in ways that they perceive to be normative and acceptable in a social context. However, these perceptions may not be accurate, and individuals could experience pluralistic ignorance where they have false assumptions about one another in social interactions. While the present set of studies focused on career preferences among PhD student-advisor dyads, pluralistic ignorance could have an impact on the pipeline across different stages of higher education, as well as in other organizations. For example, undergraduate students could overestimate the degree to which their professors value graduate school for them and orchestra students could reject personal advice about becoming a professional musician (vs. less risky choices such as a music educator) because they did not realize it was normative (see Dobrow & Tosti-Kharas, 2012).

Dispelling pluralistic ignorance by revealing actual norms led to some positive outcomes, such as increased comfort in having conversations and correcting misperceptions. It is easy to imagine that other industries have an analogous set of misconceptions between managers and employees, focusing on aspects of career advancement, that arise due to poor communication. To adapt to the changing landscape of graduate education in STEM, and to streamline the higher education pipeline and cultivate a more diverse workforce, it is important to identify and dispel areas where potential misunderstanding could arise.

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### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in OSF at <https://osf.io/b7hkn/>.

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## ENDNOTES

- <sup>1</sup> In the context of the questionnaire, it was clear that teaching career meant a career at a college or university that serves primarily undergraduate students.
- <sup>2</sup> We computed percent agreement between both coders instead of Kappa values due to the imbalance in case distribution in our sample (i.e., occurrence of a theme being reflected in a given category was relatively low, resulting in low Kappa values, known as the first Kappa Paradox; Feinstein & Cicchetti, 1990).
- <sup>3</sup> We also performed a series of independent sample t-tests to rule out the possibility that participants who did not provide adequate responses or skipped the open-ended questions were less comfortable having career discussions generally, and in each career option. Participants who responded to the prompts were equally comfortable (as indicated on a 10-point scale anchored at 0 and 10) discussing industry, teaching-focused, and academic research positions than those who did not. See SOM for specific values.
- <sup>4</sup> We have also explored how career option, norm condition, and perspectives (self vs. perceived advisor) affect participants' ratings for each of the three career options, see SOM for more details.

## REFERENCES

- Austin, A. E. (2002). Preparing the next generation of faculty: Graduate school as socialization to the academic career. *The Journal of Higher Education*, 73(1), 94–122. <https://doi.org/10.1080/00221546.2002.11777132>
- Corbin, J., & Strauss, A. (2008). *Strategies for qualitative data analysis*. SAGE Publications, Inc. <https://doi.org/10.4135/9781452230153>
- Dobrow, S. R., & Tosti-Kharas, J. (2012). Listen to your heart? Calling and receptivity to career advice. *Journal of Career Assessment*, 20(3), 264–280.
- De Souza, L., & Schmader, T. (2022). The misjudgment of men: Does pluralistic ignorance inhibit allyship? *Journal of Personality and Social Psychology*, 122(2), 265–285. <https://doi.org/10.1037/pspi0000362>
- Feinstein, A. R., & Cicchetti, D. V. (1990). High agreement but low kappa: I. The problems of two paradoxes. *Journal of Clinical Epidemiology*, 43(6), 543–549. [https://doi.org/10.1016/0895-4356\(90\)90158-I](https://doi.org/10.1016/0895-4356(90)90158-I)
- Fuhrmann, C. N., Halme, D. G., O'Sullivan, P. S., & Lindstaedt, B. (2011). Improving graduate education to support a branching career pipeline: Recommendations based on a survey of doctoral students in the basic biomedical sciences. *CBE—Life Sciences Education*, 10(3), 239–249. <https://doi.org/10.1187/cbe.11-02-0013>
- Halbesleben, J. R. B., Wheeler, A. R., & Buckley, M. R. (2007). Understanding pluralistic ignorance in organizations: Application and theory. *Journal of Managerial Psychology*, 22(1), 65–83. <https://doi.org/10.1108/02683940710721947>
- Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology*, 8(1), 23–34. <https://doi.org/10.20982/tqmp.08.1.p023>
- IBM Corp. Released 2021. IBM SPSS Statistics for Macintosh, Version 28.0. Armonk, NY: IBM Corp.
- Miller, D. T., & Prentice, D. A. (2016). Changing norms to change behavior. *Annual Review of Psychology*, 67(1), 339–361. <https://doi.org/10.1146/annurev-psych-010814-015013>
- National Institute of General Medical Sciences. (2022). *Individual development plans*. <https://nigms.nih.gov/training/strategicplanimplementationblueprint/Pages/IndividualDevelopmentPlans.aspx>

- National Science Foundation. (2023). *Survey of doctoral recipients, 2021*. <https://ncses.nsf.gov/pubs/nsf23319>
- O'Connor, C., & Joffe, H. (2020). Intercoder reliability in qualitative research: Debates and practical guidelines. *International Journal of Qualitative Methods*, 19, 160940691989922. <https://doi.org/10.1177/1609406919899220>
- Prentice, D. A., & Miller, D. T. (1993). Pluralistic ignorance and alcohol use on campus: Some consequences of misperceiving the social norm. *Journal of Personality and Social Psychology*, 64(2), 243–256. <https://doi.org/10.1037/0022-3514.64.2.243>
- Prince, M. A., & Carey, K. B. (2010). The malleability of injunctive norms among college students. *Addictive Behaviors*, 35(11), 940–947. <https://doi.org/10.1016/j.addbeh.2010.06.006>
- Sargent, R. H., & Newman, L. S. (2021). Pluralistic ignorance research in psychology: A scoping review of topic and method variation and directions for future research. *Review of General Psychology*, 25(2), 163–184. <https://doi.org/10.1177/1089268021995168>
- Sauermann, H., & Roach, M. (2012). Science PhD career preferences: Levels, changes, and advisor encouragement. *PLoS One*, 7(5), e36307. <https://doi.org/10.1371/journal.pone.0036307>
- Sherman, D. K., Nelson, L. D., & Ross, L. D. (2003). Naï realism and affirmative action: Adversaries are more similar than they think. *Basic and Applied Social Psychology*, 25(4), 275–289. [https://doi.org/10.1207/S15324834BASP2504\\_2](https://doi.org/10.1207/S15324834BASP2504_2)
- Sherman, D. K., Ortosky, L., Leong, S., Kello, C., & Hegarty, M. (2021). The changing landscape of doctoral education in science, technology, engineering, and mathematics: PhD students, faculty advisors, and preferences for varied career options. *Frontiers in Psychology*, 12, 1–22. <https://www.frontiersin.org/article/10.3389/fpsyg.2021.711615>
- Thiry, H., Laursen, S. L., & Loshbaugh, G. (2015). “How do I get from here to there?” An examination of Ph.D. science students' career preparation and decision making. *International Journal of Doctoral Studies*, 10, 237–256. <https://doi.org/10.28945/2280>
- Turner, J., Perkins, H. W., & Bauerle, J. (2008). Declining negative consequences related to alcohol misuse among students exposed to a social norms marketing intervention on a college campus. *Journal of American College Health*, 57(1), 85–94. <https://doi.org/10.3200/JACH.57.1.85-94>
- Woolston, C. (2019). A message for mentors from dissatisfied graduate students. *Nature*, 575(7783), 551–552. <https://doi.org/10.1038/d41586-019-03535-y>
- Woolston, C. (2022). “I Don't want this kind of life”: Graduate students question career options. *Nature*, 611, 413–416. <https://doi.org/10.1038/d41586-022-03586-8>
- Yin, R. K. (2016). *Qualitative research from start to finish* (2nd ed). The Guilford Press.

## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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