Professorial fit: perceptions of engineering postdoctoral scholars

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Abstract

Purpose – This study aims to explore the perceptions of a diverse set of 16 engineering postdoctoral scholars regarding their fit for the professoriate. The professoriate speaks to the body of tenured/tenure-track faculty within higher education institutions.

Design/methodology/approach – An intrinsic case study design was conducted to provide an in-depth understanding of the factors influencing engineering postdoctoral scholars' perceived professorial fit using person–job fit theory.

Findings – As a result of inductive and deductive data analyses techniques, four themes emerged: the professoriate is perceived as a calling for those who desire to teach and mentor the upcoming generation of engineers; research autonomy in the professoriate is highly attractive; the work demands of the professoriate are contrary to the work–life balance sought; and the professoriate appears daunting due to the competitive nature of the job market and the academic environment.

Originality/value – This study is critical for those invested in possessing a deeper understanding of the postdoctoral career stage, its relationship to the professoriate as a career choice and broadening participation in engineering academia.

Keywords Person–job fit, Intrinsic case study, Engineering postdoctoral scholars, Professoriate

Paper type Research paper

> "I take pride in the fact that my research has led to two senior design winners and I take pride in working with the students and getting them to do some really good research." ~Tom, Asian male postdoctoral scholar

Fulfillment from teaching and mentoring, as described by Tom, fuels his passion for pursuing a career as a professor. Yet, little is understood about how these experiences translate to the way in which postdoctoral scholars perceive their professorial fit. Understanding how fit is determined is critical for those invested in understanding the postdoctoral career stage, its relationship to the professoriate as a career choice and broadening participation in engineering academia. The professoriate speaks to the body of tenured/tenure-track faculty within higher education institutions. This research investigates professorial fit through an intrinsic case study (Stake, 1995) grounded by person–job fit theory (Edwards, 1991). Scholarship concerning academic engineering career trajectories is sparse on how postdoctoral scholars determine their compatibility for the professoriate (Horta, 2009; Jaeger *et al.*, 2017; Silva *et al.*, 2016; Su, 2013; van der Weijden *et al.*, 2016; Yang and Webber, 2015). The research question that guides this study is as follows:

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RQ1. What factors influence the perceptions of professorial fit among engineering postdoctoral scholars?

Literature review

A postdoctoral appointment has evolved into an essential stepping-stone to entering the engineering professoriate. It affords doctoral recipients with advanced preparation to later assume the roles and responsibilities of a tenure-track faculty member (Andalib *et al.*, 2018; Horta, 2009; Su, 2011, 2013). Engineering postdoctoral positions primarily include an individual's research duties in a laboratory to further their own and their supervisor's research agendas, which can involve collaborating with and mentoring students. Postdoctoral positions also may include formal teaching responsibilities, such as introductory-level engineering courses. Obtaining a postdoctoral appointment in engineering is a powerful influencer and determinant of whether one ascends to the professoriate (Andalib *et al.*, 2018; Silva *et al.*, 2016; Su, 2013; Yang and Webber, 2015). Postdoctoral scholars tend to exhibit higher scholarly outputs and productivity than their non-postdoctoral counterparts, as well as a more mature research vision (Horta, 2009; Su, 2011; Waaijer *et al.*, 2016). Stephan and Ma (2005) found that 80% of higher education institutions do not hire a new tenure-track faculty member who has not served as a postdoctoral scholar, signaling it as a de-facto requirement for an academic position. Yang and Webber (2015) concluded postdoctoral scholars are 6.1% more likely to enter the professoriate than those attempting to do so directly upon completing their doctoral program.

According to van der Weijden *et al.* (2016), a career as a professor is the single most desired career option for postdoctoral scholars in science, technology, engineering and mathematics (STEM), but a recent decline has occurred in academic positions and employment rates for engineering PhD recipients (St. Clair *et al.*, 2017). The main concern for those nearing the completion of their appointment involves the supply-and-demand model surrounding their career choices due to an abundance of postdoctoral scholars in STEM fields and an inadequate number of available academic positions (Silva *et al.*, 2016; Waaijer *et al.*, 2016). Postdoctoral scholars often attempt to weather this actuality by extending their appointment or cobbling together multiple academic positions (Andalib *et al.*, 2018; Waaijer *et al.*, 2016). Recotillet (2007) reported that 20% of postdoctoral scholars enter the private sector despite their desire to be a professor due to a decline in available tenure-track engineering openings.

Although some aspiring professors may face negative career outlooks, postdoctoral positions that boost confidence and self-efficacy predict one's desire to remain in academia (van der Weijden *et al.*, 2016). Encouraging relationships with supervisors and other colleagues also tend to buffer postdoctoral scholars from the stress and burnout that push hopeful academics to turn to industry or governmental employment opportunities (Kim *et al.*, 2019; Van Benthem *et al.*, 2020). Other factors found to draw individuals to the professoriate include an attraction to the life of an academic (Lindholm, 2004); the perception of research autonomy, independence and individual expression (Gibbs and Griffin, 2013; Lindholm, 2004); and a desire to help others (Gibbs and Griffin, 2013; Mendez *et al.*, 2021).

Yet, poor perceptions of the professoriate often occur during graduate school, and some students begin to regard non-academic career options as more suitable (Austin *et al.*, 2009; Burt, 2019; Robinson *et al.*, 2016; Seo *et al.*, 2020). For instance, researchers have found postdoctoral scholars of color often feel discouraged from pursuing the professoriate because marginalization, microaggressions and outright discrimination have marked their

academic experiences (Jaeger *et al.*, 2017; Mendez *et al.*, 2021; Robinson *et al.*, 2016; Yadav *et al.*, 2020). Other factors that have dissuaded hopeful academics include the norms and pressures associated with academia, a general disdain for grant writing, work–life imbalance, inadequate financial compensation, the political climate of higher education and poor supervisorial relationships (Hudson *et al.*, 2018; Kachchaf *et al.*, 2015; Kim *et al.*, 2019; Van Benthem *et al.*, 2020; Yadav *et al.*, 2020). Possessing a greater understanding of perceptions of professorial fit during the postdoctoral career stage can heighten awareness of the relationship between the postdoctoral experience and the intent to pursue a career as a professor, as well as influence broadening participation efforts in engineering academia.

Theoretical framework

Person–job fit theory (Edwards, 1991) is used as the theoretical framework guiding this study. Job fit theory involves two main strands: needs–supplies and demands–abilities. This study focuses on the needs–supplies dimension of fit, as it speaks to compatibility between the work desires of a person and the attributes of a specific job, rather than demands–abilities which centers on the fit between individual abilities and job demands (Edwards, 1991; Kristof-Brown *et al.*, 2005). Person–job fit is considered an elusive concept, but it has been studied using direct inquiry on perceived fit to indirect fit assessments of separately rated individual and job characteristics (Kristof-Brown *et al.*, 2005). Person–job fit theory serves as a component of the interview protocol, the basis of the deductive data analysis process and in considering the study's implications. The use of this theory may advance knowledge on the intersection of engineering postdoctoral scholar needs/desires with the supplies/demands of the professoriate, which can guide understanding of the reasons some postdoctoral scholars vie for a tenure-track faculty position, and others pursue careers in industry, government and national research labs.

Methodology

Research design

An intrinsic case study design (Stake, 1995) grounded by person–job fit theory (Edwards, 1991) was used to explore the perceptions of 16 diverse engineering postdoctoral scholars regarding their fit for the professoriate. Intrinsic case studies are valuable when the case itself is unique and occurs within an authentic, contemporary setting. Cases can be bound to an individual, a group of people or an organization, as well as to a process, project or relationship (Creswell and Poth, 2018). Additionally, Stake (2005) positions case study research as a choice of what to study, extending it beyond a mere methodological approach. Thus, in this instance, this case study is bound by a group of people and a process, engineering postdoctoral scholars considering their next career step. The research question that guided this study was as follows: What factors influence the perceptions of professorial fit among engineering postdoctoral scholars?

Participants

All 16 engineering postdoctoral scholar participants were recruited from the National Postdoctoral Association using a dedicated email alert. Study involvement was incentivized by the provision of a $25 e-gift card. The sample comprised two African Americans, five Asian Americans, three Latinx and six White participants. Seven identified as female and nine as male. Engineering fields included aerospace, biomedical, chemical, education, electrical, environmental health, mechanical and nuclear. All participants were within their first postdoctoral position, had been in their position for at least one year and held appointments at Doctoral Universities with Very High Research Activity, commonly known as R1 institutions (Indiana University Center for Postsecondary Research, 2018). Table 1 provides participant pseudonyms and demographic indicators.

Table 1. Demographic indicators for engineering postdoctoral scholars

Pseudonym	Race/Ethnicity	Gender	Engineering field
Abeo	African American	Male	Biomedical
Amal	Asian American	Male	Mechanical
Angela	Latinx	Female	Biomedical
Armando	Latinx	Male	Chemical
Dhalia	Asian American	Female	Biomedical
Eugene	Latinx	Male	Biomedical
Jian	Asian American	Male	Nuclear
Joe	White	Male	Mechanical
Meadow	White	Female	Biomedical and Electricals
Michael	White	Male	Biomedical
Natalie	White	Female	Education
Pete	White	Male	Biomedical
Scarlett	African American	Female	Biomedical
Talia	Asian American	Female	Biomedical
Tina	White	Female	Aerospace
Tom	Asian American	Male	Environmental Health

Data collection

Per Institutional Review Board approval, all participants were provided with a consent form detailing the purpose of the study, the interview procedures and the safeguards in place to protect their anonymity. The study authors administered the interviews via a one-on-one process through web conferencing or by phone; they were digitally recorded and averaged 60 min in length. We used a semi-structured interview protocol grounded by person–job fit theory (Edwards, 1991). Queries focused on career interests and goals, job needs, appealing and unappealing aspects of the professoriate and confidence and capacity to succeed in a STEM career field. Example questions included as follows:

Q1. What are the favorite parts of your postdoctoral position?

Q2. When have you felt the most successful during your postdoctoral appointment?

Q3. What components of the professoriate are most attractive?

Q4. What are the most important factors determining your career path moving forward?

Great effort was made to build rapport with the participants and to ensure they felt heard and respected by creating a natural, free-flowing dialogue in which we were active listeners in the interview. While the interview protocol was carefully worded and questions were specified in a particular order, the interviews were conducted in an unstructured manner to create a comfortable, genuine dialogue. Upon completing the interviews, the recordings were transcribed by a third-party transcription service; all recordings were permanently deleted once the transcripts were reviewed and cleaned for any errors. All transcripts were then uploaded into the NVivo 12 software platform to organize, analyze and visualize the data.

Reflexivity

Prior to data analysis, we engaged in reflexivity. Reflexivity is integral in qualitative inquiry, as it forces the consideration and exposure of researcher bias in the data analysis process through analytical memoing and dialogue. Experiences, beliefs and values about the arc of the academic career, and that which each considered the job of a professor, were bracketed out both individually and collectively (Patton, 2015). We

separately wrote reflections and then participated in group dialogue to achieve this end. We all agreed the professoriate is a rewarding career for those interested in helping and guiding others, as well as advancing and creating new knowledge. Still, the tradeoffs of being in a highly demanding career field can interfere with personal desires, such as family or even an identity outside of academia. Considering this study focuses on engineering postdoctoral scholars, we found ourselves approaching the research design and implications from an outsider's perspective as none of us possess an engineering background or held a postdoctoral position. Assumptions and predispositions were mitigated to an extent by the similarities and dissimilarities of our research team. We are all women, one identifies as multi-racial and the others as White. We are all social science researchers trained in qualitative methods within educational settings. Two of us are professors and hold administrative roles on our campus, and the other two are part-time research assistants who intend to pursue a tenure-track faculty position in the near future. Our different vantage points allowed for rich dialogue and even debate about our own professorial fit.

Data analysis

Data analysis strategies established by Silverman (1993) and Stake (1995) were used to examine the perceptions of postdoctoral scholars regarding their fit for the professoriate. Silverman's (1993) inductive thematic content analysis technique was employed to search for themes related to the research question. The transcripts were coded individually through three rounds of review before we collectively cross-referenced the codes and the evolving themes. This method allowed for flexibility when approaching research patterns in inductive ways (Silverman, 1993). Process and evaluative codes were created and collapsed into themes to summarize perceptions of professorial fit (Patton, 2015). Process codes included observable and conceptual actions undertaken by the participants, such as mentoring, which served as a larger category for individual experiences such as personal fulfillment from helping others and paying forward support. Evaluative codes included judgments about fit, such as aligned or mismatched. These judgments were wrought with emotion; for example, they shared feelings of anger, confusion, and defeat when their fit was questioned by themselves or others.

Stake's (1995) four-step deductive data analysis process of direct interpretation, categorical aggregation, pattern recognition and naturalistic generalizations was used to refine the themes that initially emerged inductively. A structured coding protocol was designed using person–job fit (Edwards, 1991). The protocol focused the analysis process on fit perceptions relative to job desires and attributes. By applying the first step of Stake's deductive data analysis process, interview transcripts were again reviewed independently using the coding protocol to engender direct interpretation of the perceived fit factors influencing career interest in the professoriate. This process enabled us to draw interpretations consistent with the interview data individually before collectively discussing preliminary findings. In the second step, categorial aggregation was accomplished cooperatively by synthesizing the overarching concepts and ideas drawn from the transcripts in the first step. This stage revealed the aspects of the professoriate that drew participants in and away from pursuing a career in academia, such as a desire to train the next generation of engineers and poor job outcome expectations. Following Stake's (1995) third step of pattern recognition, precise content was developed through grouping associated data, developing fuse codes and refining the themes identified across the interview data. Differing opinions and perspectives were considered and debated until

consensus was met, which occurred naturally, as the positive and negative factors that influenced perceptions of professorial fit were quickly evident.

In the fourth step, naturalistic generalizations occurred by evaluating the themes to ensure they captured the entirety of the data and could be applied broadly (Stake, 1995). Using Silverman's (1993) inductive technique first was crucial in completing this deductive step, as it provided guidance on approaching the interview data sequentially with an expansive view of the interview data and then with a narrow view. This approach allowed for a successively deeper understanding of professorial fit that engendered a diverse array of study implications. After this step, we were better informed of conflicting findings concerning theme development. Four final themes emerged:

(1) the professoriate is perceived as a calling for those who desire to teach and mentor the upcoming generation of engineers;

(2) research autonomy in the professoriate is highly attractive;

(3) the work demands of the professoriate are contrary to the work–life balance sought; and

(4) the professoriate appears daunting due to the competitive nature of the job market and the academic environment.

Trustworthiness

Multiple verification strategies ensured the findings were trustworthy (Lincoln and Guba, 1985). To address credibility and confirmability, we diligently followed the analytical methods of Silverman (1993) and Stake (1995) to ensure the integrity of the inductive and deductive data analysis process (Patton, 2015). To safeguard transferability, thick, rich descriptions with participant direct quotes were incorporated into the findings (Patton, 2015). Dependability was addressed by evaluating how the themes represented the whole text, as negative confirming evidence was included in the findings (Lincoln and Guba, 1985). Dependability also was achieved by involving each of us in discerning and evaluating the identified themes through the employment of several feedback loops during the data analysis process and by engaging in reflexivity throughout the data collection and analysis processes.

Limitations

While the study's design attended to uncovering researcher bias through the process of reflexivity, we cannot absolve ourselves from the fact that confirmation bias could have affected our findings and interpretations. We believe strongly in the need to better understand the postdoctoral career stage and its implications for broadening participation in engineering academia which could have clouded our ability to remain open to the possibility that no relationship exists between the two. Demographically the participants are diverse in race/ethnicity, gender, age and engineering sub-discipline. Still, all hold postdoctoral positions at R1 institutions, limiting the transferability of their experiences to others in different institutional contexts. Finally, this study was designed to ascertain perceptions of professorial fit among engineering postdoctoral scholars in their postdoctoral appointment, which limited attention to undergraduate and graduate student socialization experiences that certainly influence present perceptions. And while demographic information was collected from participants, their socially constructed identities were considered supplemental to the interview data. This methodological decision restricts understanding where perceptions and experiences are nuanced along identity lines.

Findings

A call to teach and mentor

All participants perceived the professoriate as a calling to teach and mentor the upcoming generation of engineers. Several discussed their desire at an early age to teach, as was the case with Eugene, who studied the vaccine for malaria in a high school biology class. He became so enthralled in the scientific method that he became "inspired to teach about research, how to carry research out, and influence others thinking about the importance of research." Jian indicated, "I had this idea about my career from an early age, I love to teach and wanted to teach and be a professor." These formative experiences laid the foundation for nearly all the participants' interest in teaching. These early experiences, coupled with collegiate instructional opportunities, solidified their decision to base their career around teaching, as was shared by Angela:

> The other thing I did in undergrad that I think cemented my love of teaching and is the main reason why I continue to be on that academic path as opposed to, say, doing research at a company or a national lab is that [. . .] I tutored at our learning center. And I always enjoyed that. And so that was also like, "No, this is what I'm supposed to do. I want to research, and I want to teach."

The "sheer joy" they received from teaching was a decisive factor for each postdoctoral scholar as they considered their professorial fit. The potential to teach and mentor future engineers was noted as a passion they hope to continue in their careers. Talia shared, "I would like to teach in the future. I don't know if that's more lecturing undergrad or more mentoring graduate students or mentoring postdoc assignments." She envisions a career in mentoring and believes her dream can become a reality only in academia.

Participants who primarily are interested in teaching are aware it could affect their prospect of a tenure-track faculty position and obtaining tenure, as described by Natalie:

> I'm still trying to decide after I finish my postdoc whether I want to do tenure-track at a smaller teaching, focused school or if I want to do just instructor/lecturer type, non-tenure-track positions. But definitely interacting with students, the curriculum development, and the teaching aspect of higher ed is what draws me to that career path.

Her positive teaching experiences attract her to an academic position that will allow her to emphasize teaching in her career. Even those intending to pursue a career in industry expressed enjoyment in teaching. As stated by Armando, "Experiences that I had during my PhD were very rewarding in terms of teaching others, like being a mentor for all the undergrads and also being a mentor for all my lab mates." Despite these positive experiences, he believes industry is a better career fit because he is confident he can reproduce these teaching and mentoring opportunities across any career field.

The prospect of working with students through teaching and mentoring was noted as the principal reward for persevering through graduate school and postdoctoral appointments. This theme was particularly true for the postdoctoral scholars of color, as they spoke in unison about their passion for guiding the next generation of engineers of color. The positive emotions engendered from teaching and mentoring distinctly solidified their perceived professorial fit. Person–job fit theory (Edwards, 1991) indicates that the participants' personal desires fit their career aspirations because their primary job responsibilities would entail close work with students.

Research autonomy

When considering their professorial fit, participants consistently discussed the positives of an autonomous career field. Postdoctoral scholars repeatedly spoke of a future in the

professoriate that would allow them to set their own career goals, pursue personal research interests, design scholarly projects, and be "their own boss." Angela noted, "I'm personally kind of tired of being a trainee, and not being fully independent to make my own decisions [. . .] from conferences to attend to how much time I spend in the lab." Her supervisor's research agenda currently dictates her schedule, but she believes the transition to a tenure-track faculty position can allow her the independence she desires. Michael echoed the sentiments of autonomy in the following statement:

> I think that'd be really nice to have the flexibility to explore the science you want to explore. I know that when you're an investigator, let's say at a private company, like a for-profit company, you obviously have an agenda that may or may not be what you really want to do research on.

Pete also reiterated the value of autonomy, "For me, the most appealing part of [being a professor] would be being able to really set my own research questions. Then decide what it is I want to figure out. Then try to figure it out." Similarly, Dhalia indicated, "I am going to stay in academia because there are less constraints. I feel like I might be able to be more independent and be more self-motivated." The postdoctoral scholars consistently noted the value of independence as a "must-have" in their future careers.

Other participants discussed how autonomy bolstered their perception of professorial fit. Meadow shared why she believes academia is a better fit for her than industry, "When I was considering industry versus academia, I just had a lot more freedom in academia, and I can work on the things I'm interested in." Individuals assumed the professoriate would provide the independence necessary to chart their workload and career trajectories, which was the main fit factor. Yet, Armando doubted the autonomy of the professoriate when he shared a lack of freedom in his current postdoctoral work, "Some of the projects or ideas that I suggested never came through because either it wasn't of interest, or maybe because of the approach, or the budget. It has been a tough learning curve into lowering my very high expectations." Autonomy for this individual was rare, which dissuaded him from characterizing the professoriate as a career of independence, as was noted by others. While this perception was the minority opinion, it was an important insight.

Almost all participants indicated research autonomy was a major fit consideration for pursuing a career as a professor. Abeo shared he is completing his faculty application package and consistently finds his career goals moving forward are "to run my own lab, to develop independent research ideas. Do things that I'm curious about." According to person–job fit theory (Edwards, 1991), the perceived degree of autonomy in the professoriate served as a vital fit factor that influenced professorial career intentions. The postdoctoral scholars found autonomy and freedom were attractive attributes of the professoriate that aligned well with their work desires, strengthening their academic career interests and perceptions of professorial fit.

Unachievable work–life balance

The majority of the postdoctoral scholars spoke of their desire for a work–life balance when considering their fit for the professoriate. Tina stated, "Work-life balance plus a positive work environment is really big; I think those two things together are what will lead to overall happiness in my life." Scarlett echoed this sentiment:

> In general, if I could have a happiness balance and a healthy balance in my work [. . .] especially when you consider deadlines, you overlook that, and people become unhealthy, which makes them unhappy. So, if I could be somewhere that, you know, endorses that, that's really important.

Work–life balance was an essential factor influencing perceived professorial fit for almost all participants, particularly the women.

Nevertheless, the absence of work-life balance was consistently noted as an inevitable component of the professoriate. Examples were commonly shared that the imbalance is exacerbated in academia compared to other career fields. Angela said, "This pressure to work all the time. . .just publishing to publish and raising funds to raise funds. And that even though you have freedom, sometimes you don't." She found these demands were extensive and exhausting and pushed many postdoctoral scholars to perceive the professoriate as incompatible with their desire for work–life balance. Most indicated they, their mentors, and their supervisors lacked work–life balance. Meadow stated, "A lot of the faculty I interacted with on the tenure-track were very stressed about finding money and stressed about getting a certain number of publications to get promoted. And that just wasn't something that really appealed to me." This type of "inevitable stress" and unhealthy work–life balance caused many postdoctoral scholars to reconsider their desire to enter the professoriate. As a result, they were more receptive to career prospects outside academia.

Similar sentiments were shared by Joe, who indicated the time and effort required to be a professor did not coincide with his current personal priorities:

> I briefly considered a career in academia [. . .] I feel like it would be something that may require a lot of hours, and I'm just recently married, and we're looking to start a family. So the thought of having to commit to all those hours on the early end, right as I'mstarting a family and trying to build my personal life, I tend to shy away from that.

Time was considered a precious resource that had no bounds relative to the professoriate, influencing participants to consider industry, national research labs and governmental work to ease their work-life balance concerns. Meadow indicated work-life balance was the main reason for choosing against pursuing an academic career:

> I think that if I were to not go for it, it would be somewhat because of feeling like I wouldn't be able to have a work-life balance. And maybe being afraid [. . .] that sometimes you feel like you're judged for not making your work the only thing you care about.

Most postdoctoral scholars indicated that the nonexistence of work-life balance in academia was characterized as a significant fit concern relative to entering the tenure-track job market.

The reason many postdoctoral scholars do not enter the tenure-track job market may be apparent when considering their desire to achieve work–life balance. The perception that this balance is unattainable, coupled with the intense pressure to sacrifice everything for one's work, appeared to lure hopeful academics to a career outside academia in which a balance was assumed to be manageable. According to person–job fit theory (Edwards, 1991), the lack of perceived work–life balance served as a warning against potential professorial fit due to its adverse influence on academic career interests, despite the indication that the professoriate offers an unparalleled level of freedom and autonomy not found in other employment sectors.

Competitive job market and academic environment. While the perceived fit for the professoriate was strong among the participants, half expressed concern regarding the competitive nature of the job market. They doubted their ability to secure a tenure-track position due to the limited number of available positions. Joe indicated:

> The fact that there are so few of them and they're so competitive makes it a little bit less appealing because it seems like I've got to do, well, a lot more than what I've done, in order to get the type of faculty position that I would really like [. . .] there is something likemaybe 10 new faculty positions for every 200 PhDs.

Jian expressed similar sentiments, "Students are realizing on their own, oh, I'm not likely to become faculty [. . .] that the real chances are sort of low. So, I'm going to hedge my bets and apply and do these other things." Nearly every participant indicated their concern about their likelihood of landing a tenure-track position, which led them to question their professorial fit. This concern may have served as a self-fulfilling prophecy, as some were not certain they would even enter the tenure-track job market despite their interest. By default, they were considering career options in government, industry and national research labs.

The overarching theme of competition also was discussed relative to its influence on the work relationships and environment within academia. Specifically, postdoctoral scholars focused on how the competitive and even "ruthless" nature of the field and potentially limited positions create undue strife among colleagues. Scarlett said, "It's a space that seems like it can be highly competitive in a nasty way, where people aren't supportive or collaborative of one another. That's a place that I don't want to be." Abeo discussed his view on the role of competition in academia, "I've been in environments during my PhD where it felt very competitive [. . .] where it didn't seem quite as collaborative as I hoped it would be [. . .] there wasn't that much incentive that I observed among professors to work together." The competitive environment of academia appeared to lead some postdoctoral scholars to question their fit for a career as a professor.

Some of the participants felt they did not "publish enough to be competitive in the job market" during their postdoctoral appointment, although they believe they gained new engineering skills that would benefit them and others if they were to pursue a tenure-track position. One postdoctoral scholar, Amal, shared that his supervisor told him he was unqualified to work at a top institution, which signaled the professoriate was not the right fit for him. When faced with limited prospects and a lack of support, most turned to industry as their next career because they felt it was a better fit for their realities. While the majority continued to express an interest in a professorship, they voiced concern about the competitive nature of the field and their fit for a career that appears to be "full of pressure" and lacking collaboration and collegiality. In reference to person–job fit (Edwards, 1991), participants questioned their professorial fit because positive job outcome expectations dwindled. Despite believing they possessed the abilities to succeed as a professor, they felt unprepared to be a competitive candidate in the tenure-track job market. This realization, along with the competitive nature of academia, led participants to question their fit for the professoriate.

Discussion

Broadening participation in STEM fields, and particularly in the engineering discipline, is of paramount importance to the scientific and educational communities because the USA is failing to leverage the talents and skillsets of all citizens, particularly those who have historically been excluded from accessing the opportunities of education, such as people of color and women. As a result, the nation is deficient in the human capital necessary to be competitive in engineering in the 21st century (NSF, 2018). Sharing the viewpoints and insights of a diverse set of postdoctoral scholars who are next in line to assume tenure-track faculty roles through an intrinsic case study may provide direction and guidance on how perceived professorial fit influences career choice. This understanding may be particularly instructive to those invested in increasing the pool of competitive candidates entering the tenure-track faculty job market. Future studies are planned to focus narrowly on the experiences of postdoctoral scholars of color and women, but this study intentionally sought to encompass the experiences of White males to provide a comprehensive picture of perceptions of fit. Interestingly, these perceptions consistently crossed racial/ethnic and

gender lines. Thus, this study responds to the call in the literature regarding the need to better understand the factors that influence postdoctoral scholars to pursue the professoriate (Horta, 2009; Jaeger *et al.*, 2017; Silva *et al.*, 2016; Su, 2013; van der Weijden *et al.*, 2016; Yang and Webber, 2015).

The findings of this intrinsic case study (Stake, 1995) provide unique standpoints on factors considered by postdoctoral scholars to be areas of fit when weighing the pursuit of a tenure-track faculty position. The greatest fit was found by those who feel the professoriate is a calling to teach and mentor the next generation of engineers. Each shared stories of mentors and supervisors who shaped their interest in engineering and helped to bolster their STEM identity – the ways in which individuals come to believe they belong and can succeed in a STEM career field. These experiences profoundly impacted the participants, as each noted a desire to pay forward the mentorship and guidance they received. These findings support the work of other scholars who found individuals aspiring to the professoriate intend to use their academic platform to help and support others (Gibbs and Griffin, 2013; Mendez *et al.*, 2021).

The autonomous nature of academia and the ability of the participants to determine their research agenda and follow their scholarly interests also produced perceptions of fit for the professoriate. This finding is supported explicitly in the work of Gibbs and Griffin (2013) and Lindholm (2004). While autonomy certainly is a component of the professoriate, some postdoctoral scholars possess an unrealistic view of how autonomy plays out in practice. It is often coupled with managing a heavy workload and chronic stress, with intense pressures to secure external funding and publish to make successful progress toward tenure (Eddy and Gaston-Gayles, 2008; Hudson *et al.*, 2018; Kachchaf *et al.*, 2015; Van Benthem *et al.*, 2020).

One factor that influenced the postdoctoral scholars to perceive a mismatch with the professoriate involves the work–life imbalance modeled by supervisors and mentors, which sent messages of balance being unachievable and even disparaged in academia. This imbalance led most participants to consider a career in industry, government or national research labs as better suited for their intended work–life balance pursuits. As found by other researchers, poor supervisor support, organizational behavior and departmental norms that promote work–life imbalance play a negative role in whether one pursues a career in academia (Eddy and Gaston-Gayles, 2008; Hudson *et al.*, 2018; Kachchaf *et al.*, 2015; Kim *et al.*, 2019; Van Benthem *et al.*, 2020). An unhealthy work environment negatively influenced participants' career choices away from the professoriate, as many of these hopeful academics shared professorial fit uncertainty regarding personal work–life desires.

Finally, the postdoctoral scholars questioned their fit due to their disillusionment with the limited number of available tenure-track faculty positions. Some even referenced their desire to remain in their postdoctoral appointments for an extended period to delay the arduous task of applying for tenure-track faculty positions in the constrained job market for engineering professors. This research emphasizes the competitive and compressed market discourages interest in the professoriate, as noted by other scholars (Andalib *et al.*, 2018; Kachchaf *et al.*, 2015; Recotillet, 2007; St. Clair *et al.*, 2017; Silva *et al.*, 2016; Waaijer *et al.*, 2016).

Implications

The theoretical propositions of person–job fit theory (Edwards, 1991) underpin the ways in which engineering postdoctoral scholars view their fit for the professoriate. Knowledge of the fit factors that negatively deter engineering postdoctoral scholars from entering the tenure-track job market and, more importantly, the factors that encourage and inspire them into this career field, contribute to the literature due to the lack of attention devoted to this career stage. The needs-supplies dimension of person–job fit allows for specific consideration of the alignment of the participants' job desires and the professoriate's work

attributes. While most believe they possess the ability to be successful professors, they question their professorial fit. Supervisors interested in bolstering fit perceptions should consider how to purposely weave mentoring opportunities in the postdoctoral role since the idea of "connecting with others" and "giving back" was not only attractive and personally fulfilling but also strengthened professorial career interests. This point is particularly salient among the postdoctoral scholars of color, but in general, nearly all discussed a desire to pay forward the support they received. In addition, promoting the research autonomy of postdoctoral scholars through nurturing their scholarly independence also would be fruitful in reinforcing perceived professorial fit.

Future research

An area for future research and exploration involves the need to further dissect and study person–job fit theory (Edwards, 1991) in the context of academia. This theory has nearly a 100-year history in management-related studies in business, but none were found in the higher education literature. Related fit theories, such as person-organization fit and person-group fit, would also be interesting to explore. For example, while a few postdoctoral scholars feel confident about their person–job fit, they are uncertain about their person–organization fit because they fail to feel cared for and valued by their institutions. Furthermore, a longitudinal approach to studying fit factors could provide greater insight into the career arc of postdoctoral scholars, particularly with a comparison of those who pursue academia versus government, industry or national research labs. A study over time may provide a more in-depth understanding of perceived professorial fit and its relationship with career outcomes such as trajectory, satisfaction and success. Expanding perceptions of professorial fit that include undergraduate and graduate experiences can be informative to those interested in socialization across this critical educational period. Additionally, it may be instructive to apply quantitative methods to perceived professorial fit by testing the relationship between perception and reality. It is a common approach applied in management-related studies of fit.

Relative to the current study, additional research is needed to increase awareness of ways to leverage the identified positive fit factors to ensure a smooth transition from postdoctoral scholar to tenure-track faculty member and to broaden participation. Focus is warranted on the experiences of postdoctoral scholars of color, as nearly all reported "unsupportive" or "hostile" environments during their graduate work and/or postdoctoral appointment, which led them to question their "stamina and resiliency to make it as a professor." Considering how race/ethnicity and gender intersect in regard to perceived professorial fit also may be fruitful in developing greater awareness of postdoctoral experiences, as a substantial body of work exists in this area with STEM doctoral students (Litson *et al.*, 2021; McGee *et al.*, 2021). Insight on how these negative fit factors affect the most well-positioned postdoctoral scholars to consider diverting from academia holds implications for the diversification of the professoriate. Similarly, additional efforts should be made to separate the effects of early experiences on socially constructed identities within postdoctoral appointments. Further delineating its influences on postdoctoral career paths can aid in better understanding successful broadening participation efforts. Additionally, nearly all participants indicate a desire to pay forward the mentorship and guidance they received; these altruistic motivations call for further study, as they profoundly influenced perceptions of professorial fit.

Conclusion

This intrinsic case study (Stake, 1995) grounded by person–job fit theory (Edwards, 1991) provides a deeper understanding of perceived professorial fit among

engineering postdoctoral scholars. A case study approach was appropriate given the value of generating a better understanding of how engineering postdoctoral scholars weigh their next career step, as it has implications for the engineering workforce in and out of academia. The findings indicate fit is strong when the postdoctoral scholars distinguish the professoriate to be a calling to teach and mentor the next generation of engineering scholars and when they prefer to be in an autonomous career field. These factors overshadow perceptions that work-life balance is unachievable or that the job market and academic environment are overly competitive. Thus, this study offers a nuanced understanding of the factors postdoctoral scholars consider when assessing their professorial fit and career prospects. As these fit factors cross race/ethnicity and gender lines, they can be leveraged within academia to bolster fit perceptions by postdoctoral supervisors, which ultimately can increase the pool of competitive candidates entering and diversifying the engineering professoriate.

References

Andalib, M.A., Ghaffarzadegan, N. and Larson, R.C. (2018), "The postdoc queue: a labour force in waiting", *Systems Research and Behavioral Science*, Vol. 35 No. 6, pp. 327-348, doi: 10.1002/sres.2510.

Austin, A.E., Campa, H., Pfund, C., Gillian-Daniel, D.L., Mathieu, R.D. and Stoddart, J. (2009), "Preparing STEM doctoral students for future faculty careers", *New Directions for Teaching and Learning Monograph Learning*, Vol. 2009 No. 117, pp. 83-95, doi: 10.1002/tl.346.

Burt, B.A. (2019), "Toward a theory of engineering professional intentions: the role of research group experiences", *American Educational Research Journal*, Vol. 56 No. 2, pp. 289-332, doi: 10.3102/0002831218791467.

Creswell, J.W. and Poth, C.N. (2018), *Qualitative Inquiry and Research Design: Choosing among Five Approaches*, 4th ed., Sage.

Eddy, P.L. and Gaston-Gayles, J.L. (2008), "New faculty on the block: issues of stress and support", *Journal of Human Behavior in the Social Environment*, Vol. 17 Nos 1/2, pp. 89-106, doi: 10.1080/10911350802168878.

Edwards, J.R. (1991), "Person-job fit: a conceptual integration, literature review, and methodological critique", in Cooper, C.L. and Robertson, I.T. (Eds), *International Review of Industrial and Organizational Psychology*, Wiley, Vol. 6, pp. 283-357.

Gibbs, K.D. and Griffin, K.A. (2013), "What do I want to be with my PhD? The roles of personal values and structural dynamics in shaping the career interests of recent biomedical science PhD graduates", *CBE—Life Sciences Education*, Vol. 12 No. 4, pp. 711-723, doi: 10.1187/cbe.13-02-0021.

Horta, J. (2009), "Holding a post-doctoral position before becoming a faculty member: does it bring benefits for the scholarly enterprise?", *Higher Education*, Vol. 58 No. 5, pp. 689-721, doi: 10.1007/s10734-009-9221-1.

Hudson, T.D., Haley, K.J., Jaeger, A.J., Mitchall, A., Dinin, A. and Dunstan, S.B. (2018), "Becoming a legitimate scientist: science identity of postdocs in STEM fields", *The Review of Higher Education*, Vol. 41 No. 4, pp. 607-639, doi: 10.1353/rhe.2018.0027.

Indiana University Center for Postsecondary Research (2018), "The carnegie classification of institutions of higher education", Bloomington, IN, available at: https://carnegieclassifications.iu.edu/, (accessed 16 December 2021).

Jaeger, A.J., Hudson, T.D., Pasque, P.A. and Ampaw, F.D. (2017), "Understanding how lifelong learning shapes the career trajectories of women with STEM doctorates: the life experiences and role

negotiations (LEARN) model", *The Review of Higher Education*, Vol. 40 No. 4, pp. 477-507, doi: 10.1353/rhe.2017.0019.

Kachchaf, R., Ko, L., Hodari, A. and Ong, M. (2015), "Career-life balance for women of color: experiences in science and engineering academia", *Journal of Diversity in Higher Education*, Vol. 8 No. 3, pp. 175-191, doi: 10.1037/a0039068.

Kim, J., Ott, M. and Dippold, L. (2019), "University and departmental influences on scientists' occupational outcomes", *Research in Higher Education*, Vol. 61 No. 2, pp. 197-228, doi: 10.1007/s11162-019-09584-6.

Kristof-Brown, A.L., Zimmerman, R.D. and Johnson, E.C. (2005), "Consequences of individuals' fit at work: a meta-analysis of person-job, person-organization, person- group, and person-supervisor fit", *Personnel Psychology*, Vol. 58 No. 2, pp. 281-342, doi: 10.1111/j.1744-6570.2005.00672.x.

Lincoln, Y.S. and Guba, E.G. (1985), *Naturalistic Inquiry*, Sage.

Lindholm, J.A. (2004), "Pathways to the professoriate: the role of self, others, and environment in shaping academic career aspirations", *The Journal of Higher Education*, Vol. 75 No. 6, pp. 603-635.

Litson, K., Blaney, J.M. and Feldon, D.F. (2021), "Understanding the transient nature of STEM doctoral students' research self-efficacy across time: considering the role of gender, race, and first-generation college status", *Frontiers in Psychology*, Vol. 12, doi: 10.3389/fpsyg.2021.617060.

McGee, E.O., Botchway, P.K., Naphan-Kingery, D.E., Brockman, A.J., Houston, S. and White, D.T. (2021), "Racism camouflaged as impostorism and the impact on black STEM doctoral students", *Race Ethnicity and Education*, doi: 10.1080/13613324.2021.1924137.

Mendez, S.L., Starkey, K.E., Cooksey, S.E. and Conley, V.M. (2021), "Environmental influences on the STEM identity and career intentions of Latinx STEM postdoctoral scholars", *Journal of Hispanic Higher Education*, doi: 10.1177/1538192721992436.

National Science Foundation (2018), "Building the future: investing in discovery and innovation–NSF strategic plan for fiscal years 2018-2022", NSF, Washington, DC, available at: www.nsf.gov/pubs/2018/nsf18045/nsf18045.pdf (accessed 30 July 2019).

Patton, M.Q. (2015), *Qualitative Research and Evaluation Methods*, 4th ed., Sage.

Recotillet, I. (2007), "PhD graduates with post-doctoral qualification in the private sector: does it pay off?", *Labour*, Vol. 21 No. 3, pp. 473-502, doi: 10.1111/j.1467-9914.2007.00385.x.

Robinson, W.H., McGee, E.O., Bentley, L.C., Houston, S.L. and Botchway, P.K. (2016), "Addressing negative racial and gendered experiences that discourage academic careers in engineering", *Computing in Science and Engineering*, Vol. 18 No. 2, pp. 29-39, doi: 10.1109/MCSE.2016.38.

Seo, G., Ahn, J., Huang, W.H., Makela, J.P. and Yeo, H.J.T. (2020), "Pursuing careers inside or outside academia? Factors associated with doctoral students' career decision making", *Journal of Career Development*, Vol. 48 No. 6, pp. 1-16, doi: 10.1177/0894845320907968.

Silva, E.A., Des Jarlais, C., Lindstaedt, B., Rotman, E. and Watkins, E.S. (2016), "Tracking career outcomes for postdoctoral scholars: a call to action", *PLoS Biology*, Vol. 14 No. 5, doi: 10.1371/journal.pbio.1002458.

Silverman, D. (1993), *Interpreting Qualitative Data*, Sage.

St. Clair, R., Hutto, T., MacBeth, C., Newstetter, W., McCarty, N.A. and Melkers, J. (2017), "The 'new normal': adapting doctoral trainee career preparation for broad career paths in science", *PLoS One*, Vol. 12 No. 5, doi: 10.1371/journal.pone.0177035.

Stake, R.E. (1995), *The Art of Case Study Research*, Sage.

Stake, R.E. (2005), "Qualitative case studies", in Denzin, N.K. and Lincoln, Y.S. (Eds), *The SAGE Handbook of Qualitative Research*, 3rd ed., Sage, pp. 443-466.

Stephan, P. and Ma, J. (2005), "The increased frequency and duration of the postdoctorate career stage", *American Economic Review*, Vol. 95 No. 2, pp. 71-75, doi: 10.1257/00028280 5774669619.

Su, X. (2011), "Postdoctoral training, departmental prestige and scientists' research productivity", *The Journal of Technology Transfer*, Vol. 36 No. 3, pp. 275-291, doi: 10.1007/s10961-009-9133-3.

Su, X. (2013), "The impact of postdoctorate training on scientists' academic employment", *The Journal of Higher Education*, Vol. 84 No. 2, pp. 239-265, doi: 10.1080/00221546.2013.11777287.

Van Benthem, K., Mohamad, N.A., Corkery, C.T., Inoue, J. and Jadavji, N.M. (2020), "The changing postdoc and key predictors of satisfaction with professional training", *Studies in Graduate and Postdoctoral Education*, Vol. 11 No. 1, pp. 123-142, doi: 10.1108/sgpe-06-2019-0055.

van der Weijden, I., Teelken, C., de Boer, M. and Drost, M. (2016), "Career satisfaction of postdoctoral researchers in relation to their expectations for the future", *Higher Education*, Vol. 72 No. 1, pp. 25-40, doi: 10.1007/s10734-015-9936-0.

Waaijer, C.J.F., Macaluso, B., Sugimoto, C.R. and Larivière, V. (2016), "Stability and longevity in the publication careers of U.S. doctorate recipients", *PLoS One*, Vol. 11 No. 4, doi: 10.1371/journal.pone.0154741.

Yadav, A., Seals, C.D., Soto Sullivan, C.M., Lachney, M., Clark, Q., Dixon, K.G. and Smith, M.J.T. (2020), "The forgotten scholar: underrepresented minority postdoc experiences in STEM fields", *Educational Studies*, Vol. 56 No. 2, pp. 160-185, doi: 10.1080/00131946.2019.1702552.

Yang, L. and Webber, K.L. (2015), "A decade beyond the doctorate: the influence of a US postdoctoral appointment on faculty career, productivity, and salary", *Higher Education*, Vol. 70 No. 4, pp. 667-687, doi: 10.1007/s10734-015-9860-3.

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