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Mentor-mentee relationships in academia: insights toward a fulfilling career

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Over my academic journey, I had the privilege of learning from several insightful professionals in the field of Physiology and Neurosciences. During my graduate and postdoctoral training at seven universities in Brazil, the US and Canada, my mentors were able to stimulate my curiosity and motivation and made me very enthusiastic about science, teaching and especially mentoring. Despite the hurdles that researchers confront daily, having a supportive mentor in a diverse and inclusive workplace influenced my decision to pursue a career in academia. Unfortunately, for the vast majority of graduate students and aspiring scientists, this is not the case. Engaging with colleagues from different fields and cultural backgrounds taught me how students and trainees always expected more from their mentors, on multiple levels. Many studies have shown that high levels of attrition across STEM disciplines, as well as an increased time-to-degree completion, are indicative of this scenario. In this perspective article, I outline the findings of the *ad hoc* research mentorship method, as well as my self-reflections on how we could conquer the major problems correlated with a research mentor-mentee relationship. I specifically illustrate how communication, time, and environment constitute interrelated components that can be managed effectively to produce short and long-term results toward an optimal and fruitful partnership. Finally, I highlighted institutions' critical role in implementing effective mentorship practices, procedures and policies that support mentors and students. These discussions on the importance of appropriate mentorship can assist all levels of mentors in creating a pleasurable pathway for knowledge transmission and contribute to ensuring that a more equal, diverse, and inclusive population of young scientists has the opportunity to excel in their professions.

KEYWORDS

mentor-mentee relationship, attrition, graduate students, post-doctoral trainees, junior faculty members, research mentorship

1. Introduction

Attrition rates and time-to-degree completion serve as crucial indicators of a graduate program's efficacy (Groenvynck et al., 2013). Over the last decade, we have witnessed a higher volume of attrition in graduate education, especially in science, technology, engineering, and mathematics (STEM) areas (Sowell et al., 2015; Levecque et al., 2017; Kis et al., 2022). Furthermore, when we examine the disproportionately under-represented (UR) this scenario becomes much worse (Bowen et al., 1992; Lovitts, 2001; Nettles and Millet, 2006). High attrition rates among STEM doctorate students will significantly impact the future STEM workforce and the country's economies (Golde, 2005; Sowell et al., 2015).

Several initiatives have been undertaken to comprehend the causes of the aforementioned alarming attrition rates. A growing number of research investigations have revealed that graduate students are dissatisfied, anxious, or depressed frequently. They also did not feel welcomed or supported by their mentors or the institution (Golde, 1998; Lovitts, 2001; Sowell et al., 2015; Sithole et al., 2017). These states have a direct impact on mentee effectiveness and efficiency, causing a severe detriment to their mental health (Eby and Allen, 2002; Hyun et al., 2006; Levecque et al., 2017; Nagy et al., 2019; Allen et al., 2022). In this sense, other studies have found that more than 50% of students fail to obtain their Ph.D. degrees (Golde, 1998; Lovitts, 2001; Sowell et al., 2015).

In this context, an effective mentorship is defined as a combination of career and psychosocial support to the mentee that is marked by reciprocal satisfaction, and trust (Eby et al., 2013; Eby and Robertson, 2020). Mentorship is also defined as a "*collaborative learning relationship and working alliance based on intentionality, trust, and shared responsibility for the interactions in that relationship and the effectiveness of those encounters*" (NASEM, 2019).

Indeed, many students and trainees disclose that developing a top-notch long-term mentoring relationship elevated their probabilities of success in STEM (Jeste et al., 2009).

More recently, Tuma and collaborators' remarkable study with 40 US graduate students in life established an ecological system model to define and characterize what factors lead to a poor research mentoring experience (Tuma et al., 2021). To date, the ecological system theory has been used to explore fundamental mentor conduct, which is additionally molded by an assortment of practices, norms and disciplinary cultures found in different places and institutions (Bronfenbrenner, 1977; Chandler et al., 2011). Through a set of exploratory interviews, the results revealed that mentee discontent is typically caused by a lack of mentor knowledge or availability, lack of interpersonal skills, deceit, unequal treatment, interpersonal mismatch, and lack of career or emotional support. Furthermore, the mentor's actions are not the only source of dissatisfaction. The impact from the entire research group, department and institution (collegial protection to mentor, lack of policies to protect mentees against hostile mentor behavior; toxic working environment) and finally the culture of science and research (abusive power structure; lack of incentive to mentor provide a quality mentorship, tension due to misaligning expectations) all play a significant negative role in the relationship among mentor and mentee (Tuma et al., 2021).

The findings laid out herein ought to call our attention and prompt us to inquire "*What are we doing wrong*" and "*How can we do better*"?

A potential rationale for the paucity of attention and acknowledgment given to mentorship in comparison to other professional academic tasks is that it has been neglected over the years (Stolzenberg et al., 2019). In this viewpoint piece, I discuss some of my research mentorship experiences and self-reflections as a graduate student and postdoctoral trainee. I have highlighted three major interdependent components that I feel we should address to significantly increase the quality of a mentor-mentee research connection. The first element, communication, is directly linked with the second one, time. I explore the significance of effective and constant communication between mentor and mentee, as well as the time investment essential to form trusting and enduring relations. The final element, which pertains to time accessibility, is the micro (laboratory and classroom) and macro environment (department, institution) and how they may foster the establishment of effective mentor-mentee interactions. Figure 1 presents some instances that may aid mentors to take more assertive actions and also inform mentees about what to expect from their mentors. Figure 2 provides examples of how the institutional environment and funding agencies may assist the adoption of a cultural change in higher educational institutions that encourages the creation of recurring research-informed mentorship practices.

As previously stated, this manuscript brings forth my take on how we might strengthen mentorship relationships in academia. Readers interested in expanding their knowledge in the study and practice of mentorship are referred to two excellent guides both published in 2019. First, *The Science of Effective Mentorship in STEMM*, was created by the National Academies of Sciences, Engineering, and Medicine (NASEM) (NASEM, 2019). Second, the *STEM mentoring emerging strategies for inclusion,* was published by the American Association for the Advancement of Science (AAAS) (Smith and George, 2019).

2. Elements to enrich mentor-mentee relationships in academia

2.1. Communication: forthcoming, truthful, and continual

Numerous research investigations have found that high-quality mentoring is directly related to graduate students' persistence in academia (McGee and Keller, 2007; Williams et al., 2016). Thus, just as it is in all other professional fields, communication is a valuable ability that should be deeply explored in all phases of our academic trajectory. For instance, even before officially entering a laboratory, students should contact future lab peers to help them to make a better choice of mentor and research environment they envision working. They can get a glimpse of the supervisor's mentorship style, attitude and availability, as well as confirm whether they share comparable research interests, values, and life objectives. Once in a research setting, open and ongoing communication will aid in the development of a tighter and more trustworthy relationship between mentors and mentees (Willemyns et al., 2003; Wanberg et al., 2007). Even brief (but regular) interactions count, especially for junior mentees as they make them feel guided and more confident about their performance. I hold the stance that my learning curve and work enthusiasm were always enhanced when I had the option to be closer to my mentors. Each one, with its own approach, provided me with the opportunity to learn a variety of lessons, most of which were pleasant but occasionally difficult. Furthermore, our friendship has endured over the years, and they have provided support and counsel when needed. Those experiences pushed me to be committed to my mentees as well. There are no perfect mentors, in my opinion, but we can surely focus on the traits and great future results that may result from the encounter.

Having mentors with different personalities and workstyle taught me to use communication in an open and straightway form, and most of the time I could feel that things would work out. By communicating, mentors and mentees have the opportunity to align and define clear and realistic expectations and goals, in a way that both can be benefited (Majocha et al., 2018). For instance, creating space for weekly meetings, make students and trainees develop a sense of collaboration

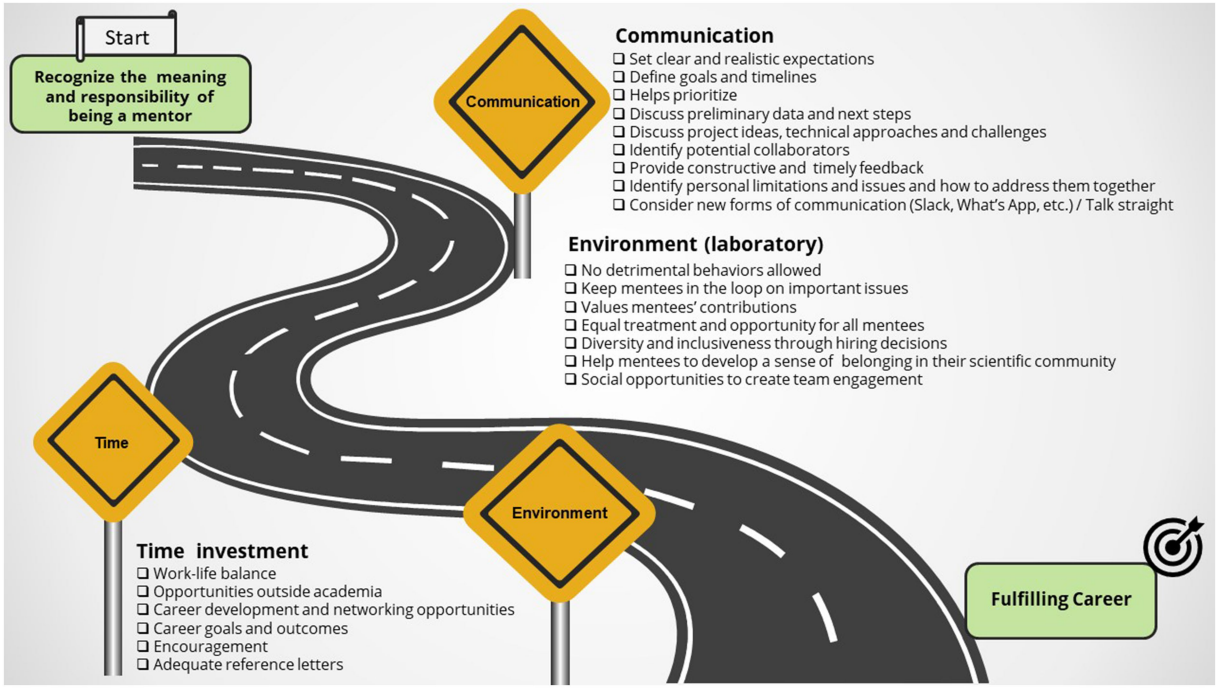

FIGURE 1
Examples of strategies that mentors could use to establish effective mentorship practices through communication, spending quality time with mentees to discuss topics that go beyond research projects, and how the microenvironment (laboratory, classroom) could favor the implementation of better mentorship practices. Through these 3 elements, mentors can offer knowledge transmission, skill development, career guidance, sponsorship and psychosocial support functions (e.g., psychological and emotional support, role modeling) (created by Tenorio-Lopes; supported by NASEM, 2019).

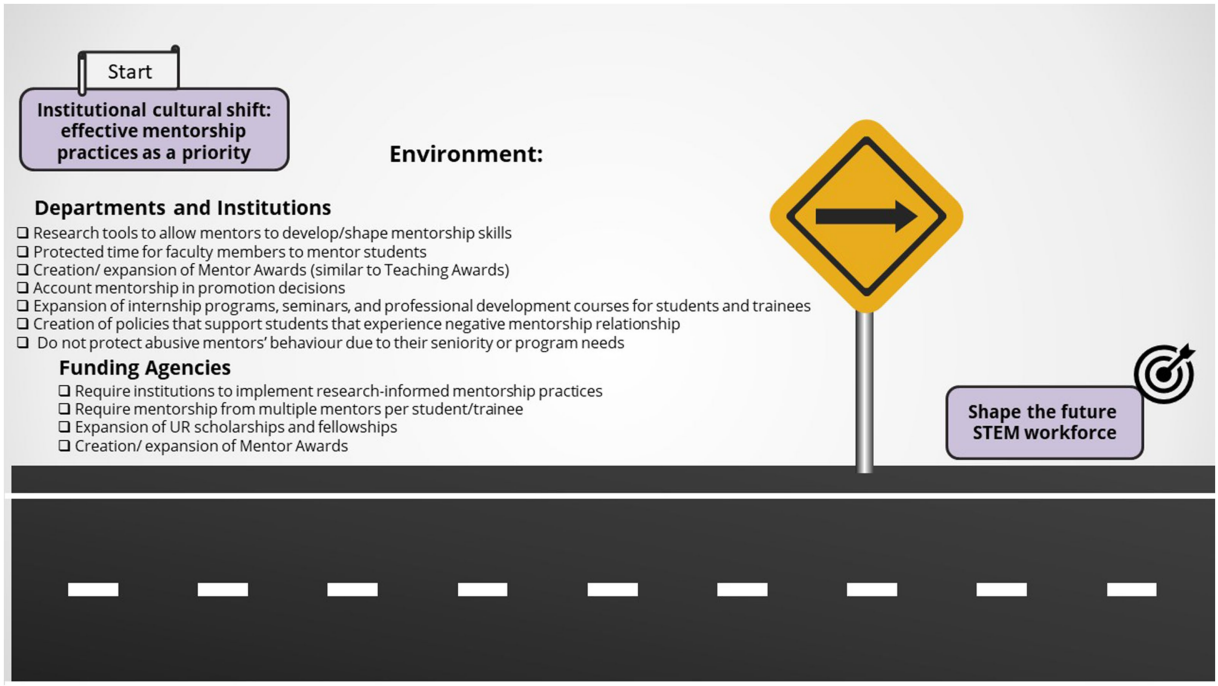

FIGURE 2
Examples of how institutions and funding agencies could help to accelerate the implementation of a cultural change in higher education that supports the creation of ongoing research-informed mentorship practices with broader access to all academic communities. Those actions can positively impact and help to shape the future STEM workplaces, allowing that creativity and innovation support professionals to be more responsive to emerging problems. UR: under-represented (Created by Tenorio-Lopes; Supported by Jeste et al., 2009; Fleming et al., 2012; NASEM, 2019).

where they can discuss preliminary data, develop solutions to solve project issues and/or other concerns, find external collaborators, and think about career development strategies (Figure 1). Especially during transition phases, students and trainees could benefit from the mentor's experience and guidance in providing networking opportunities, supportive reference letters, and discussing different career options, even when those are dissimilar from their research interests or outside academia. Although the value of face-to-face meetings cannot be replaced for some, novel forms of contact may be beneficial with limited mentoring time. This modality, also known as e-mentoring (electronic), has grown in popularity over the last 20 years (Ensher and Murphy, 1997; Bierema and Merriam, 2002; Single and Single, 2005). Slack and What's App, for example, are useful, engaging, rapid, and less formal communication systems that allow ongoing dialogs between mentors, mentees, and the entire research team. Online mentorship services such as MentorNet (Powell, 2006; MentorNet, 2019) and MyMentor (MyMentor, 1997; Sorkness et al., 2017) are also available. Users have shown a high level of satisfaction with these tools (Rowland, 2012).

2.2. Time: an investment in enriching a relationship

"*No significant learning occurs without a significant relationship.*" The renowned phrase by Dr. James Comer, an American psychiatrist and Yale professor, translates well into our thoughts on how to build effective mentor-mentee relationships. In 1968 he established the Comer School Development Program, a trailblazing initiative based on cooperative mentorship methods in which educators, parents, and the community worked together to closely assist the children's development and academic learning. The positive outcomes of his method have been featured in many media outlets and academic journals (Comer, 2004; Comer, 2009). As previously observed, establishing communication routines is an essential step toward building a stronger mentorship practice, which is inextricably tied to time availability. That is, in most cases, the true issue. Mentorship, like other working relationships, is a dynamic process that must be developed in stages and continuously (NASEM, 2019). It should be an honest and open process in which both mentor and mentee are committed to mutual growth (NASEM, 2019). That would need hours of dedication from both sides, where mentors, for example, provide career advice and encourage skill development (Kram, 1983; Roberts, 2000). Concerns will be addressed and goals will be revisited during these times. Merely investing time in the mentor-mentee connection can lead to the development of trust, which is considered the foundation of good mentoring (NASEM, 2019). However, the mentor's availability is significantly hampered by their commitment to other numerous academic obligations such as attending conferences, institutional meetings and leadership events, serving in committees, and teaching. Furthermore, the constant pressure to obtain continuing research funding lead mentors to devote an incredible amount of time to writing grants, thus preventing them to be physically/mentally/emotionally available for mentoring (Johnson and Nelson, 1999).

This is especially difficult for emerging mentors who are coping with all demands placed on new faculty members. Then comes the importance of having a supportive environment that understands and recognizes the relevance and long-term benefit of successful mentorship follows (NASEM, 2019). Institutions must provide training mentors on how to employ evidence-based mentorship methods and resources (Pfund et al., 2016). As a result, when mentors set aside time expressly for mentoring education and be involved not only in both the mentee relationship level but also departmental/institutional level, we will have skilled mentors who are familiar with the practice of successful mentorship (NASEM, 2019).

2.3. Environment: laying the groundwork for communication and quality time to blossom

A healthy work environment has been shown to lead to greater job satisfaction, creativity and productivity (Cameron et al., 2011; Redelinghuys et al., 2019).

Although there is evidence of effective mentorship in place in some institutions, various hurdles limit intervention, implementation and dissemination of procedures and policies to promote proper mentorship (NASEM, 2019). The primary barrier is an institutional culture that does not prioritize mentorship (Stolzenberg et al., 2019) (Figure 2). That culture overburdens faculty members with numerous academic responsibilities restricting their time to form satisfying relationships with mentees. Another example is that mentorship is not always recognized, rewarded or taken into consideration in promotion decisions. Other barriers such as lack of infrastructure and resources, and expertise also limit que mentorship's quality. A second aspect that is critical to enriching the quality of mentorship experiences is the creation of an equal, diverse and inclusive working environment (Mannix and Neale, 2005; Summers, 2011; Whittaker and Montgomery, 2012; Bert, 2018). This could be reached intentionally through hiring decisions, assuring that people with different backgrounds and perspectives but driven by similar learning objectives work to grow together. It is important to mention that faculty working with working with UR students and trainees should specifically learn how to engage with students who come from different backgrounds from their own (Jeste et al., 2009; Montgomery, 2016; Clayton-Pedersen et al., 2017). A number of research studies have discovered that a varied workforce is synonymous with higher financial performance (Cook and Glass, 2011) and better occupational health (Nielsen and Huse, 2010), resulting in a more equitable work environment with lower employee turnover (McKAY et al., 2007; Kaplan et al., 2011).

As an international woman arriving in Canada from a Latin country, throughout my post-doctoral studies at Université Laval and the University of Calgary, I had first-hand experience being labeled as a UR trainee. I was acquainted with an array of workplace cultures, two new languages and family/societal situations. I had been parted from my family for many years, and after the first months of the excitement of the new, those things hit me hard. Fortunately, my job in a research lab was pleasant, and a large part of that was due to the encouragement I received from my mentors. They made me feel directed, included, and valued for my contributions which made me realize the impact of a devoted mentorship. I have had extensive and dynamic encounters with colleagues from the United States, Canada, India, Pakistan, China, France, Bolivia, Algeria, and the United Kingdom. I discovered that being immersed in such a diverse and inclusive environment aided me in developing my capacity to

adapt to various educational settings, accommodate different learning styles, and I learned the value of working collaboratively, a vital talent in academia. As a result of my immersion in the lab environment, I was equipped to relish the learning opportunities and create a more versatile and empathic approach as a researcher and mentor.

The establishment of an equal, diverse and inclusive environment should be a shared responsibility throughout the entire institution, requiring the dedication of deans, department chairs and individual faculty members (Fleming et al., 2012; Montgomery, 2016). In this regard, the growth of internship programs, seminar series, and social activities to enhance networking could benefit all students and trainees.

Moreover, and often neglected, is the importance of mentees developing a sense of belonging to a broader community (Figure 2). Mentors, for example, can encourage participation in a key scientific meeting once a year where their mentees can be closer to a specific community related to their fields. The creation of a professional development program would enable them to know further about the prospects available in their scientific fields and most importantly, to be better equipped to take more assertive actions in the future.

Finally, funding agencies can contribute to a cultural shift in which mentorship is acknowledged as an essential component of the program curriculum (Jeste et al., 2009). For example, encouraging and requiring institutions to develop individual mentorship plans for students (particularly for UR); creating/expanding a category for Mentor Awards; and requiring mentoring from multiple researchers as a way to expose students to a diverse set of technical skills, are all means to help with the rolling out of better mentorship practices (Campbell and Campbell, 2007; NASEM, 2019).

3. Final thoughts: the importance of continuous mentorship over the road

Whereas the majority of literature about mentoring in academia revolves around graduate students and postdoctoral trainees, the importance of having a mentor guiding junior faculty members is also essential (Campbell, 1992; Chalmers, 1992; Kohn, 2014). Surviving the overload phase of the first few years of tenure is difficult. Launching a new research program, securing physical space, and equipment, producing grant proposals and articles, attending conferences, serving on university and research committees, designing and teaching courses, recruiting students and lab personnel and… mentoring them! In most situations, we were trained to perform research but not prepared to tackle all the other employment opportunities simultaneously. With all of these demands, new faculties are likely to be quickly gobbled up, therefore it is not surprising that they require the helping hand of a (skilled and experienced) mentor. It would be very helpful to assist in strategically balancing time constraints, by prioritizing suitable duties, bringing forth support about the department's customs and networking (both inside and outside their institution), and identifying internal and external financial opportunities (Zeind et al., 2005; Popper, 2007).

Cultivating our teaching expertise and establishing ourselves as educators convey new obstacles. We must learn how to effectively deliver lectures, devise novel courses, assignments and exams, and accept and deal with criticism from students, other educators, and even from ourselves. "*Achieving brilliance in both academia and research is a long journey*," one of my mentors warned me, "*and we must give ourselves time to improve and grow progressively while giving our best.*" Gaining information from mentors who have faced similar situations in the past can be incredibly beneficial in avoiding naive blunders.

Finally, through a mentor-mentee relationship new faculties could be also benefited in terms of obtaining logistic, strategic, and emotional support (Popper, 2007; Kohn, 2014). The pressure to obtain funding and the general feeling of job insecurity plays a huge role in the first years as a young professor when we are trying to solidify our professional identity. Indeed, these are the two main reasons why new faculty, especially UR researchers, are quitting academia along with role overload, inequitable hiring practices, and harassment (Christian et al., 2020; Gewin, 2022).

4. Conclusion

Mentoring experiences can positively impact the individuals involved. Countless mentees (including myself), report developing life-long relationships with their mentors. Yet, positive mentorship experience is directly proportional to the decrease in attrition rates across STEM fields (NASEM, 2019).

In higher education, an excellent mentoring system ought to be greatly appraised. It not only offers value on an individual scale, but it also generates prosperity throughout every bit of the organization. I am convinced that to see a culture shift that recognizes the value and impact of providing high-quality mentorship to students and junior faculty - is an absolute requisite. Individual mentors should have protected time to hone their mentoring abilities and effectively guide their mentees. Otherwise, given the multitude of duties, demands, and competitiveness demanded of senior postdocs and junior professors, developing a strong mentorship skill set will be an arduous process. is challenging to develop a robust mentorship skill set. Because everyone should be permitted to have a personal/family life aside from work, we are approaching a point of rupture in which exceptional trainees will rarely opt to pursue academic careers. We must ensure that these exceptionally driven scientists receive appropriate support and mentorship to do remarkable research while imparting their burning passion for science through purposeful practice, criticism, contemplation, and training. Moreover, they should become great mentors to guide the next generation of STEM workers.

We may foresee an improved prospect for academia when educational establishments prioritize mentorship in their programs by deploying new practices and regulations. These activities would be reflected in the recruitment quality, personnel retention, and attrition decrease particularly among UR students.

Developing stronger mentorship policies within graduate institutions across the countries should be the starting point for an enriched learning experience and personal growth, allowing trainees to successfully optimize their learning capacity and achieve their professional goals in science.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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